

SOFIA MUNICIPALITY

ARCHITECTURE AND TOWN PLANNING DIRECTORATE
MUNICIPAL ENTERPRISE “SOFPROECT - MASTER PLAN”

MASTER PLAN OF SOFIA MUNICIPALITY

SYNTHESIS REPORT



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AMENDMENT TO THE MASTER PLAN OF SOFIA MUNICIPALITY

1. BACKGROUND INFORMATION

1.1. INTRODUCTORY NOTES

This brief report concerning the draft for amendment to the Master Plan of Sofia Municipality has been prepared in compliance with the requirements of Article 24, Paragraph 2, Item 2 of Ordinance No. 8 of the Ministry of Regional Development and Public Works.

It is necessary to remind that the current Master Plan of Sofia Municipality was worked out by the *Sofproject – Master Plan* Municipal Enterprise in the period 1999 – 30 April 2003 and submitted to the Municipal Administration for endorsement under the procedures provided for in the regulatory framework.

Due to court appeals against the procedures for approval of the Environmental Impact Assessment Report, the 2003 Master Plan was finally approved by virtue of Decision No. 147 of the Council of Ministers of 2006 and enforced as of 20 January 2007 by virtue of Paragraph 11 of the Transitional and Closing Provisions of the Law on Regulation and Build-up of Sofia Municipality. (3Y3CO).

During that period (April 2003 – December 2006) significant socio-economic changes took place in the country, whose strongest manifestations were observed in the city of Sofia and Sofia Municipality. As a consequence of that and above all thanks to the increase in the foreign investments, which led to accelerated development of the municipal economy, there was a notable growth in the demand for building plots corresponding in terms of functional designation to the investors' interests, certified under the provisions of the Law on Promotion of Investments. The unemployment rate dropped to one of the lowest levels in the European Union.

These developments led also to increase of the number of permanent residents, which in 2007 reached the level of 1 241 000 people (NSI). According to data of the Regional Office "Civil Registration and Administrative Services" the population of the municipality by 15 March 2007 according to the "current residence" indicator was 1 381 000 people and exceeded the demographic forecast of the 2003 Master Plan - 1 300 000 people by 2010.

That unforeseeable situation and the increased level of "motorization" (vehicle ownership rate) created problems in the transport communication system, the public transport, car parking etc. Parallel to it, in the period from 2001 till 2006 a number of violations of the regulatory framework were observed which led to allowing construction in the green areas of the city and in the free spaces in the existing housing estates.

These and several other factors provided grounds for updating of some of the draft solutions laid down in the Master Plan, which according to the provisions of the Law on Regulation of the Territory may be defined as "Amendment to the Master Plan".

In this connection the design of a draft for amendment to the Master Plan of Sofia Municipality has been implemented in compliance with the requirements of Paragraph 7, (1) and (2) of the Transitional and Closing

Provisions of the Law on Regulation and Build-up of Sofia Municipality, namely:

- (1) Within six months of the enforcement of that law the Sofia Municipal Council shall approve a decision to work out a Draft-Amendment to the Master Plan, in which it defined the scope of the Amendment and the deadline for its elaboration;
- (2) The scope of the Draft-Amendment shall mandatory comprise:
 1. Changes in the scope of the green system for the purposes of preservation of plots laid down as elements of the green system of the city according to the currently enforced Master Plan of Sofia, whose designation has been changed prior to or with the approval of that Law;
 2. Improvement of the transport and communication scheme;
 3. Identification of areas for expansion of the cemeteries;
 4. Changes in the distribution of the groups of areas, planning zones and independent plots in the urbanized area with a view to establishing limits to the restructuring of the housing estates;
 5. Updating of the regulatory stipulation of areas for depots and other sites of that kind and solid waste treatment facilities.

Immediately after the enforcement of the Law on Regulation and Build-up of Sofia Municipality and with due consideration of the provisions of Paragraph 7 of the said Law, multiple comments, viewpoints and proposals concerning the stipulations of the Master Plan of Sofia Municipality were submitted by physical persons and legal entities, city-district administrations etc., for the attention of the municipal administration.

In connection with the provisions of Paragraph 7, Item 1 of the Law on Regulation and Build-up of Sofia Municipality, according to which the Sofia Municipal Council should within six months of the enforcement of the Law approve a decision for amendment of the Master Plan, the administration undertook timely the following actions:

1. By virtue of Order No. RD-09-09-20/13.04.2007 of the Chief Architect of Sofia Municipality a Working Group, composed of representatives of the *Architecture and Urban Planning* Directorate, *Sofproject – Master Plan* Municipal Enterprise and NGOs was set up with the task to study all the claims, comments, viewpoints and proposals submitted by physical persons and legal entities, the city-district administrations etc. In implementation of that order the Working Group studied, processed and prepared position papers on more than 500 comments, proposals and claims received by the *Architecture and Urban Planning* Directorate. More than 100 technical errors in the graphic parts of the Master Plan were identified, consisting in inaccurate letter indexes and need of more precise delineation of the boundaries of some of the planning zones. On the rest of the comments and proposals the Working Group came out with preliminary position papers concerning their feasibility and compliance with the law, which should be studied in detail by the design team.
2. Consultations were held with experts from the Ministry of Environment and Waters (MoEW) concerning the need of launching procedures as required by the environmental legislation. .
3. In connection with the requirements of Paragraph 7, Item 2 of the Law on Regulation and Build-up of Sofia Municipality the opportunities for improvement of certain elements of the transport and communication system were studied beforehand

ex officio; suitable plots were sought for new cemeteries, for alternative solid waster treatment sites; certain investigations were conducted also with respect to optimization of the distribution of the special-use planning zones and plots in the urbanized area, as well as in the surrounding area.

On the basis of the conducted feasibility studies and the new Items 3, 5 and 8 in Article 134, Paragraph 1 of the Law on Regulation of the Territory and Paragraph 12, Item 5 of the Law on Regulation and Build-up of Sofia Municipality a report was submitted for approving a Decision for amendment of the Master Plan of Sofia Municipality and an Assignment Note for working out a Draft-Amendment to the Master Plan of Sofia Municipality.

On the grounds of the above the Sofia Municipal Council at its meeting held on 19 July 2007, Protocol No. 114, Item 3 of the Agenda, by virtue of Decision No. 693,

DECIDED:

1. A Draft-Amendment to the Master Plan of Sofia Municipality should be worked out in compliance with the Assignment Note for Design (Annex 1, which is an integral part of this Decision);
2. The Draft-Amendment to the Master Plan of Sofia Municipality should be worked out within six months;
3. The Mayor of Sofia Municipality should assign *Sofproject – Master Plan* Municipal Enterprise to work out *ex-officio* the Draft- Amendment to the Master Plan of Sofia Municipality.
4. A Working Group for coordination of and control on the activities related to the working out of the Draft-Amendment to the Master Plan is being set up, composed as provided for in Annex No. 2, which is an integral part of this Decision.

In compliance with the above Decision the Mayor of Sofia Municipality commanded by virtue of Order No. RD-09-2004/14 August 2007 (Annex No. 4) that the draft for Amendment of the Master Plan of Sofia Municipality shall be worked out *ex-officio* by *Sofproject-Master Plan* Municipal Enterprise within six months in scope and contents as detailed in the Design Assignment Note.

Following strictly the requirements of the planning assignment concerning the Draft-Amendment to the Master Plan of Sofia Municipality, the Design Team oriented its efforts towards correction (adjustment) of the graphic part of the Plan in compliance with the decisions of the Working Group for feasibility studies, set up by virtue of Order No. RD-09-09-20/13 April 2007 of the Chief Architect of Sofia Municipality, and conducted the specialized studies for amendment of the Master Plan ensuing from the requirements of Paragraph 7, (2) of the Law on Regulation and Build-up of Sofia Municipality and the new socio-economic conditions in the development of Sofia Municipality and the Zone of Active Impact of the city of Sofia.

The studies took account of the new socio-economic conditions and direction, objectives and priorities in the development of Sofia Municipality as laid down in the District Development Strategy till the year 2015 and the updated Municipal Development Plan (2007-2013).

After its approval by the Municipal Expert Council on Regulation of the Territory the graphic part of the Amendment to the Master Plan of Sofia Municipality was submitted to the Sofia Municipal Council for review and launching of the endorsement procedures in the commissions. By virtue of the above mentioned Decision No. 951/11 October 2007 of the Sofia

Municipal Council (Annex 1) the graphic part of the Amendment of the Master Plan of Sofia Municipality in scale 1:10 000 and 1:25 000 was approved as a preliminary draft, which should be completed additionally with the appropriate additional graphic and verbal materials and proceeded in compliance with the requirements of the Law on Regulation of the Territory.

Following the legal procedures, the preliminary draft of the Amendment to the Master Plan of Sofia Municipality was submitted for review and approved by Municipal Expert Council on Regulation of the Territory.

In connection with the legal requirement that the preliminary draft of the Amendment to the Master Plan of Sofia Municipality should be submitted to public review, that the latter should not be conducted formally and that arrangements should be made to allow citizens to get firstly familiar with the draft and then to make their recommendations, lodge their protests and evaluate its advantages and disadvantages, familiarization of the citizens with the draft was conducted under a specific schedule in all the 24 administrative city-districts.

By virtue of Order No. RD-09-09-2/16 January 2008 of the Chief Architect of Sofia a timeframe was established, within which the citizens, NGOs and legal entities could submit in writing their proposals, evaluations and protests. Within the set deadline approximately 1 200 proposals and protests on the draft were received by the administration of the *Architecture and Urban Planning* Directorate of Sofia Municipality and *Sofproject - Master Plan* Municipal Enterprise.

They were reviewed and discussed by a special working group, composed of experts from the municipality, municipal councilors, NGO representatives and the city-districts administrations.

From the reviewed proposals the working group approved some 500, which had been taken into account and reflected in the final draft of the Amendment to the Master Plan. About 200 protests dealt with highlighting of some technical errors in the graphic part of the 2003 Master Plan, which were also corrected in the final draft of the Amendment to the Master Plan. The rest of the written protests were not approved on feasibility grounds, since they referred to and shall be addressed by the Detailed Regulation Plans.

The most significant and feasible proposals among those approved were those dealing with (i) the re-categorization of the republican road network in the northern end of the municipality, which is currently a barrier to its future development; (ii) improvement of the transport communication system of the city and the surrounding area; (iii) development of the green system and recreation; (iv) environmental pollution by the *Kremikovtsi* Metallurgical Combined Works; and (v) the need of change in the planning status of the area of the said Combined Works, which would create opportunities for phased curtailing of its activity and the resulting pollution.

All the decisions on the submitted proposals were approved by the Working Group with consensus and reflected in the final draft of the Amendment to the Master Plan.

The preliminary draft of the Amendment to the Master Plan was submitted to public review also by the Union of Architects in Bulgaria and the Association of Sofia Architects, which later submitted their official position papers as well.

In compliance with the legal provisions the preliminary draft was sent to the Mayor of Sofia Municipality for coordination with and assessment by the central government institutions, ministries and operating companies. Within the set deadlines 33 position papers and letters of approval from

different institutions and authorities were received. All the submitted position papers expressed agreement with and approval of the concepts of the draft for Amendment to the Master Plan.

The position papers of the institutions under this coordination procedure contained also a number of significant and feasible proposals, which were reviewed by the Expert Group and reflected in the final draft for Amendment to the Master Plan.

The brief report (Executive Summary / Explanatory Note), which is presented as an integral part of the final draft of the Amendment to the Master Plan, is the synthesis of the conceptual studies, conducted in the 2003 Master Plan, which have been preserved also in the newly conducted investigations related to the Plan.

Parallel to it, the draft presents also up-to-date information about the state of the territorial socio-economic complex of the Municipality by 2006 and in specific cases by 2007, as well as about the achieved level of spatial development of the functional systems.

The structure of the abbreviated report takes into consideration its practical applicability and hence each of its section contains the following:

- Information about changes, which have occurred in the period 2003-2006, principles and conceptual proposals, which have been laid down in the 2003 Master Plan and are reproduced in the draft of the Amendment to the Master Plan.
- Development objectives and proposals, which have been added in compliance with the new circumstances.
- Concrete description of and the underlying motivation for the introduced amendments by functional systems and problems with due consideration of the updated socio-demographic forecasts by 2030 and the specific conditions of the territory.

Therefore, in terms of type and structure the abbreviated report is an updated version of the report on the 2003 Master Plan and serves to ensure its application and programming.

1.2. HISTORICAL OVERVIEW OF THE SPATIAL DEVELOPMENT

The Sofia Plain has been inhabited since as early as during the Neolith, in the 6th Millennium B.C., when the so-called Struma Road, splitting along the valleys of the rivers Nishava and Great Morava to northwest and the river Iskar to the north, began to function. With the settlement of the Thracian lands from west to east emerged also the road along the river Maritsa. In the first millennium B.C. the Thracian tribe **Serdi** chose this location, situated at crossroads and blessed with mineral springs, for its permanent habitat and founded a human settlement, to which it gave its name – **Serdika**

During the Hellenistic period, Serdika was enclosed within the boundaries of Alexander the Great's Empire. In 29-28 B.C. it was conquered by the Romans, who created here a fortified settlement. During the rule of the Roman Emperor Trajan (98-117) Serdika has enjoyed the rights of a city with an addendum to its name – **Ulpia Serdika**, incorporated in the Pevtinger Map – a guide to the Roman Empire, and is marked as a big city, whose fortress wall had two towers.

By the end of the Roman Era (1st – 4th century) the city was famous in connection with the spread of Christendom and the holding of one of the first church conventions – the Serdika Convention (343 A.D.), which took important decisions for the fate of Christianity.

The conquering of the city by Khan Krum in 809 A.D. marks the end of

the late antiquity (5th – 7th c. A.D.). Under the rulers Persian and Boris the name of the city – **Sredets** – corresponds to its central location in the Bulgarian state.

The emergence of the new name of the city – **Triaditsa** (the Holly Trinity) is connected with the Byzantine rule on our lands and the attempts to cast in oblivion the Bulgarian name and influence.

In the period of the Second Bulgarian Kingdom the new name of the city was born – **Sofia** – in connection with the representative St. Sofia Church, situated at the high elevation to the east of the fortresses of ancient and early-Christian Serdika. The name established itself firmly and was adopted even by the Turks when they conquered Sofia in 1382. Until the liberation the city served as administrative centre of a Vilayet.

The history of the **spatial development** of Sofia as a capital may be divided into four clearly distinct periods:

- **1st period** – from the Liberation until the 1912-1919 wars;
- **2nd period** – between the two World Wars (1919 - 1939/45);
- **3rd period** – from 1945 till 1989;
- **4th period** – after 1989.

1.1.1 FIRST PERIOD – from the Liberation until the 1912 – 1919 wars

The **first period** in the development of Sofia is split into one short pre-planning sub-stage and two major planning sub-stages.

1879 – Sofia has no plan

On 22 March 1879 Sofia was declared the capital of Bulgaria. Above the rich history of the multiple archaeological layers of Serdika, the Sofia at that point of time was a small oriental human settlement with a population of 18 000 inhabitants and an area of 250 ha. The houses were grouped in 17 neighbourhoods, while the entire city was huddled approximately within the boundaries of the first city ring of today's city.

First planning stage - 1879 - 1880 - 1892 -1903

For a first time in the new history of Sofia a plan of the city is requested in the Disposition of the Police-Master of the city of Sofia, Staff-Commander Pauli, to the City Council, dated 9 March 1878 – six days after the signature of the San-Stefano Treaty and one year before the declaration of Sofia for capital. Being cadastral plan in its essence, this plan was worked out by the Minister of War Nikolay Kopitkin in 1878. During the same year Anton Kolar, Chief Architect of the Province, designed a plan, which was approved on 17 October 1878 by Prince Dondukov-Korsakov. This scheme has not been preserved, however obviously it has been studied in detail by the French engineer Amadie (together with the engineers Mihad and Schex), who in the early 1979 was assigned by the Chief of the Technical Department with the Sofia Municipality, Eng. Roubel, to work out a regulation plan, approved on 16 January 1980 by the Council of Ministers and endorsed by Prince Alexander Battenberg on 10 April 1880.

The **objective** of the plan was the development of the city as the capital of the state. The initial period of its implementation was characteristic for the high degree of optimism for the future of the city. As compared to all follow-up plans, it retained also to the highest extent the function of a plan **preceding the development** of the city

The **major ideas** laid down in the plan were as follows:

Construction of an *orthogonal* (“American”) street network. The width of the small service streets is 12m, that of the major streets is 15 m, and of the main boulevards – up to 25 m.

Due consideration of the available radial incoming streets and the ring pit and embankment, which thus turn into a street running circular. In this way the new system of streets was established as a combination between orthogonal and radial-circular street networks.

Adoption of the model of “open structure” by providing an opportunity for territorial expansion of the city in the radial direction

Adoption of the existing religious and public buildings as structuring points: the *Sveti Kral* Church, the Lions Bridge, *Vazrazhdane* Square, the Prince's Palace, the *Banya Bashi* Mosque

Introduction of a system of public squares (spaces, unknown to the oriental city): “outer squares” - at the entrance gates to the city – the Lions Bridge, *Vazrazhdane*, *Macedonia* – and “inner squares” – the cathedral square *Sveti Kral*, *Slaveykov* Square and *Sveti Sedmochislenitsi* Square.

Establishment of the centre of the supreme power of the city and the state – the space of the Memorial Cathedral *St. Alexander Nevski* with the *St. Sofia* Church and the lot assigned for the building of the Holly Sinod, situated at the highest elevation cross-point of the city.

The major implementation of the plan has taken place during the term of office of the Mayor Dimitar Petkov, and its major updating was effected in 1892 by Architect Alexander Nachev. The ideas of the “Amadie Plan”, which were developed further by the **Nachev Plan**, were as follows:

- Linking of the radial roads with structures and sites of general significance for the entire city;
- Formation of new circular public squares: at the *Ruski Pametnik* (Russian Memorial), around the *Vassil Levski* Memorial and around the Eagles Bridge;
- Establishment of a castling link along *Dragoman* Blvd. (now *Stephan Stambolov* Blvd.);
- Encircling of the territorially expanded capital by a new ring implemented as a system of hordes, which takes account of the topography of the terrain.

The new ideas in this plan trigger the start of the construction of the green system of Sofia, namely:

- Green areas of general importance for the city: the *Borisova Gradina* (Boris Garden), the park of the Central Cemetery, the green areas of the *Alexandrovska* Hospital, the green barrier in front of the Central Railway Station, along the river valleys, the spatial links between public squares and sites;
- Green areas of neighbourhood importance: the garden around the *St. Nikola Sofiyski* Church in *Tri Kladentsi* Quarter, the garden in the *Banishora* Quarter, the *Doctors* Garden in the Doctors' Memorial Quarter.

The idea of phased introduction of new areas in the structure of the city gained grounds. Initially, it was oriented in western direction (*Yuchbunar*), followed by extension in southwest direction and the area of the Doctors' Memorial as phase two, the *Banishora* Quarter during phase three and *Dolni Lozenets* and other quarters have been left for the fourth and last phase.

This planning stage ended with the “cadastral survey” of 1897, worked out by Eng. Wilhelm Bartal – a really precise “snapshot” of the city at that time.

Second planning stage - 1903 - 1914

After the layout of the basic street network, several other plans followed (1903, 1907, 1910, 1912 and 1914), which were of a technical nature

and whose aim was to regulate the development of new territories for expansion of the city. They contained already clearly defined regulatory functions with respect to the spatial development of the city.

The period between the Liberation and the 1912 – 1919 wars was remarkable by high construction activity. Many representative buildings for the state administration were erected, some of which have been preserved till the present day. The buildings of the Military School, the Army Club, the Ministry of War, the State Printing House, the National Assembly, the National Theatre, the *Alexander Nevski* Cathedral, the Russian Church, the Palace of the Holly Synod, the Sofia Mineral Public Bath, the Central Market Hall etc. were built, each of them having its own appearance and high architectural value. This created the specific appearance of the city during that period, which has been preserved till present in certain parts of the central city core.

Implementation of the first large-scale public works projects began: water supply and sewage and electrical street lighting in 1890, tramway transport in 1901, pavement of the streets – as of 1905, construction of bridges etc.

This remarkable period for the development of Sofia, which continued for somewhat more than 30 years, ended with the 1912-1919 collapse and the overall crisis that followed. The consequences of it undermined the rationale of further implementation of these plans. For the spatial development of Sofia this marked the real end of the 19th c. – its planning theories, models and styles. However, in the “historical memory” of the city (deposited in its planning structure) these will remain the plans with the highest rate of **implementation** of their visions, marked by an unknown (before and after) spirit of optimism and hopes for the future, whose traces may be found in the tissue of the city even in our days.

SECOND PERIOD – between the two World Wars (1919 - 1939/45)

The second period of the spatial development and planning of Sofia (1919-1944) is divided into three planning phases.

Planning Phase One - 1919 -1928

It began with the general post-war crisis. In Sofia it gained exacerbated-beyond-the-normal dimensions as a result of its overlapping with the enormous (almost “physically” palpable) **demographic crisis** - the result of the huge for the scale of the city refugee migration influx from the “lost” territories – Macedonia, Thrace, Dobrudja and the Western Outlying Parts. The city was besieged by located on unregulated areas refuge-type habitat, which might hardly be called “dwellings”. The delayed actions of the part of the local authorities were limited to working out of partial regulation plans for “fragments or patches” of the surrounding areas, the majority of which had been already populated by the new settlers

This regulation planning was the most intensive during the period 1922-1924, however even the plan of 1928, the latest somewhat more extensive one in terms of scope, did not rise above its main and only designation – to cope with the planning chaos. It is in this way that the quarters *Krasno Selo*, *Ovcha Kupel* and *Malashevtsi* emerged in the period 1912-1914, *Zaharna Fabrika* – 1920, *Kriva Reka*, *Lozenets*, *Banishora*, *Kyulyutsite* – 1921, *Hadji Dimitar*, *Poduyane*, *Batalyona*, *Razsadnika* – 1922 etc. By 1938 a total of 53 new areas were added to the city.

This phase gave birth also to one of the two remarkable “phenomena” of the period between the two World Wars – **the small-size lot**. Twenty seven thousand lots with small-size front were created. The consequences of this speculative “lot sizing” affect the planning activity in the city till the present

By the end of that period Sofia possessed already a developed railway junction. Besides the Central Railway Station, a ring railroad with the *Poduyane* and *Zaharna Fabrika* Railway Stations was constructed, as well as blind deviations, servicing mainly military stores and arsenals. A large number of petty industrial enterprises emerged next to the railway areal.

The situation was mastered in terms of regulatory intervention by the publication in 1924 of the Building-related Police Ordinance. For a first time it divides Sofia into four zones by type of build-up, permissible height of the buildings, residential density – central core and first, second and third zones. Stricter requirements were introduced concerning the approval of the plans and control of construction, for a first time an architectural commission was set up with the Department of Architecture of the Sofia Municipality. The Ordinance, together with the plan of 1928, settled the consequences of the post-war crisis and marked the **successful end** of this grave period for the city

Planning Phase Two - 1928 - 1934

The period after the post-war crisis was a time of new civil optimism and hope for the future, however unfortunately **not bound** with actual planning vision for the development of the city. In fact, a new chaotic period of construction set in, this time brought to life by a radically different reason – the economic revival and improved financial situation of the inhabitants. This was the beginning of an unknown till that point of time large-scale **restructuring** of the city, which had affected to the utmost the major structuring elements of the city – the system of **residence**. The plan of 1928 was no more capable to cope with the new reality and to regulate the processes of **restructuring** of the city

At the beginning of that period the second big “phenomenon” took shape – **the collective-type of housing** (a group of citizens, wealthy enough to wish a qualitative improvement of their lifestyle, however not wealthy enough to resolve their problem using the model of the past – the individual house, agree to live in a common, collectively constructed housing). This is how the **housing co-operatives** were born and institutionalized. This, however, gave also rise to the principal collision between the structural components of the city – the contradiction between the scale of the neighbourhood and the lot (adapted to another type of buildings) and the scale of the new mass-type of buildings. The small size of the lots required closed build-up, the number of storeys of the buildings was tripled (from 2-3 storeys to 6-8 storeys), the open green spaces were drastically cut off, the streets and inner neighbourhood spaces ‘shrank’, and the residential environment lost its spatial and sanitary comfort

The result, according to the contemporaries of this dynamic process of **restructuring** of the city, was an actual “replacement” of the old Sofia by a new city, larger in scale, however with less light and much more “greyish”. It is hard to presume how far these processes would go and what the final results would have been, had it not been for the growing awareness and public concern at the end of 1933 and the beginning of 1934, but what is more important – the understanding of the true administrative scope of this problem by the new municipal management of the city

Planning Phase Three - 1934 - 1938

This was one of the most fruitful and active periods of planning activity in the history of Sofia, aimed at **re-orientation** and **restructuring** of its spatial development. Upon accession to office, the leadership of the municipality, headed by Eng. Ivan Ivanov, worked out a remarkable **behaviour strategy**.

Its objective was to cope with the spontaneous processes of development

of the city and to ensure its reliable and modern future by means of elaboration of a Master Plan. The steps of implementation of this objective were impressive for their consistency:

- raising of public awareness that the problems faced by the city mark in fact a situation of **crisis**;
- ensuring public support for the idea of the need of elaboration of a **Master Plan**;
- establishment by a legislative act of **the necessity** to resolve this public need, the **deadline** for its resolution and the **regulatory status** of the documents, which shall guarantee compliance with it;
- collection and systematization of information about the state of the city as an indispensable condition for the development of an assignment note for design of a Master Plan
- development of the Assignment Note for design;
- assignment of the design of the Plan, envisaged by virtue of a special law;
- establishment, by virtue of the same Law, of temporary Rules for Conducting of the Planning Activity in Sofia, until the approval of the Master Plan;
- elaboration of the Master Plan;
- conducting of public hearing of the Plan with a view to winning public support for its **implementation**;
- enforcement of the Master Plan and the Rules for its Implementation by virtue of their enforcement by Law.

The period began with the drafting of a **Law on the Build-up of the Capital Sofia**, enforced in the form of an **Ordinance-Law** of 1934, which constituted the outlined **strategy** and provided for the elaboration of a Master Plan. The Master Plan was enforced on 12 April 1938 with the approval of a new Ordinance-Law for its application

The Assignment Note for Design of the Master Plan (worked out on the basis of the prescriptions of the Ordinance-Law and the instructions of the city leadership to Prof. Musman) formulated the following principal objectives of the plan:

In territorial aspect the plan should cover “the parts of the city, situated within the city boundaries, as well as the surrounding areas, whose nature and interest are closely related to the capital” (Art. 2 of the Ordinance-Law). Meanwhile, “Prof. Musman was assigned the task not to expand the city, but rather to make it more compact”.

To define the **prospective number of residents** at the final stage of the implementation of the plan. “The task to develop Sofia as a modern, large city, with about 600 000 inhabitants, was put forward.” (Prof. Musman)

The city should be **spatially structured** in specific zones, ensuing from the nationally recognized “model of habitation” – “... for social and **patriotic** considerations we would like to prevent Sofia from replicating the picture of many other cities in the West. We would like to prevent the population of a large city to be “uprooted” from the land, as this is done on the continent. We should avoid these shortcomings of the large cities” (Eng. I. Ivanov).

The city centre should be “rehabilitated” by way of restructuring through broadening of the streets that have “become too tight”.

To resolve the **transport problems** of the city by “creating a better communications network”, which shall include also the “fixed skeleton of the railway tracks” (Eng. I. Ivanov).

The area of the city should be enveloped by a **green system**, so that

“Sofia shall develop as a garden-city...”, and belts of green stripes should be created as well.

The Plan should envisage opportunities for setting up considerable **public spaces and sites** through “distribution of monumental buildings, large public squares, memorials etc.”, “... a stadium, playgrounds, etc.

How does the “Musman Plan” achieve these objectives?

On the issue of the **territorial scope**, for a first time in our practice an attempt was made to apply *regional planning*, whereat the scope of the studies was extended to cover not only over the area of the city, but also of its surroundings.

The forecast for the **prospective number of inhabitants** envisaged higher population growth than the one laid down in the Assignment Note– “650-700 thousand inhabitants, and that on the specified area size” (Prof. Musman). The forecast was correct, since it took into consideration the capital nature of the city and the needs put forward by this function, as well as the available regional resources, which had to be satisfied under conditions of “normally” evolving demographic and migration processes, limiting its growth to the framework of a “healthy body weight”. The forecast was hardly capable of taking into account either the dimensions of the forthcoming crisis, or the directions and scale of its consequences

On the issue of the **spatial structure** of the city, the area of the city was divided into two major components – inner city and outer city. The inner city was split into six residential and several functionally independent zones: industrial, commercial, administrative, open and green spaces, playgrounds and sports facilities, cemetery, civil airports, etc. They have been specified within precise boundaries and defined by their functional content, the regimes of their build-up and even their social category was specified. Buildings and infrastructure in good condition were to be fully preserved. The main structural underlying concept was mutual penetration between the city and the surrounding environment under the principle of organized segmentation of the compact city in the direction from the centre towards the periphery, accompanied by diminishing of the build-up density for the account of penetration of the surrounding nature towards the city centre. The functional zoning principle was not drastically puristic. Each of the zones possessed elements of the functions of the others to a degree allowing it to satisfy its own needs

The idea, known presently as the idea of “**secondary urban centres**”, *linked* to the concentration of public and service functions along the radial roads, which connect the belts of the functional zones, was manifested in a rudimentary form

The industrial zones were divided into two major groups: zones of a “burdensome” nature and zones of “non-burdensome” nature, the former being structured into autonomous zones, while the industries of a “non-burdensome” nature were dispersed among all the other zones.

The solution of the issue of transport communication aimed at linkage of all the parts of the city into a unified organism on the grounds of the following **considerations**: to achieve a smooth realization of the transport communication, to alleviate the main communication streets, to separate transit from local traffic, to reduce the crossroads traffic along the main communication streets, to separate the different types of traffic (high-speed, slow, linked and free traffic), to separate the mobile traffic from the immobilized (parked) traffic, adequate location of combined garages, etc. According to the topical at that time **theory**, “transport communication on

the area of any city is split into railway communication and a system of communication streets”. The project envisaged development of a unified “communication system” – a city encircled by a railroad ring, cut through by the most heavily loaded horde of the existing railway areal. An orderly system of freight and passenger railway stations was envisaged, all parts of the city being serviced depending on their functional designation. All entry and exit destinations were retained, corrections and additions were introduced with the aim “not to hinder the city’s development”. The railway system was appropriate for city transport services and was linked to the other transport systems in the city.

The solution of the road communications was based on several **imperatives**

- to deviate the transit traffic from the city centre
- to retain the star-shaped structure of the so-called “outgoing main road arteries”, established since centuries
- to encircle the city by a by-pass road, called “panoramic” road
- the points of intersection of the outgoing arteries with the by-pass road to be linked by hordes, which will take up the inner city traffic
- the system should function as a unified organism with the railway network

The flexible application of these imperatives led to the following planning results:

- The “transit proper”, i.e. the “international road traffic”, was conducted to the north of the city and ran parallel to the northern arch of the railroad ring, whereby three main bus terminals were situated on it.
- The southern part of the “Panoramic Road” was divided into an “outer” one (to the skirts of Vitosha mountain) and an “inner” one (linking into an arch the three main natural sights of Sofia – the hills of *Slatina*, *Lozenets* and *Konyovitsa*. The points of intersection of the “Outer Panoramic Road” with the outgoing arteries, which were also starting points of the inter-district hordes, take the shape of city “gates” – the *Tsarigrad* (Istanbul) destination, the Lom destination, the Belgrade destination and the Athens destination, supplemented by a few others, leading to the southern “gates” in the mountain skirts – Boyana, Dragalevtsi, Simeonovo.;
- The existing city rings were completed by way of broadening of the profile of the main streets, including break-throughs, like the one connecting Pachevich Street with Rakovski Street.

The idea of the plan about the **green system** of the city was quite clear: the nature penetrated the city fabric wedge-wise, getting up to the boundary of the second central zone. The wedges were linked by green belts, which followed the major by-pass communications – by road and by rail. Their role was not only to protect the residential areas from the harmful effects of communication, but also to restrain the city growth. The notion “green areas” comprised all varieties – forests, parks, green yards, areas for agricultural use etc. Water currents were a particularly important element of the system. The fact that the water quantities in the Sofia rivers are small and their runoff is not constant was taken into consideration. Integrating this element into the general system of green areas the project “besieged” the city with ponds and pools. Besides their designation for sports and entertainment, they also played the role of reservoirs, designed to maintain permanent regime of the water currents. The system was almost a closed-loop one.

The project’s concept for **organization of the public spaces, buildings and sites** of the social infrastructure took advantage of the two “vertical” horizons in the Sofia landscape: the high one – that of Vitosha and Lyulin

mountains, and the lower one, outlined by the hills of Slatina, Lozenets and Konyovitsa.

The concept was categorical and vigorous: beginning with a reconstruction of the *Sveta Nedelya* Square, **the first axis** was laid down in westward direction, which included a new business centre (in the section along *Stamboliyski* Blvd. till *Vazrazhdane* Square) and ended at the forest-covered hill of Konyovitsa, densely lined up with public buildings of cultural, historical and entertainment character.

The development of **the second axis** in eastern direction passes through reconstruction of the sacralic centre of the city – *Sveti. Alexander Nevski* Square to reach up to the Slatina hill, also saturated with sites of cultural and historical significance.

The axis in southern direction – towards Lozenets – is the most categorical one. Going through the intense commercial sector along *Vitosha* Blvd., across a strictly delineated water area, the axis reaches its *pointe* – “a memorial building, for instance an Army Museum”, situated “on the top of the *Lozenets* redoubt”, “to become the butt of the streets *Maria Louisa* and *Tsaritsa Yoanna*.”

All the three hills were connected to the belts of the green system and to the “inner panoramic road”, and all the three offered rich overview opportunities – both towards the city and to the surrounding mountains. Thus, **for a first time** in the history of the physical planning of the city of Sofia the idea was born for a **unified panoramic fabric** (structure) of the city.

For a first time in our practice the plan dealt with the time horizon of its application. Two time horizons were defined: a long-term horizon with 1980 as a conventional boundary and the next 15-20 years (after 1938) as a short-term horizon. The latter presumed a phased application of the plan and detailed analysis of various parts of the city. The governing conviction was that “..... the plan could not and should not be implemented in a hurry..... And I think that it would not be finalized by us alone – generations after us will still be working on it ...” (Eng. I.Ivanov). .

However, this did not happen. The implementation of the plan was suspended with the start of the bombing attacks by the aviation of the Alliance in 1944. Upon the establishment of the **new** socio-economic and political **set up** of the state which followed, the objectives, tasks and mechanisms of application of the Musman Plan were declared invalid. They were no more capable of coping with the crucial **consequences** of the political change. Some fragments from the plan may be detected in the communications structure and the green system of the present day city.

THIRD PERIOD - from 1945 till 1989

The third period of the spatial development of the city of Sofia (1945 – 1989) is divided into three planning phases:

First planning phase – 1945 – 1961

The critical situation of the city at the beginning of the period was marked by a change in the political and economic set up of the country, the devastation of a considerable portion of the building stock, which laid in ruins (12,000 buildings) as a result of the bombing raids, and the increasing migration pressure by the end of the period (and after it), due to the large-scale restructuring of the agricultural sector (collectivization) and the start of the industrialization drive (marked by the opening of large number of new jobs in the cities). This development required urgent measures for coping with

the spatial situation, which was effected by virtue of the first post-war plan, worked out under the leadership of Prof. L. Tonev and approved by an Ordinance-Law in 1945.

The plan envisaged settlement of a population of 800,000 inhabitants on an area of 4,000 ha. It declared an intention for polycentric structure with city-district centres, which had, however, not been clearly and systematically reflected. The substance of the main city centre was not outlined with sufficient precision either – the new ruling power had not yet formulated its vision about its symbols.

The formulation of the new symbols of the power made the revision of the plan an urgent necessity. The new plan, worked out under the leadership of Architect D. Mitov, was approved at the end of 1949. .

Because of the absence of large-scale investments (directed to meet other demands), the ideas of these plans had gradually been falling in oblivion. A certain portion of the concept of the new city centre had, however, been implemented – the largo, the Party House, the Central Department Store, the Council of Ministers building and the Balkan Hotel were constructed in a style, which after the 1950’s had been denounced and severely criticized. In planning and structural respect this implementation had undoubtedly a favourable effect, particularly in terms of the explicit orientation in western direction, which in the present days (after the construction of the Underground line) begins to reveal its real opportunities. In the 1950’s housing construction was still moderate in scale. Several housing groups were constructed on vacant areas – *Lagera, Krasna Polyana, and Zaharna Fabrika* – mainly 3-4-storey apartment blocks. This period was marked by the start of the rapid development of industrial zones, the start of ore mining in Kremikovtzi (and later the construction of the Combined Metallurgical Works). The mechanical population growth increased sharply. The volume of housing construction increased as well – the first housing estates emerged (*Vladimir Zaimov, Lenin, Deveti Septemvri, Zapaden Park* and *Hypodruma*). Industrial construction methods penetrated the sector and a need of a new Master Plan to direct and regulate the high rates of urbanization and construction activities in the city, began to take shape..

Second planning phase - 1961 – 1972

This phase set in as early as in 1956 with the approval of an Assignment for a new Master Plan. The design was carried out by two teams, headed by Architect L. Neykov and Arch. V. Siromahov. The work on and discussion of the projects continued until 1960. The difference between the two projects was mainly in the approach to the territorial and demographic development. The project of Architect L. Neykov envisaged constrained demographic growth of the capital (at maximum 800,000 inhabitants) and orientation of its spatial development along the path of reconstruction. The project of Architect V. Siromahov envisaged construction of new large residential districts on vacant areas. Except for this difference, the projects featured very similar theoretical and design formulations and approaches. A qualitatively new element in the broad territorial scope of the investigations was the incorporation of the surrounding zone, extending over the entire Sofia Plain and the river Iskar valley – from the Iskar Dam to the Iskar Gorge. The transport network developed further the radial-circular system. The development of the urban spatial structure was declared to be explicitly oriented towards a polycentric system, however in actual fact one main city centre was preserved. The residential areas were structured in micro-districts with small service centres. In the urban planning theory and practice at that time the micro-districts were the basic structural unit with a population of 15 to 20 thousand inhabitants and a closed services cycle in which the availability of a school was the major structuring element. The

micro-districts were divided into housing groups with a population of 3 to 5 thousand inhabitants, in which the availability of a kindergarten was the major structuring element. Many years later – in the 1970’s – these systems were developed further through the higher tiers – a residential district (40-50 thousand inhabitants, availability of a polyclinic, a cinema etc.), a planning district (100-200 thousand inhabitants, availability of a hospital, theatre and *ad hoc* or periodical services complexes and buildings), macro-structural units with secondary urban centres. Functional zoning was utmost clear-cut. The existing concentrations of enterprises were developed in six industrial and warehousing districts. Musman’s ideas about the green wedges were retained and developed further. The backbone of the spatial composition in both projects (especially in Siromahov’s plan) was the then topical idea of building a “navigation canal” – deviation of water from the river Iskar along the 600^m horizontal, running between the old city and the Ring Road. Despite the fact that this idea has been later denounced, thanks to the years-long protection of the southern areas, some of the projections of the two plans (the Zoo, the Botanic Garden) have been implemented. Some land reserves for the future have also been left aside..

In the course of the debates on and comparison of the plans of Siromahov and Neykov, the plan of Architect Neykov was declared to be more appropriate from the point of view of the drive to cope with the excessive rates of demographic and territorial growth, as well as “more realistic”. An international competition was held for the development of the main city centre, and after the competition three detailed plans were elaborated. Special focus was laid on the development of the main city centre in western direction. These projects remained unrealized. Some of them (those by K. Boyadjiev and V. Siromahov) gave rise to ideas about the location of certain buildings and spatial compositions (the Trade Unions House, etc.), which have later been made use of and implemented. . Despite the good intentions and great expectations with respect to the selection of the Neykov Plan and its approval by virtue of a law for application, life had a different fate in store for it. The growth rates of the capital continued to escalate – in only 5-6 years the parameters and framework of the plan have been exceeded. Although it was the Neykov Plan that was approved by law, the reality took a different turn and the capital had in actual terms been developing according to the Siromahov Plan. In 1968 new prerequisites emerged, sufficient to make a decision for the development of a new Master Plan. New planning solutions were sought and the enforced plan was considered to be exhausted. As a legal framework, however, it has been applied for more than thirty years, although during these years strategies, plans, ideas, updatings and upgradings emerged one after another. They remain stored as a rich archive, however some ideas from then had a significant influence on urban development, which was keeping up its dynamic characteristics and was subject to unforeseeable vicissitudes of life.

Third planning phase - 1972 – 1979

This phase started in actual fact in 1969 by virtue of a Governmental Decree, without specific Assignment Note. The design team was headed by Architect Stephan Staynov. It conducted a detailed and broad survey, created a new information database and developed a modern methodology for the elaboration of the plan. On this basis in the period 1971-1972 a complex preliminary draft (concept) was completed, consisting of three parts – an urbanistic hypothesis about the Sofia agglomeration, a directive urban plan and a transport communications plan. This plan featured also innovative formulations and ideas, the most important among which were as follows:

The urbanization processes were analyzed and projected **in a broad**

territorial scope and under unlimited quantitative growth. Besides the Sofia Plain, the investigated area covered also the entire Sofia-Pernik Region. A capacity for settlement of a population of 1,450 thousand to 1,600 thousand people was identified to exist in the urbanized area of the city. The notion **agglomeration** was introduced with the aim to encourage the agglomeration processes and to incorporate neighbouring areas and their population for the purposes of alleviating the problems of excessive concentration in the capital.

The development of the city was oriented towards the linear model. It was supposed to be appropriate for Sofia, provided that the main urbanized development axis was in the direction of the railway destination Belgrade-Istanbul, i.e. the new urban areas were defined in northwest and southeast direction. Under this model it was theoretically possible to achieve optimal and clean functional zoning: to the north of the railway areal – a zone for work, a residential zone between the railway areal and the mountain, and a recreation zone in the mountain skirts.

The city structure was planned as **polycentric**, comprising five complex macro-spatial units. The main city centre spread beyond the traditional city core and evolved into metropolitan sub-centres along the three main boulevards.

The transport scheme of the city deserted the inherited radial-circular outlines and converted into a typical **tangential** one. The main transit arteries Belgrade-Istanbul and Athens-Bucharest were evacuated to high-speed routes outside the boundaries of the residential areas. A new area was envisaged for an airport complex with characteristics of a modern inter-continental airport.

The backbone of the public transport was a new **Underground** network.

The technical infrastructure was designed through clustering of the individual engineering lines in underground passable collectors in the Central City Area, and in specialized areals in peripheral areas, ensured by the respective easements.

The green areas were organized in a **system of green wedges**, penetrating the city from Vitosha, and the water areas were increased manifold with the envisaged lakes along the river Iskar.

The studies were extremely rich in ideas and radical prospective proposals, however they had been worked out without an explicit assignment and turned out to be too vanguard and theoretical. In 1972 the Government leadership evaluated them as “unrealistic” because of the excessive demographic and territorial growth laid down in them and sent them back for revision. At the same time the detailed plan of the main city centre, worked out under the leadership of Architect VI. Romenski, was approved.

Forth planning phase - 1979 – 1989

This phase started in 1975, when the package of the three plans – a district territorial development plan, a general urban development plan and a transport communications plan – had been thoroughly revised by the team of the “Genplan” Division, headed by Architect Stephan Staynov. Upon coordination with the authorities and new revision and supplement in 1979 under the leadership of Architect M. Videlov, the three plans, made into a set as General Urban Development Plan, were submitted to broad review by the general public and the professionals.

This plan was accompanied by a series of new additional studies. Special attention among them are worth the following: :

- variants for territorial development and reconstruction;
- spatial composition scheme;

- scheme of underground urbanism;
- environmental studies;
- elaboration of a comprehensive scale model of the city.

This plan sought for a compromise realistic solution, which could preserve the modern planning ideas and theoretical achievements of the 1972 Phase by orienting them to the real possibilities, requirements and constraints (some of which have been imposed by the then existing administrative set up). As a result of this approach, the principal formulations and ideas of the plan obtained the following outlines:

The urbanization processes were analyzed and projected in detail in the framework of the Sofia Plain, whereby the formulations concerning decentralization of certain activities, which were already the subject of a national strategy (the Unified Territorial Development Plan), were retained.

The development of the urbanized territory was determined for an area of 18,222 ha and a population of 1,200 thousand to 1,250 thousand inhabitants by the year 2000.

Reconstruction was defined as a priority in the development of the urbanized territory, and the envisaged new territories for intensive housing construction were situated in southeast and southwest direction, by-passing the Vitosha mountain without going beyond the framework outlined by the Ring Road.

The structure of the city was **polycentric** with five planning units (the Old City, the Southeast City, the Southwest City, the Northwest City and the Northeast City).

The functional zoning retained the aspiration to establish three parallel zones (Work, Residence and Recreation), however in actual fact it was mixed as far as each of the five large structural units were planned to include all these functions. Particularly detailed was the design of the territorial location of the manufacturing activities with combination of industry, science and services, and warehousing, which were grouped in 11 “science and industry zones” with different specialization..

The transport system of the city was **combined radial-circular system with tangential routes**. Ensuring a second city ring (via the *Slaveykov* Square break-through) and a forth city ring (via the *T. Kableshkov* break-through), as well as the consecutive laying of east-bound, west-bound and northern tangents is worth special attention.

The **Underground** Network featured an optimized route. The three diameters were retained, however their routes were linked to the existing railway stations.

Along with the retention and detailization of the projects for the green and the water systems of the city by means of utilization of the valleys of the Vitosha rivers and the orientation of the city towards the river Iskar valley, worth special mention is the development of the southward direction of the main city centre and the elaboration of the overall **spatial composition** of the city by emphasizing and comprehensive assessment of panoramic view points and visual impacts.

In 1979 the plan was endorsed by the leadership of the local authority of the capital and the Government, and a draft-law for its approval was prepared. Prior to its submission to the National Assembly, approval by the Political Bureau of the then ruling Communist Party was required, however it had not been granted. Instead, in 1980 the Government decided to allocate new territories for housing construction on vacant areas – *Druzha 2, Ovcha Kupel 2, Levski 4, Obelya 2, Mladost 1a, Malinova Dolina* and

Gorublyane 2. The majority of these areas have anyway been envisaged for housing construction under the new General Urban Development Plan, however some of them had to change their designation, although without any substantial consequences. Therefore, in 1985 the team of the *Genplan* Division (headed by Architect Sp. Ganev) conducted the next-in-the-row updating of the plan, without making changes of its underlying ideas and spatial organization and without any further procedures for its legalization.

In the period 1988-1989 updating was made also of the Master Communications and Transport Plan by a team headed by Eng. S. Simeonov, which also failed to be approved and implemented because of the political and economic changes, which took place in 1989.

FOURTH PERIOD – after 1989

The forth period in the spatial development of Sofia began in 1989 with the major transformations of the political and socio-economic development of the country. A new crisis situation emerged in the spatial development of the city, caused by the inability of the tools of the enforced Master Plan and the detailed Build-up and Regulation Plans to manage the spatial development of the city under the changed conditions.

An attempt to limit the manifestations of the crisis was made in 1990 with the decision of Sofia Municipality to launch a national competition for the elaboration of a new Master Plan, which should be adequate to the ascended changes. From the total of 25 submitted projects 5 were awarded, which offered different approaches for the solution of the task. The inability to capture and describe the new development trends in 1990, combined with the typical for urban planning stochastic bend, which deprives of certainty any forecast, on one hand, coupled with other motives ensuing from the very process of social and political change, on the other hand, put a stop to the implementation of the next stages of the design competition for elaboration of a new Master Plan. Adaptation to the new conditions took a long time and involved a series of partial amendments to the enforced Master Plan, Building and Regulation Plan and intensive efforts for design of partial amendments to the neighbourhood build-up plans.

The growing awareness of the situation put forward the urgent need to work out a new Master Plan, the work on which started upon the amendment of a special law in April 1998.

That plan was completed in April 2003 and submitted for processing by the Municipal Administration. Because of a series of legal claims related to the procedures for approval of the Environmental Impact Assessment Report at the request of NGOs, the Master Plan of Sofia Municipality was finally approved by virtue of Decision No. 6/147 of 2006 of the Council of Ministers and enforced as of 28 January 2007 in accordance with the provisions of §11 and § 14 of the Law on Physical Planning and Build-up of Sofia Municipality.

In connection with the significant socio-economic changes that have taken place in the period 2003-2006, the increase in investments and accelerated migration towards the city of Sofia and Sofia Municipality, the growing number of vehicles on the road, the then still on-going restitution of ownership rights on urban plots, there were cases of build-up on the green areas in the housing estates and other violations.

These circumstances imposed the need to update the Master Plan with due account of the new circumstances in the development of the city of Sofia and Sofia Municipality. A deadline for assignment of the amendment of the Master Plan was set up on the grounds of §7, Para. 1 and 2. of the

Law on Physical Planning and Build-up of Sofia Municipality.

After the approval of the relevant Decision of the Sofia Municipal Council and signing of the relevant Order by the Mayor of Sofia Municipality, work on the Draft-Amendment to the Master Plan was launched in August 2007. The Draft-Amendment is already completed and its processing is forthcoming.

Conclusions from the evaluation of the applicability of the previous plans

The studies suggest unequivocally that the major plans for Sofia, worked out as **models** for the *physical planning and development of the city* – the Amadie-Colar, Musman, Neykov-Siromahov and the unapproved Staynov-Videlov-Gabev-Mollov plans – became inapplicable not because of exhaustion of the stock of visions and ideas contained in them, nor because they have reached their time limit, but rather because of the **occurrences of sudden insurmountable crises**, which undermined the rationale of their presumptions, and hence – the grounds for their implementation. The following sequence and periods in the process of their application could be distinguished:

- a period of fruitful implementation of the plan;
- emergence of an unforeseen crisis;
- replacement of the no-more-topical presumptions of the plan by emergency, sporadic, unsystematic rescue actions on the part of the city administration;
- setting-in of a period, when the absence of an update plan is conceived as a *form of convenience* for the administration, combined with a *selective use* of ideas put forward by the planners (this is manifested on a particularly large scale and for a long period of time during the period Staynov-Videlov-Ganev-Mollov);
- growth of the problems of the city's behaviour to the point of the emergence of crisis, caused by the lack of plan;
- growing public awareness of the critical situation and *launching of design of a new plan, corresponding to the current conditions*.

The major conclusion is that the sequence of plans, worked out as **models** for the *planning and spatial development of the city*, is not based on a logical, internal cause-and-effect rationale, but rather it has been imposed by the impact of series of devastating crises:

1.3. GEOGRAPHIC LOCATION

From the point of view of *physical geography* the location of Sofia Municipality is analyzed and assessed with respect to the major morphological structural units. It occupies part of the Sofia Plain and parts of the surrounding mountains (Sofia??, Vitosha, Plana and Lozen mountains).

From the point of view of its position among the rest of the *regional territorial units* Sofia Municipality falls within the scope of the *Southwest Planning Region*. An important peculiarity of the location of the municipality it that it is huddled as an “enclave” within the boundaries of Sofia District. The city of Sofia is the administrative centre of Sofia Municipality, the city of Sofia District and Sofia District.

From the point of view of its *transport-geographic (communication) location* Sofia and especially its centre as a factor has played a significant role in its historical development. Its crossroads location has played a positive role for the emergence and further development of Sofia and the neighboring human settlements. That location provides grounds to talk about the factor “Sofia crossroads”. It is that factor that is been taken account of during modern times as well – in determining the routes of some *trans-continental* and *trans-European* transport corridors.

This is a point of intersection of four transport destinations of global significance: the 3-continental diagonal main route in Northwest-Southeast direction (London-Budapest-Sofia-Istanbul-Calcutta-Melbourne), Euro-African main route running in meridian direction (Helsinki, Moscow, Sofia, Thessaloniki, Cairo, Cape Town), the diagonal Euro-African main route (Tunisia-Durrès-Sofia-Bucharest-Odessa-Omsk) and the emerging transport corridor around the 40th parallel from the Caspian Sea via the Black Sea towards the Adriatic Sea (P'ot'i-Varna-Sofia-Skopje- Durrès).

Sofia is an intersection point of three Trans-European Transport Corridors:

- Corridor No. 4: Budapest-Vidin-Sofia-Thessaloniki (Istanbul);
- Corridor No. 8 Durrès-Skopije-Sofia-Bourgas-Varna;
- Corridor No. 10: Belgrade-Sofia-Plovdiv-Istanbul.

In the context of the transport communication location of Sofia Municipality the *intra-Balkan and national roads* are important elements of the Sofia crossroads. Sofia bears the characteristics of a real geographic transport centre on the Balkan Peninsula. If we compare the distances between the capitals on the Balkan Peninsula and some of the bigger cities in the area, measured along the international roads traversing the region, it becomes evident that Sofia is characterized by the shortest average distances (455 km), followed by Skopje (523 km) and Thessaloniki (530 km). This is an objective basis for the future development of the city as an important centre not only within the country, but also in the region of Southeast Europe. Highlighting of the *strategic transport-communication location* should be supported by the respective transport-communication policy. The tapping of that potential would respectively affect also the general socio-economic development of Sofia Municipality and the country as a whole.

The major conclusion from the assessment of the geographic location and the Municipality's position in national and regional context may be formulated as follows:

- The favorable location of the Municipality and its centre has been appreciated as early as in the past and has been taken into account for the settlement development. Under modern conditions the geographic location of the city of Sofia and Sofia Municipality has been evaluated as a favorable factor enhancing their attractiveness;
- In this sense the Amendments to the Master Plan of Sofia Municipality should categorically be re-evaluated and the routes of the Trans-European transport corridors traversing the territory should be preserved in the context of their both promotional and limiting impact on the development of its northern parts.

1.4. NATURAL CONDITIONS AND RESOURCES

Relief

Sofia Municipality is characterized by a varied relief. As a whole, the relief may be characterized as **comprising flat areas, valleys and mountain slopes and mountain areas**. A certain zoning is typical for the relief of Sofia Municipality. In North-South direction the relief changes from mountainous in the north (mountain ridges and slopes) to flat land in the middle (the Sofia Plain with the lowest mountain skirts of the Balkan Mountains Range) and mountainous again in the south (Vitosha, Plana, the Lozen Mountain). Flat ridges (high-mountain plateau relief) are characteristic for the high-altitude parts of Vitosha and partly for Lozen Mountains.

For vertical indentation the maximum differences in the elevation of the lowest and the highest points per area unit (1 km²) are recorded. The investigations of detailed topographic maps show that about 18 per cent of the area of Sofia has a vertical indentation of the relief below 10 m/km². These are mainly areas in the Sofia Plain. Small parts of the Sofia Plain and the low-lying mountain skirts (13.3% of the area of Sofia Municipality) have a vertical indentation of 10-25 m/km². Parts of the quarters Darvenitsa, Druzhba, Slatina Redoute, Lyulin Housing Estate, the fore-mountain skirts of Sofia Mountain (9.8% of the area of Sofia Municipality) have an indicator of vertical indentation of the relief of 25-50 m/km². With the increase of the height above sea level the vertical indentation of the relief also increases, for instance the areas in the mountain skirts situated in the northern and southern ends of the plain and in the skirts of the surrounding mountains the indicator of vertical indentation is from 50 to 100 m/km².

The horizontal indentation of the relief denotes the density of the river and gully network on the area of Sofia Municipality and is not affected by the elevation above the sea level. The lowest indicator for density of the river and gully network (below 0.5 km/km²) is characteristic for the majority of the area of the Sofia Plain and the Vitosha Plateau (31.9% of the total area of the municipality). Somewhat higher values for this indicator have been recorded for certain areas of the mountainous parts of Sofia Municipality – 1.5-3.5 km/km², as well as for small parts of the Sofia Plain.

As a result of the active economic activity, performed on the territory of Sofia Municipality, a number of *anthropogenesis formations* have been created, which complement the natural characteristics of the relief. These are the artificial reservoirs (the *Iskar* Dam, the *Pancherevo* Lake), road and technical infrastructure (viaducts and bridges along the *Hemus* and *Trakiya* Highways), damaged plots, quarries and quarry ponds, brownfields, waste banks etc.

Climate

The climatic characteristics of Sofia Municipality have been elaborated with a view of the impact of climate on the economic activity and the living conditions of the population. The Municipality falls within the **moderate-continental climatic** region in Bulgaria. The average annual air temperature varies from +10.0°C in the Sofia Plain to +1.8°C in the high mountain belt. In the low-mountain belt and the medium-mountain belt the average annual air temperature varies between +8.0 and +5.0°C. The mean January temperatures are negative and drop further with the increase in altitude – from –1.5 to -7.0°C The mean July temperatures also decrease with the increase of altitude – from +20.5°C (Sofia) to +9.0°C (at Cherni Vrah in Vitosha Mountains).

Western and north-western **winds** predominate in Sofia Plain, followed by eastern winds. In the medium- and high-altitude mountain belt the frequency of southern and south-western winds is higher.

The **precipitation rate** in the region increases from the lower to the higher parts. The annual amount for the Sofia Plain is approximately 600 mm, and in the high mountain areas of Vitosha – approximately 1100 mm. The number of days with **snow covers** also increases with the altitude – from 42 for the Sofia Plain to 180 in the high parts of Vitosha.

On the basis of the assessment of the climatic factors and their impact on the economic development of Sofia Municipality the area could be divided into three climatic zones:

- zone of moderate continental climate, favourable for economic activities – agrarian sector, transport, construction, etc (covering

- areas situated at 500 to 800 m above sea level);
- zone of medium-mountain version of the moderate continental climate, relatively favourable for development of mountain-type agriculture and stock-rearing, for development of forestry activities, construction and for recreation and tourism (at 800 to 1800 m above sea level);
- zone of high-mountain version of the moderate continental climate, not suited for economic activities with the exception of mountain-tourism and skiing (at an altitude of more than 1800 above sea level);

Geological and hydrological conditions

The available geological information and the studies conducted on the area of Sofia Municipality show that the Sofia Plain, in which the major part of the municipality is situated, is young, tectonically active graben structure. It has a complex structure and manifests current activity. The most serious risk for the region are earthquakes from local seismic foci with a magnitude of up to 7.0. In this respect one should take into consideration also the manifestations of certain disastrous and unfavorable physical-geological processes. Among them gravity processes predominate along the periphery of the hollow, while in the central parts of the hollow processes connected with fluctuations of the shallow waters and weak soils predominate.

On the basis of the geological information and years-long prospecting of the area of the Sofia Plain *engineering geological zoning* of the area of the city of Sofia has been produced in scale 1:10 000.

Its objective is to serve the construction sector, which is directly related to the socio-economic development of the territory. The engineering-geological zoning unites 13 zones featuring analogous geological conditions with a focus of the plots heaving unfavorable conditions for construction activity.

Water

Sofia Municipality is poor in surface running waters. The main elements of the hydrographic network in Sofia Municipality are the *rivers and water reservoirs*. In the river network the river Iskar is the most important drainage factor. The **network of tributaries** is asymmetrical and is represented by a multitude of left-hand tributaries with only one right-hand tributary - the river Lisnovska (Stari Iskar). The left tributaries spring from Vitosha Mountains (the river Bistritsa, the river Perlovska – with its right-hand tributary the river Slatinska – and the river Vladayska) and from Lyulin Mountains (the river Suhodolska – left-hand tributary of the river Vladayska – and the river Bankyanska). Another left-hand tributary is the river Blato, which cuts the area of Sofia Municipality to the east of the town of Kostinbrod. The majority of the river Iskar tributaries within the boundaries of Sofia Municipality are short (less than 30 km long).

Water reservoirs are of anthropogenesis origin – some have been artificially constructed (dams) for regulation of river waters for the purposes of complex utilization, others have emerged at locations, which used to be quarries for rock materials (usually alluvial-lake sands).

The dams on the territory of Sofia Municipality are the *Iskar* Dam (area of about 30 km² and maximum storage capacity of 673 million m³), the *Pancherevo* Dam (area of about 0.900 km² and storage capacity of 6.7 million m³), *Passarel* Dam (area 0.330 km²) and about 10 mini-dams (including equalizers) with total area of about 1 km².

Lakes in pits are encountered in large groups around the villages of

Negovan, Chepintsi, Chelopechene, Dolni Bogrov, Krivina, Kazichene, Gorublyane, Vrazhdebna and to the east of the Sofia Airport; and in small groups or standing alone around the villages of Katina, Svetovrachane, the town of Novi Iskar and the Gara Iskar (*Iskar* Railway Station) and Druzhiba quarters. Their total area amounts to 3.340 km². In the structure of the water resources besides the surface running waters particular importance for the territory under review have the underground fresh and mineral waters. In the eastern parts of the Sofia Plain (along the rivers Lesnovska and Iskar) and in the area of Kazichene-Lozen-Ravno Pole the ground waters lay predominantly at a depth 2.0 – 3.0. A zoning scheme of the territory by water mirror depths in scale 1:10 000 has been compiled for the city of Sofia and in scale 1:25 000 for the surrounding area.

Mineral waters

The mineral waters of Sofia, one of the major factors for its emergence as a settlement, have been known for thousands of years.

Eight types of thermal waters are stored in its underground space, which makes it the sole European capital possessing natural wealth of that kind.

The deep location of the thermal mineral waters and the long period of their water exchange and reproduction cycle (500 to 1000 years) precondition their protection and low vulnerability to pollution and exhaustion.

About 50 mineral water sources have been identified in Sofia Municipality and above all in the city of Sofia and certain parts of the Sofia Plain of which 12-15 have been conserved (in practice not exploited currently). There are also localizations of mineral water sources with several springs. Out of the total number of mineral water sources 10 have been classified as deposits of national significance and 8 as suitable for bottling as table water.

In terms of their properties these are 8-10 types of mineral waters of different chemical, physical and applied characteristics. Their total delivery rate is between 450 and 500 l/sec and their geothermal energy are estimated at about 40 MW. The characteristics of the mineral waters on the area of Sofia Municipality vary considerably in terms of localization, delivery rate, chemical and mineral composition, and temperature range.

To date 23 alone-standing deposits of mineral waters have been identified on the area of Sofia Municipality, of which only 8 come to the surface as natural springs. Sofia may rely on exploitation of 30-35 alone-standing or tapped hydro-geological deposits (including through identification of new ones).

In terms of their nature a significant portion of the deposits is of the so-called “filtration”-type (i.e. renewable), which makes them promising in long-term aspects. Their total delivery rate is considerable: 133.9 l/sec. The deposits having higher delivery rate, i.e. higher capacity, are those at Bankya (25 l/sec), Zhelezniitsa (20 l/sec), Pancherevo (17.5 l/s), Sofia-centre (16.5 l/sec), *Svoboda* Quarter (12q0 l/sec), Knyazhevo (10 l/sec), Gorna Banya (10 l/sec) etc. From the conserved (currently unexploited) mineral water springs the ones of higher delivery rate are those in the area of Zona B-5, in the area of the *Borisova Gradina* Park etc. From the currently functioning springs five are of national significance. These are Sofia-centre, Bankya, Knyazhevo, Zhelezniitsa and Pancherevo.

The major directions for economic utilization of the mineral waters on the area of Sofia Municipality are as follows:

- ⇒ Development of the recreation-curative and rehabilitation activity;

- ⇒ Development of multi-functional spa centres and facilities in and around the city;
- ⇒ Integration of the mineral waters as a resource for development of facilities for active recreation in and around the city;
- ⇒ Development of table-water-bottling industry (capacity 2-3 million l/day);
- ⇒ Geothermal-water-based space heating and air-conditioning of spa, curing, recreation, tourism and other facilities;
- ⇒ Auxiliary yards for geothermal-water-based greenhouses, aquaculture nurseries and industrial fish-breeding farms;
- ⇒ Hydro-geothermal nature-and-science attractions;
- ⇒ Provision of the population of the capital with healthy mineral drinking water in extreme and emergency situations.

Soils and vegetation cover

In the flat hollow part of the municipality – the Sofia Plain – the local soil variety is represented by black earth (humus) soils, alluvial-meadow and diluvia-meadow soils. This type of soils is favorable for development of some traditional for the municipality agricultural productions – grain and forage crops, vegetable-growing, fruit-growing etc. Maroon and brown forest soils are characteristic for the slopes of the surrounding mountains.

On the area of Sofia Municipality are encountered representatives of natural vegetation typical for all forest vegetation belts in Bulgaria. The alpine pastures of the high-mountain belt, to be found in the Vitosha Mountains, are spread in vast grass and low-bush communities. Coniferous forest formations of *Picea*, *Pinus sylvestris* and *Albies alba* predominate in the higher parts of the medium mountain belt (Vitosha – *Bistrishko Branishte*), and forests of *Pinus sylvestris* (Vitosha – above the village of Zhelezniitsa, Plana Mountains) and *Fagus* (Lozen Mountains, Vitosha) predominate in its lower parts. There are forests of *Quercus tetraea*, *Carpinus etrelus* and *Fagus* in the lowest parts of this belt. Under the influence of human activity part of these forests have degraded into bushes of *Corylus avellana* or grass communities. At certain places artificial plantations of *Pinus sylvestris* and *Pinus nigra* have been created.

The major nature sights on the territory of Sofia Municipality are set in zones with specific protective regime. These are the Vitosha Nature Park and the nature reserves *Vitoshko Branishte* and *Torfeno Branishte*.

The remaining 44 protected sites are of the category ‘nature sights’. Two of them are sights of the still nature – earth pyramids near the village of Katina in Quaternary sediments and the *Samokovishteto* waterfall in the land of the village of Bistritsa. Some centuries-old samples of foreign species have also been declared nature sights: *Ailanthus altissima*, *Sophora japonica*, almond-tree.

A clearly manifested altitude-based zoning is observed in the distribution of nature landscapes in Sofia Municipality, which is due to the variety of the relief (from about 500m above sea level at Novi Iskar up to 2290m above sea level at the *Cherni Vrah* Peak) and the related changes in the components of the natural landscapes.

Depending on the territorial combination of the components of the natural environment, which determine the landscape diversity, and the manifestations of the altitude-based zoning, the natural landscapes in Sofia Municipality are divided into three major **types**:

- Mountain landscapes

- Foothills landscapes
- Plain-bottom landscapes

The analyses and assessments of the *nature resources* of Sofia Municipality indicate that the diversity and quality characteristics of the individual components of nature have a *favorable impact* on the development of the territory. Some of these resources (mineral waters, mountain climate etc.), however, have not been tapped rationally for the development of tourism. On the other hand, the observations related to some of the changes in the quality parameters of the individual natural components, which have been conducted during the past years, reveal that these changes are not significant. Deterioration of certain qualitative characteristics (mainly sanitary-hygienic ones), which are related to the standards of urban environment and partially to the environment in the surrounding area, has been noted only as a consequence of anthropogenic interventions in the natural environment.

*The following **conclusions** may be drawn:*

- Despite its limited area Sofia Municipality possesses a rich variety of high-quality resources. These are put at the service of the socio-economic development.
- The precious land resources comprise high-category agricultural land, used for the development of the agrarian sector.
- Sofia Municipality is blessed with a precious nature wealth – mineral waters varying in chemical and physical composition and temperature. Some 50 water sources of high delivery rate have been identified and serve as a resource for development of different kinds of spa tourism.
- The opportunities for multi-facet utilization of the mineral waters in the city of Sofia and Sofia Municipality (for instance taking advantage of the geothermal energy or setting in place thermal-water-based entertainment facilities and centres for spreading knowledge in natural sciences etc.), however, are not fully tapped.
- Underutilized for the purposes of socio-economic development is also the favorable combination of natural conditions (mountain climate – variety of landscapes – mineral waters) as a resources bank for combination of different forms of tourism (mountain and spa tourism, eco-tourism and spa tourism, etc.).

The identified **ore deposits** are as follows:

- Manganese ore: insignificant deposits of no interest from economic point of view have been discovered at the village of Pozharevo / Bozhurishte Municipality/;
- Copper: insignificant quantities have been discovered at the *Venetsa* Locality;
- Lead-zinc ore, mixed with silver and sulphur, has been discovered in the area of the village of Ossenov Lag and the village of Izdermets. In the recent years the deposits are not exploited.

Quarries for building materials:

New concessions have been assigned after 2003 for the following pits:

- *Kubratovo 1* – 800 m to the south of the village of Svetovrachane
- *Ton 1* – to the southeast of the village of Katina

Hydro-thermal resources:

The major characteristics and territorial localization of the identified and potential hydro-thermal resources are illustrated on a specialized scheme in scale 1: 25 000. Eight thermal-water-bearing zones have been defined, which contain and/or reproduce thermal waters varying in their nature,

composition and properties and manifest either significantly or radically different conditions for hydro-thermal circulation, accumulation and exploitation:

- Zone of sporadic deposits of alkali thermae of low mineral content: deposits have been found around Bankya, Ivanyane, Gorna Banya, Knyazhevo, Sofia-centre, Lozenets Quarter, *Borisova Gradina* Park. It is possible to discover new ones within the stretches of the housing estates *Lyulin, Zapaden Park, Razsadnika, Lagera-Hypodruma, Ivan Vazov, Dianabad, Geo Milev-East, Mladost-1* and *Druzhdza*, as well as in the skirts of Vitosha near Boyana, Dragalevtzi and Simeonovo. They are characterized by low mineralization (0.130-0.300 g/l); bicarbonate-sulphate-sodium composition; higher silicon (H₂SiO₃) content, alkali reation, temperature 25(30)-50(55) °C.
- Linear zone with sporadic deposits of thermal waters from alkali-earth type: discovered deposits in Ovcha Kupel and Pancherevo. Potential deposits in the space between Krasno Selo, Southern Park, Mladost-4, Gorublyane or German. Properties of the mineral waters: mineralization 0.4-1(1.2) g/l, bicarbonate-sulphate-calcium-sodium composition, neutral reaction; temperature in the range of 25(30)-50(55) °C.
- Artesian zone with thermal mineral waters of higher bicarbonate (sodium) mineralization; prospecting exposures near Kostinbrod and Nadezhda Quarter with potential sites for bore-well exploitation at Obelya-Vrabnitsa, *Severen* Park (Nadezhda), Hadji Dimitar, Poduyane and to the east. Properties of the mineral waters: mineralization 1-2.5 g/l; bicarbonate-sodium content; higher content of sulphide (H₂S), fluorine, silicon and other additive; temperature 30(35) to 55°C, possibly 65°C.
- Zone of sub-thermal Karst waters: prospecting exposures near Kostinbrod with potential points for boring near the village of Zhiten and the village of Golyanovtsi. Properties of the water: mineralization 0.4-0.6 g/l; bicarbonate-calcium-magnesium (alkali-earth) composition; temperature from 20(25) to 30 (35) °C, possibly 40°C.
- Artesian zone with mineralized waters of exotic sodium-Glauber composition: prospecting exposures: Dobroslavtsi, Novi Iskar (Kumaritsa), Gnilyane, Mramor, Trebich, Iliyantsi, Chepintsi and between Krivina and Dolni Bogrov. Perspective locations for prospecting and exploitation: around the above settlements plus Mirovyane, Kubratovo, Benkovski, Negovan, Vrazhdebna and Chelopechene. Water properties: relatively high mineralization (2.5-4.5 g/l); sodium-Glauber (bicarbonate-sulphate-sodium) composition; higher content of fluorine, lithium, silicon and other elements; in part of the zone – free CO₂.
- Kazichene (Eastern Sofia) thermal-waters-bearing zone: identified fields around Kazichene and Ravno Pole – two parts of a common deposit. Potential locations for prospecting and exploitation: around Busmantsi, Gara Iskar, Verila, Mussachevo, Lozen and Vrazhdebna. Property of the thermal waters: mineralization 0.8-1 g/l; bicarbonate-alkali-alkali-earth composition; increased content of silicon, fluorine and free CO₂; temperature from 40-50°C up to 80-90°C.
- Peripheral layer-type artesian thermal-water-bearing zone: [rospecting exposures of the zone around Svetovrachane, Gorni Bogorov, Dolni Bogorov and Elin Pelin. Potential locations for prospecting exploitation: around Mussachevo, Elin

Pelin, Dolni Bogorov, Gorni Bogorov, Botunets, and the strip between Negovan, Lokorsko, Podgumer and Svetovrachane. Quality of the waters: relatively low mineralization (0.6-1.5 g/l), bicarbonate-sodium composition; sulphide sulphur (H₂S) content, alkali reaction, temperature 30(35)-50(55)°C.

- Joint-crack-valley thermal-water-bearing system in the Plana Mountains granite-diorite massif: exposed deposits at the village of Zheleznitsa and the *Iskar* Dam (Shtarkelovo Gnezdo). Properties of the waters: low mineralization (0.3 g/l); bicarbonate-sulphate sodium composition; alkali reaction; increased silicon and fluorine content; temperature 25-40°C.

Perspectives for utilization of the hydro-thermal resources according to the Strategy concerning Mineral Waters in Sofia and its surroundings.

The strategic objective and perspective in the multi-facet and comprehensive utilization of the mineral waters potential of the Sofia area during **the next 20 years** and beyond should be the development of viable and significant in social and economic aspect hydro-thermal centres, public catering facilities, enterprises and activities.

Mail conclusions:

The analyses show that in the period 2000-2006 no substantial changes have happened in the natural conditions and resources.

It is worth noting that in the northern area of Sofia Municipality large territories are granted under concession contracts for extraction of inert materials without co-ordination of their localization and programmes for rehabilitation with the Sofia Master Plan or the Concept for Development of the Territory, including that of the *Iskar* Water Park. That situation casts doubts on the possibility for rapid cultivation of the northern territories, which is one of the priorities in the spatial development of the municipality.

In the course of the public debates in the administrative districts from the northern territories on the draft for amendment of the Master Plan of Sofia Municipality the population objected against that approach and emphasized the risk of pollution of the soils and the atmospheric air resulting from the transportation of the extracted materials (especially during high summer and in winter) – an impact that is clearly noticeable even in the present.

2. ANALYSIS OF THE CURRENT STATE AND DEVELOPMENT TRENDS OF THE ECONOMY OF SOFIA MUNICIPALITY

2.1. ECONOMIC DEVELOPMENT FACTORS

The state of and trends in the economic development of Sofia Municipality are definitely influenced by a set of factors and prerequisites, which may be clustered into two major groups:

- Factors promoting the socio-economic development
- Factors hampering the socio-economic development

The factors and prerequisites of a ***promotional nature*** are as follows:

- *The favorable location* of Sofia Municipality and its centre, the city of Sofia, and their role as a centre and chief international transport centre in the country.
- *The functions of the city of Sofia as a communication junction* with a well-developed transport network and communications. As compared with the rest of the districts

in the country the capital possesses the highest transport and communication accessibility, although the city of Sofia is lagging considerably behind the other big and capital cities in Europe.

- *The very high general infrastructure equipment of the territory*, which provides Sofia Municipality advantages in terms of general conditions for development, in which infrastructure acts as one of the decisive factors for restructuring and boosting of production.
- *The accumulated experience and traditions* in the development of the services sectors.
- *The large number and high quality of the human potential and labour resources* of high skills level and rich production experience. The great number of inhabitants, estimated to be a factor promoting production and consumption of goods and services.
- *The existing significant in terms of capacity material base* of all economic sectors.
- *The existence of a large number of higher educational establishments and research and development centres and institutes*, which act as incentives for further innovative development of the city of Sofia with a possibility for setting in place of technology parks and other forms of merger between science and production.
- *The attractiveness of the territory for investments* for implementation of projects in the domain of business infrastructure, industry, trade, tourism, logistics, top level services etc. In terms of volume of foreign investments Sofia ranks on the first place nationwide. Their cumulative amount by the end of 2006 was US Dollars 6 922 034 thousand (?).

Apart from the factors and prerequisites promoting the socio-economic development of Sofia Municipality, account is taken also of factors and prerequisites of a hampering nature. To mention just a few:

- Insufficiently manifested or unreliable *links to the new European and global poles of concentration of economic activity and entrepreneurship*, which results in increase of the costs and efforts on the part of the regional industry in its strive to achieve commercial and investment penetration and to ensure a share in the expected expansion of the international markets.
- *Shortage of markets* for sale of the production output because of the as yet inadequate absorption capacity of the domestic market, the as yet low purchasing capacity of consumers, and the low competitive capacity of the turned out production and the disruption of the existing foreign trade relations.
- *Underdeveloped technological, market and entrepreneurship infrastructure* of a modern type, capable of activating the business and earning the country and the city strong positions in the strained international, regional and urban competition with respect to attraction of investments, high-prestige activities and modern manufactures as catalysts of the overall development.
- *Low rates of restructuring and modernization of industrial production*, development of innovative and competitive production lines – consumers of a significant amount of investment capital.

2.2. GENERAL CHARACTERISTICS OF THE TERRITORIAL ECONOMIC COMPLEX

One of the primary macro-indicators illustrating the state of the socio-economic complex of the municipality is the Gross Domestic Product

(GDP)*. It gives an idea of the state of the economy.

In 2002 GDP to the amount of BGN 9 429 million or 29.1 per cent of the national total was produced on the area of the municipality (Sofia Municipality). In 2005 the amount of the GDP increased to BGN 13 259 million.

For the purposes of the comparative analysis (for assessment of the place of Sofia Municipality in the national socio-economic complex) the relative indicator “GDP per capita” is issued.

In 2002 the value of this indicator was BGN 7 938 at national average BGN 4 109. In 2005 the GDP per capita in the municipality was BGN 10 811.

This is almost two times the achieved GDP per capita nationwide. In terms of that indicator Sofia Municipality is considerably ahead of the rest of the districts in the country.

The GDP per employed person in the municipality was BGN 23 890 (EUR 12 215).

Another economic indicator, which gives an idea of the economic state of the municipality, is “amount of revenue from activities”. The revenues from activities of the enterprises in 2003 amounted to a total of BGN 37 213 million, including 50.4 per cent from trade, car repair, personal items and household goods, and 19.67 per cent from the processing industry. In 2006 these figures were respectively BGN 61 646 million, including 55 per cent for the sector “Trade” and 11.5 per cent from the processing industry. Within only three years there is an increase of 65.7 per cent and that mainly from the activities in the tertiary sector (services).

Another indicator, giving an idea of the economic potential of Sofia Municipality is the amount of investments for acquisition of long-term material assets. In 2003 the investments amounted to BGN 3 958.1 million and in 2006 to BGN 7 569.8 million. The increase only for that period is 90 per cent.

The direct foreign investments in the financial enterprises in 2006 amounted to BGN 1 842 million. Apart from any other requirements, the increased investment activity calls for new plots and that predominantly for development of the tertiary sector activities.

2.3. PRIMARY SECTOR

2.3.1. Agriculture

The agrarian sector participates with a small relative share in the GDP (below 1 per cent), which is the result of the high development of the other two sectors – the processing industry and services. In 2006 the production output of agriculture accounted for 0.4 per cent of the GDP of the municipality and manifests a trend of retaining that share.

The number of those employed in this sector is also small. Their relative share in 2006 was hardly 0.3 per cent of the total number of employed persons and also demonstrates a trend for stabilization.

Irrespective of the quoted data emphasizing the more modest share of the agrarian sector in the socio-economic complex of the municipality, it has its standing position in the future development of the territory. This is related to the utilization of the available land resources and provision of agricultural production (that direct consumption is of particular significance in this respect) and ensuring employment and a source of income for the population.

The total amount of the *utilized agricultural area* in Sofia Municipality in 2005 was 45.6 thousand ha. As compared to 2004 (49 832 ha) there is a reduction of 4 277 ha, which is quite annoying. The reasons for that phenomenon need to be studied comprehensively.

One of the major factors for that process is the accelerated urbanization of the area of the municipality. The majority of the arable land plots are situated in the northern, less urbanized part of the municipality – in the area of Novi Iskar, Kremikovtsi and Pancherevo.

Sectoral structure. The agricultural sector in the municipality has a plant-growing and stock-rearing structure. It is specialized in the production of fodder, meat, milk, vegetables and potatoes. An agricultural zone has formed around the city of Sofia. Its production meets part of the demand of the capital for fresh vegetables, milk and dairy products.

Table No. 4
Area under crops of the agricultural farms in Sofia Municipality in ha for the period 1998-2003*

Indicators	1998	2000	2003
Total	22 760	15 365	10 321
Cereals	15 476	8 055	5 770
Industrial crops	788	1 049	2 618
Vegetables, potatoes, strawberries, horticulture	2 844	2 825	357
Fodder	3 623	3 405	923
Miscellaneous crops	29	31	653

Source: NSI Sofia in Figures

In the period 1998 – 2003 a well manifested trend of diminishing of the land under crops has been observed.

Stock-rearing in the municipality is specialized in cattle-breeding, sheep-breeding and poultry farming. It is developing in close linkage with the capital city, more precisely with meeting the demand of its population for meat, milk, eggs and honey.

Table No.5
Dynamics of the number of domestic animals in Sofia Municipality for the period 1998 -2003*

Indicators	Years				
	1998	1999	2000	2001	2003
Cattle	7 317	7 897	8 298	7 028	7 969
incl. cows	5 261	5 640	6 050	5 626	4 914
Buffaloes	10	57	16	20	36
Pigs	14 584	17 964	19 320	15 821	8 185
Sheep	26 253	26 807	27 317	20 872	12 023
Goats b	10 385	12 020	12 800	9 491	7 269
Poultry	164 342	176 391	170 279	161 714	108 461

2.3.2. Forestry

The data from the balance of the territory indicate that in 2002* the forest areas occupied 42 622 ha. This accounts for about 1 per cent of the total area of forests in Bulgaria. The afforested areas is 32 841 ha or 0.98 per cent of the forest stock – respectively 4 446 795 ha or 0.95 per cent of the national total.

* By the time of completion of that report data published by NSI about the GDP for 2006 were not available.

*Latest published data

On the area of Sofia Municipality all the forests are special-use forests, i.e. this is the only district (municipality), in which there are no forests for economic use or forests of predominantly wood-logging and environment-shaping designation..

The special-use forest areas comprise 25 638 ha of forests serving for water-protection, erosion-prevention, melioration, recreation and other types of use and 7 203 ha of forests in protected areas, accounting for 2.92% of the national total.

On the area of the municipality operate two forestry farms – the Sofia-city State Forestry Farm and the *Vitosha Nature Park* Economic Enterprise. The forest resources on the area of the city of Sofia are limited and have no specific industrial importance. With the new Forestry Development Regulation as of 1995 the utilization of timber has been on the increase and that will to a large extent meet the demand of Sofia.

2.4. SECONDARY SECTOR

2.4.1. Industry

Industry is of notable significance for the economy of Sofia Municipality. In 2006 it ensured about 11.6 per cent of the revenue from activity in the material sphere, provided employment for approximately 24 per cent of the employed persons and operated 45 per cent of the existing material production facilities.

In 2006 the total number of industrial enterprises with less than 250 employees was 3 940, including 28 in the mining and quarry industry. As compared to 2003 their number has decreased by 518 enterprises.

The high number of industrial enterprises in the individual sectors is a proof that the majority of these are micro or small enterprises with a small number of employees. Medium-size and big enterprises are approximately 70.

A better idea of the place and importance of the individual sectors in the industrial development of the territory is provided by the data about the production output of the industrial enterprises (by sectors). The production output of industry in 2003 amounted to BGN 7 140 million, in 2004 – BGN 8 576 million and in 2006 – BGN 7 377 million.

Table No. 7

Structure of the production output of the processing industry sectors in Sofia Municipality for the period 1998-2006 (in percentage)

Indicators	Year		
	2001	2003	2006
Processing industry total	100.0	100.0	100.0
Food, beverages and tobacco products	10.3	11.8	14.3
Metallurgy and metal products	15.3	14.7	34.9
Production of electrical, optical and other equipment	6.4	7.4	8.2
Production fo paper and cardboard	5.1	5.3	
Production of textile, textile products and clothing	2.7	4.5	9.6
Production of machines and equipment	2,8	3.1	3.7
Production of chemical substances and products	4.4	4.2	6.1
Other sectors	53.0	49.0	23.2

Source: NSI Sofia in Figures

2.4.2. Construction

The development of the **construction sector** in Sofia Municipality is connected with the needs and the scale of the city and the adjacent territories. The recent years are characterized by qualitative changes in the

structure of construction output. The period of transition is characterized by grave reduction in the construction of industrial buildings and buildings for public use and gradual attenuation of housing construction under industrialized technologies. The major directions of construction are related to construction of residential and business buildings, maintenance and development of the urban transport and engineering infrastructure.

In 2001 a total of 33 788 persons were employed in the sector. In 2006 their number was 48 859 persons. The gross production output of the enterprises in the construction sector was BGN 1 316 million and in 2006 it amounted to BGN 4 728 million or during the period under review in marked an increase of 3.6 times.

A total of 57 128 dwellings were built during the period 1992 – 2001, while the population diminished by 11 547 persons. During the period from 30 December 2001 till 30 December 2006 the number of dwellings increased by 8 679 persons and that of the population by 59 312 persons.

2.5. TERTIARY SECTOR

Economic characteristics of the sector

With respect to the place of social activities and the functions of the social structure of Sofia Municipality beside the data about the employed persons account is taken also of the size of budgetary expenditures for and the involvement of the state and local authorities in the development of these activities. The performed analyses and evaluation of the employment rate provide an opportunity to make the following conclusions::

- In the period 2001 – 2006 r. a trend of increase of the total number of employed persons in the municipality was noted – from 544.5 thousand to 569.4 thousand. The tertiary sector in Sofia Municipality has the highest weight in terms of relative share of the persons employed in it in the total number of those employed – 75 per cent on the average. That situation has remained valid for the entire period. Thus, if in 2001 the number of employed persons in the tertiary sector was 423.3 thousand people (75.5%), by 2006 their number was respectively 429.9 thousand people (76.4%) of the total number of employed persons in Sofia Municipality.
- The well-manifested public services functions of Sofia, as well as its development as an important business centre are some of the major reasons for the significantly higher relative share of the employed persons in the tertiary sector as compared to other municipalities in the country.

In 2006 the involvement of the private sector as a form of ownership in the domain of employment in the tertiary sector of the Sofia socio-economic complex was 70 per cent. In the field of activities, which are evolving on a market-based principle the participation of the tertiary sector is almost 90 per cent.

From the data about the employment rates it is evident that in some of the sectors of explicitly social nature – administration, education, health care, culture, etc. – 129.9 thousand persons were employed in 2006. This number represents 30.2 per cent of the total number of employed persons in the tertiary sector. Therefore in Sofia Municipality alone in education are employed 34.6 thousand people and in health care and social activities – 27.9 thousand people.

Irrespective of the fact that the number of employed persons in social activities is high, the tertiary sector accounts for 73.4 per cent of the Gross Value Added produced by the territorial economic complex of Sofia Municipality.

2.5.1. Business infrastructure

The *infrastructure in support of business* comprises the banks and other crediting institutions, the insurance companies, real estate agencies, customs authorities, regional development agencies, business incubators, stock and stock exchanges, trade fairs, specialized exhibitions etc.

One of the criteria for the degree of development of the business infrastructure is the number of employed persons in the above mentioned sectors and activities. In 2001 their number in the activities “Financial brokerage” and “Real estates transactions and business services” amounted to 93 158 persons (17.1 per cent) and in 2006 to 107 086 persons (18.8 per cent) of the total number of employed persons in Sofia Municipality. An illustration of the significance of the business infrastructure in the municipality is the fact that the number of employed persons in it accounts for 50 per cent of the total number of people employed in the business sector nationwide. This is a consequence of the localization in Sofia of the central offices of all banks and insurance companies, the customs and taxation administrations and many other business structures.

2.5.2. Tourism

The **factors** for development of tourism in Sofia Municipality are related to:

- The place and role of the city of Sofia in the tourism destinations. The city of Sofia is the point of departure and arrival for foreign tourists using air transport on their way towards the winter resorts falling within the zone of active influence of the city and beyond (*Vitosha*, *Borovets*, and *Bansko*). Part of the transit foreign tourists takes advantage of the tourism infrastructure of the city.
- The economic functions of the capital city are an important factor for development of tourism.
- The existence of tourism resources of diverse nature and high quality. Sofia Municipality possesses natural-geographic and cultural-and-historical resources that may compare with those of the biggest tourism and resort agglomerations in the world. Among them are the surrounding mountains of the Sofia Plain. The abundance (in terms of quantity and quality) of mineral waters, the rich cultural and historical heritage (the *Serdika-Sredets* Architectural historical reservation, the *Boyana Church* and *Borisova Gradina* – a landmark of park and garden landscaping art), numerous monasteries from the so-called *Sofia Sveta Gora*,
- The existence of protected areas in Sofia Municipality and the closeness of the city of Sofia to them – the *Vitosha Nature Park* with two reservation – *Torfeno Branishte* and *Bistrishko Branishte*, and the nature landmarks *Boyana Fall* on the river *Boyana*, *Samokovishteto* waterfall on the river *Bistritsa*, the *Duhlata Cave* (the longest cave in Bulgaria), the *Kutina Piramides* – earthen pyramids in the land of the village of *Kutina*, the *Golyam Dol* Locality, the *Vrana Park* – a monument of park-and-gardening landscaping art, etc..
- The existing tourism infrastructure in the municipality, etc.

One of the criteria about the state and the place of the tourism sector in the socio-economic complex of the municipality are the number and relative share of employed persons in it.

The data for 2001 indicate that 16 882 persons were employed with labour contracts in the economic activities “Hotels” and “Restaurants” in Sofia Municipality (the self-employed excluded). In 2005 their number increased to more than 21 875 persons.

Table No. 9
Dynamics of the number of accommodation facilities and overnight stays in Sofia Municipality for the period 2001-2006

INDICATORS	YEARS		
	2001	2003	2006*
1. Accommodation facilities including hotels	36 28	62 57	135 81
2. Overnight stays of foreign citizens including in hotels	371 403 371 213	529 315 528 960	781 821 772 622
3. Overnight stays of Bulgarian citizens including in hotels	268 786 252 360	447 073 435 634	502 162 470 221

Source: NSI Sofia in Figures 2006

The statistical information for 2006 shows that in Sofia Municipality there is a total of 135 accommodation facilities, including 81 hotels and 8 chalets.

In 2006 a total of 1 284 thousand overnight stays had been realized in all the accommodation facilities, including 781.8 thousands by foreign citizens.

The comparison of the data about the realized overnight stays and the number of guests gives an idea of a certain shortage of accommodation capacity of the hotels of higher category. The foreign citizens' stay is 2.3 bed-nights per person and of Bulgarian citizens' – 1.6 bed-nights per person, which means that the accommodation base is used above all for business trips.

The analysis of the data according to the above indicators characterizing tourism in Sofia municipality during the period 2001-2006 reveals that there is a trend of growth in both the accommodation facilities and in the overnight stays, respectively from 640.2 thousand (2001) to 1 284.0 thousand (2006). In 2006 the overnight stays of foreign citizens exceeded those of Bulgarian citizens almost 1.6 times.

As tourism centres in Sofia Municipality beside the city of Sofia are known also the **city of Bankya** and **Pancherevo**.

2.6. MAJOR CONCLUSIONS AND DEVELOPMENT DIRECTIONS

In 2005 on the area of the municipality was produced the biggest GDP nationwide – BGN 13 259 million. The GDP per capita for the population of the municipality (district) amounted to BGN 10 811 (at current prices). For this indicator Sofia Municipality (District) ranks the first among the remaining 27 districts in the country. In 2005 the GDP per employed person in the district was BGN 23 300 (EUR 11 913).

The sectoral structure of the socio-economic complex of Sofia Municipality indicates that the tertiary sector plays a leading role in it (77.8 per cent of the total GDP and 75.5 per cent of the employed persons). Industry relegates from its positions in the past and is in the process of serious restructuring.

The administrative and other servicing functions of the city of Sofia act as a factor for development of a strong tertiary sector, characterized by the presence of a large number of representative sites of the legislative, executive and judiciary power, of the finance-and-credit and business sectors, etc.

As a consequence of the restructuring of the economy, evaluated from the point of view of revenue from activities of the enterprises and the number of employed persons by sectors, the share of the secondary sector (industry and construction) in the revenue from activities and number of employed persons is permanently diminishing as compared to the tertiary sector.

STRUCTURE OF EMPLOYED PERSONS (in percentage)

sectors	2001	2002	2005	2006	Forecast Master Plan 2020	Forecast Master Plan Amendment 2030
Primary	0.31	0.37	0.23	0.3	0.5	05
Secondary	50.36	53.00	24.92	24.2	25.5	23.5
Tertiary	49.33	45.63	74.85	75.5	74.0	76.0
total	100.0	100.0	100.0	100.0	100.0	100.0

Source& NSI, Sofia in Figures 2003, 2006

The data presented above prove that the secondary sector is steadily diminishing its share in the economic structure of the municipality and has reached the level envisaged in the 2003 Master Plan. Its development in perspective should be based on technologies and production lines capable of ensuring high Value Added. In this process one should not underestimate the role of the small and medium-size enterprises, which can easily adapt to the market demand and provide jobs in different professional fields.

In the city of Sofia are formed 26 industrial zones, which in territorial aspect exceed by far the needs of the secondary sector. At the same time many of them have a key location in the structure of the city – near to the Central City Area, major urban transport arteries, serviced by mass urban transport and well-provided by primary engineering infrastructure – and therefore they offer a huge reserve for development of other important functions to the benefit of the city and the region.

The restructuring and functional re-arrangement of old industrial zones (the so-called “brownfield regeneration”) is a modern European and global practice, which leads to optimization of the urban structure and reduces the need of urbanization of new territories.

Because of the high price of land in Sofia and the absence of sufficient number of big plots with adequate infrastructure in place, the potential of the industrial areas for development of large-scale investment projects (large business, trade and residential estates) does not remain unnoticed by the private sector. The trend towards their restructuring should be promoted and regulated with the Amendment to the Master Plan of Sofia Municipality to convert them into mixed multi-functional zones of sufficiently favorable build-up parameters, acting as incentives for that functional and structural change.

The trend towards their restructuring and change in the functional designation is supported and regulated also with the Amenment to the Sofia Master Plan.

The tertiary sector is also in the process of qualitative changes. Its development in the period 2001 – 2006 shows that in respect of the revenue from its activity there is a significant increase, while in respect of the number of employed persons the increase is insignificant.

The detailed analysis reveals that the qualitative changes in the internal structure of the sector are due to diminishing of the number of employed persons in the activity field “Trade, car repair, personal items and household goods” and increase of the number of employed persons in activities related to business services.

These qualitative changes require also new well-equipped spaces (logistics, business centres, market places, exhibition areas, etc.). The investors' assessment is that there is shortage of sufficient office areas of higher category.

The trend towards a change in the functional designation of the industrial zones (especially those in or near the central parts of the city), is supported and managed by the proposed amendments of the Master Plan.

By strengthening the importance of the “Mixed multi-functional zone(C_{мф})” a possibility is created for avoiding the mono-functional organization of the areas designated for business services and their depopulation after office time, which is the biggest problem of such zones in some of the medium-size and large cities in Europe.

3. ANALYSIS OF THE TRENDS AND PROCESSES IN THE SOCIAL SPHERE

3.1. DEMOGRAPHIC DEVELOPMENT

3.1.1. Development in the period 2001-2006

For outlining of certain trends in the demographic development of the municipality it is necessary to track the evolution of the demographic processes in the period 2001-2006. These processes are directly related to the spatial planning and an important factor for amendment of the Master Plan of Sofia Municipality. On that basis has been worked out also the forecast for the demographic development till 2030.

Qualitative parameters of the population

The population of Sofia Municipality in 2006 was 1 237 891 people and by the end of 2007 - 1 241 000 people. In terms of population size it is the most populated municipality nationwide – it occupies the first place among all the other municipalities. About 16 per cent of the country's population lives in it. The indicator that gives a better idea of the population size of Sofia Municipality is population density. At the background of average population density of 69.9 people/km² nationwide (2006) for Sofia Municipality this indicator is 13 times higher – 922.0 people/km².

The dynamics in the population size in the municipality for the past 6 years reveals certain not very well manifested fluctuations. In 1998 the calculated population of the municipality was 1 199 708 people. According to data from the population census by the end of 2001 it was 1 176 000 people. In 2005 it was 1 231 622 people (calculated figure) and at the end of 2007 - 1 241 000 people.

As a conclusion with respect to the dynamics of the population size one may note the existence of a trend towards a relatively stable demographic state (number of permanent residents) during the period 1998-2007. It may be assumed that with certain small deviations in the individual years the number of permanent population of Sofia Municipality is in the range of 1.2 million people.

This population size may be evaluated as a significant human resource, which may ensure the necessary workforce for socio-economic development of the municipality.

The population size is a resultant indicator of the joint impact of natural and mechanical modifications. The natural population growth of the population of Sofia Municipality is on the average negative for the period of investigation but with a trend towards diminishing of its negative values. This is the consequence of the increase in the birth rate values and harnessing of the death rate (Table 1).

* For 2006 the holiday resort homes have been included as well.

Table No. 1
Dynamics of the demographic development of Socia Municipality for the period 1998 – 2006

Indicators	Year					
	1998	1999	2000	2001	2003	2006
Population by 31 December - number	1 199708	1211531	1222180	1178579	1 208 930	1 237 891
Birth rate - ‰	7.8	8.0	9.1	8.6	8.9	10,3
Death rate - ‰	12.5	12.0	12.1	12.6	12.5	12,7
Infant mortality rate - ‰	11.1	10.8	7.9	7.6	6.6	4,4
Natural population growth - ‰	-4.7	-4.0	-3.0	-4.0	-3.6	-2,4

Source: NSI, Sofia Municipality in Figures

The impact of the mechanical population growth on the population size (as a result of the domestic migration, for which there is statistical information) demonstrates that Sofia Municipality is the most attractive settlement territory because of the existence of employment opportunities and the high level of the services sector.

In terms of dynamics the mechanical population growth varies from 13 394 people (2001) to 19 136 people (2003) and a drop in the population growth rate to 13 962 people in 2005 and 9 149 people in 2006.

The main attracting centre for domestic migration is the city of Sofia.

Table No. 2
Dynamics of domestic migration of Sofia Municipality for the period 2001 – 2006 (in absolute numbers of the migrants)

Indicators	Year					
	2001	2002	2003	2004	2005	2006
Migration to (number of people)	34 300	28 302	32 679	29 278	30 176	19 247
Migration from (number of people)	20 906	10 703	3 543	12 679	16 214	10 098
Mechanical population growth (number of people)	13 394	17 635	19 136	16 599	13 962	9 149

Source: NSI, Sofia Municipality in Figures

The evaluation of the impact of *contingent of temporary residents* on the development of Sofia Municipality and the city of Sofia is incomplete because of the absence of reliable statistical data. To this end are used expert assessments and data from the “Registration of Citizens and Administrative Services” Office, which still give a certain idea of that contingent, which is putting a “heavy load” on the capital.

According to data from the „Registration of Citizens and Administrative Services” Office by 15 March 2007 the population of Sofia Municipality having a permanent and present address in the settlements of the municipality is 1 242 128 people. Approximately the same figure is quoted by the official statistical sources as permanent population of the municipality.

By the same date the number of people registered by present address in the municipality is 1 381 406. This means that the municipality is inhabited for short periods of time of some 139 000 people, who retain their permanent residence in other settlements. A large portion of these temporary residents are students and pupils attending various specialized educational establishments. .

By expert assessments the daily commuters to the municipality from human settlements of the neighboring Pernik and Sofia Districts are some 30-35 thousand people.

The contingent, who visits the district per day for reasons related to culture, shopping or pending matters at some of the central institutions etc. is almost of the same size.

This means that every day on the area of the municipality there are about 1 500 000 people. The consequences from that demographic overload comprise in the first place problems with the functioning of the transport-communication system and the other service systems.

In **territorial aspect** the demographic development of Sofia Municipality shows that in 2006 of the total number of the population (1 237 891 people) 1 154 000 people lived in the city of Sofia and 83 881 in the remaining human settlements of the municipality. For the period 2001 – 2006 a trend towards rapid increase of the number of the population of the compact city took shape: in 2006 it already exceeded its forecast increase to 1 150 000 people in the period till 2020 laid down in the 2003 Master Plan. The capital is in a threshold state, since its infrastructure is not prepared for servicing such a demographic mass. With the Amendment to the Master Plan urgent measures for overcoming of that state are proposed.

In the human settlements around Sofia there is also increase in the number of the population by some 4 000 people. Such increase has been noted above all in the cities of Buhovo, Bankya and Novi Iskar.

The interest in settling down on the territory to the south of the Ring Road (Lozen, Pancherevo), as well as in certain human settlements in the northern end of Sofia Municipality, is the reason for the negligible increase of the population size in the surrounding area of the city of Sofia.

Despite the emerging slight trend of increase of the number of population in the surrounding zone of the city, its concentration in the capital is still too high – more than 93 per cent (by far higher share as compared to a number of other European cities of the rank of Sofia).

It is a well-known fact that in the case of other capitals in Europe and other big cities the share of the population living on the territory and in the human settlements outside the compact city reaches 30-35 per cent. .

Comparative data about the number of the population in the municipality and in the city of Sofia (“Registration of Citizens and Administrative Services” and NS) are presented in Table No. 3.

Table No. 3
CHARACTERISTICS OF THE INHABITANTS OF SOFIA MUNICIPALITY ACCORDING TO ADMINISTRATIVE STATUS

Indicators	Sofia Municipality		City of Sofia	
	2006 number by 14 March	2007 number by 15 March	2006 number by 14 March	2007 number by 15 March
Inhabitants by permanent address	1 323 775	1 333 892	1 201 360	1 209 832
Inhabitants by present address	1 377 100	1 381 406	1 246 471	1 249 891
Inhabitants with identical permanent and present address	1 237 839	1 242 128	1 123 562	1 126 589

Inhabitants of Sofia Municipality temporarily living outside the municipality (Items 1 minus 2)	85 936	91 764	77 798	83 243
Inhabitants of other human settlements temporarily living in the municipality (Item 2 minus Item 3)	139 261	139 278	122 909	123 302

Source: “Registration of Citizens and Administrative Services (GRAO)” Office with Sofia Municipality

Official statistical data by 31.12.2005	by 31.12.2006	by 31.12.2007
Population of:		
- Sofia Municipality		
1 231 622 people	1 237 891 people	1 240 788 people
- the city of Sofia		
1 148 429 people	1 154 010 people	-

Source: Territorial Statistical Office – Sofia, “Sofia in Figures”

Qualitative characteristics of the population

The qualitative characteristics of the population are analyzed by using data about different types of structures - by gender, age, educational level and ethnic origin.

The **gender structure** of the population of Sofia Municipality does not differ much from that of the country total and of the other districts.

The statistical data about the gender structure of the population show that in Sofia Municipality the number of women predominates. Out of the total of 1 237 891 inhabitants (2006) the number of men is 588 036 people or 47.5 per cent and that of women 649 859 **people** or 52.5 per cent of the total.

The age structure of the population is more favorable as compared to that in the rest of the districts in the country. In 2006 the ratio between the major age groups was distorted – the share of the population below active age was 13.1 per cent, that of the population in active age 67.1 per cent and above active age – 19.8 per cent (Table No. 3).

Age structure of the population (in percentage)

	1998	2003	2006
below active age	15.3%	13.6 %	13.1%
In active age	62.2%	65.2%	67.1%
above active age	22.5%	21.2%	19.8%

At the end of 2006 every fifth person was in retirement age. On that basis it is expected that in the coming years the change in the age structure of the population will continue, as well as its ageing.

The low relative share of the young generation (below active age) is an indicator for unfavorable natural reproduction of the population in the future. It will sustain the need of mechanical population growth of the population in active age.

The results of the emerging trends from the demographic development so far from the point of view of its age structure and the projection of that structure on the future development are grounds to expect that in the next 10-20 years significant changes will take place in the age structure of the population in the form of its further ageing. If the demographic processes proceed along the present line, the development of Sofia Municipality will

have to rely mainly on demographic “influx” of population in active age from the remaining parts of the country. This process is already manifesting itself in the municipality.

The assessments of the age structure of the population are taken into account in the process of determination of its potentials to ensure the **necessary labour resource** for the future development. The considerable contingent of population in active age (831 000 people by 2006) is a guarantee that the required labour resource for the socio-economic and infrastructure complex of the municipality may be ensured. From the above number the employed persons represent 600 100 people (72.2 per cent) per year on the average.

The educational structure of the population is another important characteristic of the quality of the human resource. That qualitative characteristic of the population predetermines to a large extent the educational and skills level characteristics of the labour force potential of Sofia Municipality.

The educational level of Sofia Municipality differs strongly from that of the rest of the districts in the country. The population census of 2001 found that 27.3 per cent of the population in the municipality has university education. If one excludes the children below 7 years of age, the share of inhabitants with higher and college education increases to 28.9 per cent of the total.

Table No. 4

Educational structure of the population of Sofia Municipality by 2001 (results from the population census)

Indicators	Number	%
Total number of inhabitants	1 170 842	100.0
Incl. with higher education	255 529	21.8
College education	64 309	5.5
Secondary education	494 439	42.2
Primary education	170 650	14.6
Elementary school	67 371	5.8
Unfinished primary education	47 172	4.0
Illiterates	4 650	0.4
Children	63 338	5.3
Not indicated	4 384	0.4

Source: NSI, Sofia in Figures, S. 2004

An important **factor** for the concentration of a high relative share of highly educated population in Sofia Municipality is the concentration of higher educational establishments (20) – universities and specialized higher institutes.

In Sofia is located also the biggest R&D centre for fundamental research and theoretical studies – the Bulgarian Academy of Sciences. The presence of top level institutional structures (of the executive, legislative and judicial power), as well as cultural and other institutions, in which are employed persons possessing high educational background, also contributes to the big share of highly education population in the municipality. As compared to 1992 the changes in the educational structure of the population in the municipality is negligible.

3.1.2. Development forecasts

The data in Table No. 1 below reveals that for the period 1985 – 2001 the population of Sofia Municipality marks a diminishing trend. The city of Sofia retains its population size with minor deviations. The natural growth demonstrates a steady trend of negative growth, which under a closed demographic balance (less the mechanical growth) would by 2020 reduce

the population of the municipality to some 1 050 000 people at deteriorated age structure.

This fact indicates that in order the preserve the attractiveness of the municipality in the future as well it would need an annual mechanical population growth of about 10 000 – 15 000 people by 2020 in order to compensate the negative growth and refresh the age structure of the labour force.

Table No. 1

Territory	1985*	1992*	March 2001*	2020 Forecast 2003 Master Plan	31 Dec. 2003	31 Dec. 2006
1	2	3	4	5	6	7
Sofia Municipality	1 201 719	1 190 126	1 174 431	1 300 000	1 208 930	1 237 891
The city of Sofia	1 084 808	1 107 155	1 096 389	1 150 000	1 127 556	1 154 010
Surrounding area	116 911	82 971	78 042	150 000	81 374	83 881

Source: * NSI, Official population census

** NSI, Sofia in Figures – 2003, 2006

The initial forecast was oriented towards forecast population of 1 400 000 people by 2020, but in the course of the co-ordination procedures the Ministry of Economy objected against such an increase of the population (about 350 000 people mechanical growth), since that would cause depopulation of the human settlements of the Southwestern Planning Region of the country. The proposal of the Ministry of Economy was to reduce the forecast population size to 1 280 000 – 1 300 000 people at the end of the forecast period. It is on that figure that the planning of the development of the municipality was based. .

In compliance with the agreed regional approach of planning of the development of the municipality and the enormous concentration of population in the city of Sofia it has been decided that for overcoming the lack of balance in the distribution “centre-surrounding area” it is necessary that the larger portion of the expected migration flow should be taken up by the surrounding area. The proposal of the 2003 Master Plan was as follows:

- Sofia Municipality: 1 300 000 people (absolute growth as compared with the baseline year 2001 approximately 125 000 people)
- The city of Sofia: 1 150 000 people (absolute growth 54 000 people)
- Surrounding area: 150 000 people (absolute growth about 72 000 people).

Using the analogue approach in planning of demographic development (cities of EU Member States) it was expected that in the pre-accession period and after it the mechanical growth by 2010 would be significantly higher than the envisaged average annual growth because of the anticipated increase in foreign investments, intensive economic development of the municipality resulting in new jobs, and the existing stagnation in the socio-economic development in the other parts of the country. .

It was expected that after that period (2010) migration towards the municipality would calm down and act solely as a linkage between the labour market demand and the high professional qualification.

The management of the process of territorial orientation of the newcomers above all to the human settlements outside the boundaries of the city of Sofia was planned to be realized through priority regulatory planning and

development of the surrounding area and also of the human settlements of the Zone of Active Influence of Sofia (which comprises 8 municipalities with a population of approximately 105 000 people).

Because of the delay by more than four years of the procedures for approval of the new Master Plan of Sofia Municipality nothing has been done in that direction and hence the new migrant population and the investments in construction of housing and public buildings were oriented entirely towards the city of Sofia.

In the meantime the mechanical population growth in the municipality reached values unknown for Bulgaria as a consequence of the absence at the national level of effective regional development policy. The unemployment rate in Sofia Municipality was constantly diminishing, while in the other regions of the country it was up to tenfold higher. .

All that led to situation, where by the end of 2007 the population of the city of Sofia has almost reached the forecast level for 2020. The municipality happened to be unprepared to cope with such a migration pressure. It was not possible within such a short time (2001 – 2007) to set in place the infrastructure and other facilities for the permanent population.

As already mentioned, the mechanical growth reached its peak during 2003 - 19 136 people – and by 2006 dropped gradually to 9 149 people.

The data indicates that a trend towards calming down of the mechanical growth has set in, but it is still persistent and in 2006 and 2007 aggravated the crisis situation above all in the city of Sofia as regards the engineering and transport infrastructure and organization of public transport.

The data quoted in Table No. 3 show that by 15 March 2007 the permanent population of the municipality almost reached the forecast population number by 2020 and in the city of Sofia it has already exceeded the planned population number. Bearing in mind that the economic development of the municipality will continue at the same pace till 2013, one should expect the following:

- a large portion of the temporary residents will settle down permanently here;
- at least the half of the population with permanent address in Sofia Municipality but not actually living there (the majority is working abroad) will return;
- a large number of foreign citizens purchase dwellings in the capital and thus a new situation is emerging, for which there is no accurate forecast in the 2003 Master Plan.

In this sense the Amendment to the Master Plan of Sofia Municipality is urgently needed as laid down in Paragraph 7 of the Law on Regulation and Build-up of Sofia Municipality.

The size of the forecast permanent population is the major parameter on which the planning of all the urban functional systems is based. This applies above all to the System “Residence”, for which adequate number of plots should be allocated for future development (and that above all in the surrounding area) and for raising the intensity of utilization of the residential areas within the optimum limits of such approach.

The actual figure about the current and future population of the municipality is also an exclusively important factor for planning of the transport infrastructure and sites of the social structure financed by the budget. Development of up-dated demographic forecast until 2030 is an objective necessity for the administration of the municipality.

In connection with that *Sofproject - Master Plan* Municipal Enterprise assigned urgent elaboration of “Updated forecast for the demographic development of Sofia Municipality till 2030”. The forecast has been worked out on the basis of official statistical information and the demographic development trends. In addition the following factors and conditions were taken into account:

- The natural population growth will retain its negative values till the end of the forecast period. Under a closed demographic

balance (development less mechanical growth) there will be a natural drop of the population in the municipality in the period till 2030 by about 217 000 people.

- If the rates of the mechanical growth of the population would be retained, an improvement of the natural population growth might be expected as a result of the improvement of its age structure and increase of the contingent in fertile age. If that happened, the drop of the population size would naturally be limited to about 92 000 people.
- The above data indicate that the mechanical growth of the population of Sofia municipality is absolutely indispensable for its retaining economic attractiveness. This is particularly important for the labour market.
- A trend towards diminishing of the mechanical population growth was noted during the period 2002 – 2006. In 2006 it was 9 149 people. Of these some 3 500 – 4 000 people compensate the negative natural population growth and the other part meets the specific needs of the municipal economy. According to expert assessments the objective demand for mechanical population growth is about 10 000 people annual average during the period till 2030.

The updated demographic forecast till 2030 has been worked out in three versions with due account of the above mentioned conditions and different parameters for the major indicators (Tables 1, 2 and 3).

The versions are as follows:

- Version “A”
 - Total permanent population 1 430 000 people (2030)
 - Absolute population growth (2006 – 2030) – 192 000 people.
 - Total mechanical population growth (2006 – 2030) – 284 000 people
- Version “B”
 - Total permanent population 1 485 000 people (2030)
 - Absolute population growth (2006 – 2030) – 247 000 people
 - Total mechanical population growth (2006–2030)– 340 000 people
- Version “C”
 - Total permanent population e 1 625 000 д. (2030г.)
 - Absolute population growth (2006 – 2030) – 387 000 д.
 - Total mechanical population growth (2006–2030)– 480 000 people.

The evaluation of the three versions indicates that if the regional disparities in the economic development were not discarded, than Version “C” would be realized, however that would be disastrous both for the country and for the municipality, which is already in a threshold situation as regards the transport and engineering infrastructure.

Versions “A” and “B” are close in values and most probably the demographic development till 2030 will take place under one of them. In the course of the planning of the Amendment of the Master Plan of Sofia Municipality it was recommended to base the dismentining of the functional systems on Version “B”.

The notion “a pulsating city” was introduced in Tables 1, 2 and 3 concerning the demographic forecasts. It shows the real daily loading of the area of the municipality by a contingent, which is not registered administratively but lives in some of its human settlements.

Possibilities for prospective increase of the population of Sofia Municipality by way of natural and mechanical growth:

Version “A”

Year	Natural reproduction capacity of the population		Average annual mechanical population growth		Mechanical opulation growth on a periodical basis	
	Trend-based	Optimistic	Trend-based	Optimistic	Trend-based	Optimistic
2006	1 237 891	1 237 891	-	-	-	-
2010	1 215 937	1 219 827	12 000	16 000	48 000	64 000
2015	1 183 518	1 208 519	11 000	14 000	55 000	70 000
2020	1 140 657	1 194 832	8 000	12 000	40 000	60 000
2025	1 086 844	1 176 197	7 000	10 000	35 000	50 000
2030	1 020 300	1 145 617	6 000	8 000	30 000	40 000
					208 000	284 000

Year	Trend-based version of natural population growth		Optimistic version of natural population growth		“Pulsating city” – optimistic version		Seasonal migrants	Daily commuters
	Trend-based version of mechanical population growth	Optimistic version of mechanical population growth	Trend-based version of mechanical population growth	Optimistic version of mechanical population growth	Including seasonal migrants	Including daily commuters		
2006	1237 891	1 237 891	1 237 891	1 237 891	1 262 891	1 307 891	25 000	45 000
2010	1 263 937	1 279 937	1 267 827	1 283 827	1 308 827	1 353 827	25 000	45 000
2015	1 286 518	1 317 518	1 311 519	1 342 519	1 372 519	1 422 519	30 000	50 000
2020	1 283 657	1 334 657	1 337 832	1 388 832	1 418 832	1 468 832	30 000	50 000
2025	1 264 844	1 330 844	1 354 197	1 420 197	1 455 197	1 510 197	35 000	55 000
2030	1 228 300	1 304 300	1 353 617	1 429 617	1 464 617	1 519 617	35 000	55 000

Version “B”

Year	Natural reproduction capacity of the population		Avergae annual mechanical population growth		Mechanical population growth on a periodical basis	
	Trend-based	Optimistic	Trend-based	Optimistic	Trend-based	Optimistic
2006	1 237 891	1 237 891	-	-	-	-
2010	1 215 937	1 219 827	16 000	20 000	64 000	80 000
2015	1 183 518	1 208 519	14 000	16 000	70 000	80 000
2020	1 140 657	1 194 832	12 000	14 000	60 000	70 000
2025	1 086 844	1 176 197	10 000	12 000	50 000	60 000
2030	1 020 300	1 145 617	8 000	10 000	40 000	50 000
					284 000	340 000

година	Trend-based version of natural population growth		Optimistic version of natural population growth		“Pulsating city” – optimistic version		Seasonal migrants	Daily commuters
	Trend-based version of mechanical population growth	Optimistic version of mechanical population growth	Trend-based version of mechanical population growth	Optimistic version of mechanical population growth	Including seasonal migrants	Including daily commuters		
2006	1 237 891	1 237 891	1 237 891	1 237 891	1 262 891	1 307 891	25 000	45 000
2010	1 279 937	1 295 937	1 283 827	1 299 827	1 324 827	1 369 827	25 000	45 000
2015	1 317 518	1 343 518	1 342 519	1 368 519	1 398 519	1 448 519	30 000	50 000
2020	1 334 657	1 370 657	1 388 832	1 424 832	1 454 832	1 504 832	30 000	50 000
2025	1 330 844	1 376 844	1 420 197	1 466 197	1 501 197	1 556 197	35 000	55 000
2030	1 304 300	1 360 300	1 429 617	1 485 617	1 520 617	1 575 617	35 000	55 000

Version “C”

Year	Natural reproduction capacity of the population		Average annual mechanical population growth		Mechanical population growth on a periodical basis	
	Trend-based	Optimistic	Trend-based	Optimistic	Trend-based	Optimistic
2006	1 237 891	1 237 891	-	-	-	-
2010	1 215 937	1 219 827	16 000	20 000	64 000	80 000
2015	1 183 518	1 208 519	16 000	20 000	80 000	100 000
2020	1 140 657	1 194 832	16 000	20 000	80 000	100 000
2025	1 086 844	1 176 197	16 000	20 000	80 000	100 000
2030	1 020 300	1 145 617	16 000	20 000	80 000	100 000
					384 000	480 000

Year	Trend-based version of natural population growth		Optimistic version of natural population growth		“Pulsating city” – optimistic version		Seasonal migrants	Daily commuters
	Trend-based version of mechanical population growth	Optimistic version of mechanical population growth	Trend-based version of mechanical population growth	Optimistic version of mechanical population growth	With seasonal migrants	With daily commuters		
2006	1 237 891	1 237 891	1 237 891	1 237 891	1 262 891	1 307 891	25 000	45 000
2010	1 279 937	1 295 937	1 283 827	1 299 827	1 324 827	1 369 827	25 000	45 000
2015	1 327 518	1 363 518	1 352 519	1 388 519	1 418 519	1 468 519	30 000	50 000
2020	1 364 657	1 420 657	1 418 832	1 474 832	1 504 832	1 554 832	30 000	50 000
2025	1 390 844	1 466 844	1 480 197	1 556 197	1 591 197	1 646 197	35 000	55 000
2030	1 404 300	1 500 300	1 529 617	1 625 617	1 660 617	1 715 617	35 000	55 000

3.2. LABOUR FORCE MARKET

3.2.1. Employment

The employment rate is regarded as a factor for economic growth, competitiveness of the economy and social stability of the municipality. The number of gainfully employed persons in Sofia Municipality in 2006 was 600 000 people. That is 55 559 people more than the 2001 figure. The quoted data about the employment rate of the population of Sofia Municipality reveal a trend towards overcoming of the distortions in the employment rate that were characteristic for the period of transition.

Table No. 5

Dynamics of the employment rate of the population of Sofia Municipality for the period 2001 - 2006.

Indicators	Year				
	2001	2002	2003	2005	2006
Employed persons - number.	544 541	546 674	569 432	625 363	600 100
Percentage of employed persons of the total population	47.7	47.6	47.1	50.8	48.5

Source: NSI, Sofia in Figures.

Sectoral structure of employment. The employment rate of the population

*The study has been conducted by a team of the Institute of Geography with BAS, December 2007.

of Sofia Municipality is characterized by a higher share of the persons employed in the tertiary sector branches. In terms of number and relative share the persons employed in the services (tertiary sector) dominate over the figures for the two other sectors.

The gradual increase in the employment in the services sector is connected with the fact that this sector has taken up part of the labour force released from the industrial sector.

The data in Table No. 6 below show that by 2006 the number of the persons employed in the branches of the tertiary sector accounted for 75.5 per cent of the total number of employed persons. That level has remained constant during the last five years.

Table No. 6
Structure of employment by sectors* (in percentage)

Sector	2001	2002	2003	2005	2006
Primary	2.2	2.3	1.9	1.6	0.3
Secondary	22.2	22.8	22.5	22.0	24.2
Tertiary	75.6	74.9	75.6	76.4	75.5
Total	100.0%	100.0%	100.0%	100.0%	100.0%

* Average annual number (NSI)

The statistical data indicates that in the period 1990 – 2005 the number of the employed persons in the private sector of Sofia Municipality is steadily on the increase. The relative share of the employed persons in the private sector of the economy and in the social sphere has increased from 3.9 per cent in 1990 to 75.3 per cent in 2005. The trend towards increase of the employment in the private sector in Sofia Municipality is identical with the national total.

3.2.2. Unemployment

Unemployment is the next important component of the labour market, which is directly related to the socio-economic development of the municipality. Unemployment is analyzed by means of the absolute indicator “number of unemployed persons” and the relative indicator “unemployment level”.

As a consequence of the restructuring of the socio-economic complex of Sofia Municipality part of the employed persons began to drop out of the labour market. The number of unemployed persons in Sofia Municipality by the end of 2006 amounted to 39.9 thousand people. At the background of the significant number of employed persons this figure for the unemployed forms unemployment rate of 6.2 percent. In terms of that indicator the municipality has the lowest unemployment rate as compared to the remaining 27 districts in the country. The dynamics in the number of unemployed persons and the unemployment level during the period 1998-2006 point to a downward trend in the first three years and the beginning of new increase after 2001, followed by a steady drop by the end of the period. The reasons for these developments are rooted in the consequences of the structural reform in the real industrial sector and in the tertiary sector, which was carried out in the period 1998-2000.

In 2006 the unemployment rate in the cities of the municipality was 6.2 per cent and in the villages 7.7 per cent. With respect to the employment rate the differences are as follows: 55.6 per cent in the cities and 52.8 per cent in the villages.

Table No. 7
Dynamics in the unemployment in Sofia Municipality for the period 1998 -2006

Indicators	Year					
	1998	2000	2002	2004	2005	2006
Unemployed persons – thousand people.	52.0	46.5	68.0	59.4	45.8	39.9
Including: unemployed persons in the cities – thousand people	49.0	41.7	63.3	56.2	43.2	37.7
Unemployment rate - %	9.3	8.1	12.3	10.0	7.6	6.2
Including unemployment rate in the cities -%	9.1	7.7	11.9	9.9	7.5	6.2

Source: NSI, Sofia in Figures.

The data in the table refer to all the unemployed (persons registered with the labour offices and persons, who have dropped from any registration in that respect). If, however, only the unemployed persons registered with the labour offices are taken into account, i.e. 15 000 people in 2006 – the unemployment level is 2.8 per cent. According to that indicator Sofia Municipality is fully compatible with the best developed regions in the EU.

3.3. INCOME AND EXPNDITURES OF HOUSEHOLDS

The income levels, treated as a function of the growth of the economy, employment, entrepreneurship etc., are one of the factors of the living standard. The major components, forming the income of the population, are the *salaries*, *pensions* and other social transfers (maternity benefits, sickness benefits, social assistance benefits etc.), *revenue from farming and entrepreneurship*.

Table No. 8
Dynamics of the structure of the annual monetary income of households in Sofia Municipality for the period 1998 – 2006 (in percentage)

Indicators	1998	2000	2002	2004	2006
Monetary income – total in %	100.0	100.0	100.0	100.0	100.0
Including from: salary	55.3	51.7	48.5	51.1	53.5
Additional income from labour	3.4	8.3	7.2	6.0	6.8
Entrepreneurship	4.6	5.0	4.3	4.1	4.1
Pensions	23.4	24.0	25.0	23.2	24.3
Personal farm	2.3	2.7	2.3	1.5	0.8
Miscellaneous	9.2	10.0	8.0	14.1	10.5

Source: NSI, Sofia in Figures, 2006.

The dynamics in the development of the main components forming the income of the households in Sofia Municipality indicate that in the last four years there is an increase in the relative share of the income generated from salary.

This clearly manifested trend is connected with the increase of the absolute average annual amount of the salary in the country – from BGN 2 525 (1998) to BGN 5 141 (2005) and BGN 5 842 (2006).

The salary as a source of income for the households retains its leading place in the revenue part of the household budgets. The average annual amount of the salary in the individual sectors of the municipal socio-economic complex varies within broad limits. In 2006 its amount was the lowest in the sector “Hotels and restaurants” (BGN 3 297) and in “Agriculture, hunting and angling” (BGN 3 507) and the highest in the sector “Financial brokerage and real estate transactions” (BGN 11 188), “State administration” (BGN 8 577) and “Electricity, gas and water supply and distribution” (BGN 8 364).

Pensions stand out as accounting for quite a high share as a source of income of the households in Sofia Municipality. In recent years (2000 – 2005) they have retained their weight in the households’ income – about 23-25 per cent.

The rest of the main sources of income generation for the households of the municipality – personal farms and entrepreneurship – do not manifest considerable dynamics. It means that income growth is due above all to the increase in the amounts of the average salary and pensions. Irrespective of that trend the income levels of the population of Sofia Municipality is far below the average levels for other EU Member States.

Beside the income, influence on the characteristics of the living standard has also the structure of the expenditures

Table No. 9
Structure of the monetary expenditures of the househp;ds in Sofia Municipality for the period 2000-2005

	Year			
	2000	2002	2004	2006
Expenditures total	100.0	100.0	100.0	100.0
Consumer goods	86.8	88.9	83.8	86.6
Including food	40.7	39.5	34.2	34.5
Housing, water, electricity, fuels	14.1	16.0	15.5	15.4
Health care	4.1	4.6	4.9	5.5
Transport	6.0	6.1	5.4	6.3
Leisure time, cultural event	4.7	4.5	4.9	4.6

Source: NSI, Sofia in Figures.

In the expenditures of the households the relative share of the expenditure for food is still quite high and that for leisure, health care, furnishing etc. is low. The depicted structure of the expenditures of household budgets is an indicator of a not very high living standard of the population as yet.

Conclusions:

The increase in the income levels of the population, along with the high demographic mass in Sofia Municipality, makes it attractive for investors in big retail chains. The construction of big retail chains requires sites of considerable size, well-developed transport links for access to them and engineering infrastructure.

The trends towards their location in the peripheral zones of the city of Sofia or on brownfield zones, which leads to changes in their functional designation, is a practice, which has been retained in the Amendment to the Master Plan of Sofia Municipality.

3.4. BUDGWETARY SOCIAL SERVICES*

3.4.1. Current state and development of the budgetary social services

Functional scope of and changes in the regulatory framework of budgetary social services

The budgetary social services comprise education, health care, cultural, social, sports etc. services. Direct responsibilities for the development and administration of these activities have the state and the local authorities

(in this case Sofia Municipality), and in the recent years also the private sector.

Changes in the budgetary services for the period 2000-2007

Changes in the allocation of funds from the budget. For the period 1999 – 2007 the envisaged funding for the sector “**Education**” on the territory of Sofia Municipality as a relative share from the total budgetary expenditure is as follows: 1999 – 21.4 per cent; 2007 – 22.0 per cent. In terms of absolute amounts of the allocated funding: 1999 – BGN 73 660 thousand; 2006 – BGN 149 615 thousand; and for 2007 – BGN 172 300 thousand. For the period 1999 – 2007 the envisaged funding for the sector “**Health care**” on the territory of Sofia Municipality (less the state-owned hospitals) as a relative share of the total budgetary expenditures is as follows: 1999 – 18.4 per cent; 2007 – 3.6 per cent. In terms of absolute amount of the allocated funding: 1999 – BGN 63 170 thousand; 2006 – BGN 25 176 thousand; and for 2007 – BGN 29 191 thousand. The diminishing is due to taking up of part of the activities by the National Health Insurance Fund.

For the period 1999-2007 the envisaged budgetary funds for the social services activity “**Social insurance, social assistance and social care**” on the territory of Sofia Municipality as a relative share of the total budgetary expenditure are as follows: 1999 – 3.3 per cent; 2007 – 3.6 per cent. In terms of absolute amount of the allocated funding: 1999 - BGN 11 300 thousand; 2006 – BGN 20 913 thousand; and for 2007 – BGN 30 391 thousand. The budgetary funds spent for the costs of activities in the domain of **culture** in absolute figures for the period under review are as follows: 1999 - BGN 7 831 thousand for 2007 – BGN 14 693 thousand. Funding from the municipal budget is allocated for **youth and sports activities**, for sports event in schools by city-districts etc. For 2006 these budgetary means amounted to BGN 605 thousand.

Changes in the regulatory framework. In the period after the year 2000 certain adjustments have been made in the enforced norms, standards etc. In the **domain of education** these are changes in the enforced norms for “occupation rate”, which are applied in the forecast estimates, as well, namely: 18-22 children in a group in kindergartens and 25-27 pupils in a class in schools. For the forecast period (in medium-term horizon till 2013) the following norms are envisaged to be in force in the field of **pre-hospital care**: upper limit of the patients’ list 1 500 people; minimum duration of medical checks 20 minutes; recommended minimum norm for number of beds for bed-ridden patients in hospices – 10 -15 off, maximum number of beds in one room of the residential part of the hospice – 2 off.

In 2005 the National Health Care Charter was updated in implementation of a Decision of the Council of Ministers. According to the parameters laid down in it the number of hospitals on the territory of Sofia Municipality shall be as follows: multi-profile hospitals 11, specialized hospitals 21, hospitals for further treatment 1. The capacity of the hospitals in Sofia, determined by virtue of the National Health care Charter, is as follows: number of beds 6 374, including 5 149 for active treatment and 1 225 for further treatment.

Updating of the current state of the budgetary social services:

Education

The changes that have ascended in the actual state of the subsector **Preschool education and training** for the school years 1999/2000 and 2006/2007 are as follows: the achieved coverage of children in kindergartens on the territory of Sofia Municipality (79.2 per cent) is below the norm requirement (93-95 per cent). The insignificant increase in the number of facilities and their capacity is due to the opening of 24 private

kindergartens. Their total capacity, however, is 520 places. In real terms the private sector takes up hardly 1.5 per cent of the children accommodated in child-care facilities. The gravest shortcoming of the places in child-care facilities (in terms of the actual contingent of children of the age group of 3- to 6-years-old) has been indentified in the administrative city-districts *Studentski* (40.6 percent coverage per 100 children of the said age group), *Sredets* (52.3 per cent), *Krasna Polyana* (60.0 per cent), *Vitosha* (60.8 per cent), *Vrabnitsa* (63.5 per cent), *Lozenets* (67.6 per cent) etc. Relatively better provision of places per 100 children aged 3-6 years has been achieved in the administrative city-districts *Krasno Selo*, *Vazrazhdane*, *Oborishte*, *Triaditsa* and *Lyulin*.

General education. For assessment of the changes that have ascended in the general education system in Sofia Municipality its concrete quantitative parameters for the school years 1999/2000 and 2006/2007 were analyzed. The network of general schools on the territory of the municipality has the following starting parameters: total number of general schools 229, including 180 municipal schools and 49 private schools. There are 5 elementary schools, 94 primary schools, 99 general secondary school and 31 vocational high schools. The number of classrooms in the general schools is 5 274, including 5 110 in the municipal schools and 164 in the private schools. There is a trend towards insignificant diminishing of the number of pupils per class – from 22.9 pupils during the 1999/2000 school year to 21.9 pupils during the 2006/2007 school year.

Vocational education. The number of vocational training schools in Sofia Municipality shows an upward trend – from 57 (for the 2000/2001 school year) to 66 (for the 2006/2007 school year). The number of pupils remains within the range of 24 000 - 26 000 pupils in the different types and grades of vocational training schools. In the existing 28 private vocational schools are trained only 2 200 pupils, which is less than 10 per cent of the pupils in the vocational training schools in Sofia Municipality. The territorial location of the child-care facilities, the different types of schools and the accredited universities and colleges during the 2007/2008 school year is presented on diagram-maps.

Health care

Extra-hospital medical treatment

Under the enforced National Health Care Charter (updated in 2005) the number of the medical health practices (individual and group) for emergency and specialized extra-hospital medical treatment of the area of Sofia Municipality has been defined. It comprises 716 medical doctors in the specialized extra-hospital medical treatment, 842 dentists in the emergency extra-hospital treatment and 102 dentists in the extra-hospital specialized treatment. Increase of the number of medical centres is also observed – from 56 (2000) to 103 (2006) – and also of the independent medical-diagnostic and medical-technical laboratories, whose number has increased from 89 to 143. The medical centres offer specialized extra-hospital medical treatment.

Hospital medical treatment. In the recent 6 years the number of medical establishments for hospital treatment on the area of Sofia Municipality marks rapid growth – from 42 they reached 50. After the year 2000 several new private hospitals were commissioned in Sofia, of which *Tokuda Hospital Sofia* has the highest capacity (1000 beds), *Doverie* Multi-profile Hospital for Active Treatment plc. (50 beds) etc. A reverse trend is observed in terms of the change in the number of hospital beds. In 2006 that number was 8 890. With the commissioning in 2006 of several small private hospitals the number of beds in all the hospitals increased in 2008 to 9 340, which is by 4 211 beds less than the number of beds

in 2000 (13 551). The reason for that was the process of restructuring of the hospital sector in Sofia Municipality, which led to reduction of the average stay per patient down to 5-7 days, increased turnover of the use of the hospital beds etc. Because of the increase of the population of Sofia Municipality the guaranteed provision with hospital beds per 1000 inhabitants in 2006 was 7.2 beds (7.1 beds in 2008) at 11.1 beds in the year 2000. More substantial restructuring of the number of beds was realized in the following larger hospitals: *Alexandrovska* Multi-profile Hospital for Active Treatment SP plc (from 1 340 beds in 1999 to 1 100 beds in 2008), N.I.Pirogov Multi-profile Hospital for Active Treatment and Emergency Treatment SP plc (from 1 060 beds in 1999 to 79 beds in 2008), the *Tsaritsa Yoanna* University Multi-profile Hospital for Active Treatment SP plc (from 613 beds in 1999 to 490 beds in 2008), etc. The analyses and evaluations of the territorial orientation of the new hospital facilities in Sofia Municipality demonstrate that attractive for the investment capital are the areas in the eastern and southern parts of the city of Sofia. Such are the peripheral zones of the Hunting Park (*Tokuda Hospital Sofia* Multi-profile Hospital for Active Treatment plc, *St. Lazar* Specialized Obstetrics Hospital for Active Treatment, the *Vitosha* Specialized Hospital for Active Treatment in Traumatology plc). The localization of the above mentioned three private hospitals, which are in close vicinity to each other, is characteristic for the establishment of a *specialized centre for medical services* in the part of the capital.

The territorial location of the accredited medical facilities in Sofia Municipality by 2008 is presented on a scheme.

Culture

The changes in the development of the infrastructure for culture (concerning the leading or basic activities) in the period 2000-2006 are negligible in terms of both their number and their capacity. The number of theatres has diminished by 2 and respectively the number of seats by 257. The network of cinemas in Sofia Municipality shows a negligible expansion – during the period under review 4 new cinemas were inaugurated (in modern cinema-estates of the *Arena Cinema*). The concentration of infrastructure of theatre and museum activity in the central parts of the city of Sofia has not been overcome as yet.

Social activities

The changes, which ascended after the year 2000 in the existing infrastructure of social care activities on the territory of Sofia Municipality in terms of number and capacity of the social services facilities, are not very big as well. They are due mainly to the involvement of the private sector in the opening of 7 private homes for the aged with small capacity (10-15 places), development of social patronage and other social care services. Underway are projects for creation of accessible environment for physically handicapped people – pilot projects for construction of platforms and elevators for handicapped school children in primary schools No. 3 and No. 136, platforms for handicapped people in administrative buildings etc.

Sports

There have been no significant changes in the state of the sports infrastructure on the territory of Sofia Municipality in the period 2000-2006. No new structure-defining sports facilities have been constructed.

3.4.2. Updated forecast for development of the budgetary social services in Sofia Municipality by 2025

Forecast for development of education

*The presented text under Item 3.4 is a summary of the study under the task “Updating of the forecast for development of budgetary social services, related to the Amendment to the Sofia Master Plan”, December 2007, contractor “Terplan” SP plc.

Forecast of the groups and classes (by versions)

In compliance with the agreed parameters (forecast number of children and the norms for average size of a group in child-care facilities and classes in schools) the forecast was made for the number of groups in child-care facilities and classes in schools in two versions:

Trend-based version –by 2025

- Number of groups in child-care facilities (2025) - 2070
- Number of classes in primary schools (2025) – 4340
- Number of classes in general and vocational secondary schools (2025) - 1580

Optimistic version

- Number of groups in child-care facilities (2025)– 3260
- Number of classes in primary schools (2025) – 6200
- Number of classes in general and vocational secondary schools (2025) – 1900

Forecast for the infrastructure of education (child-care facilities and schools)

Trend-based version of the forecast

Need of new child-care facilities (2025): not identified, since under that version the number of children of this age group will diminish as compared to 2015.

Need of new child-care facilities total for the entire period 2008-2025: 70–75 new child-care facilities with due account of the fact that even currently there is a shortage of 15 child-care facilities (120 groups or about 3 000 places).

Need of new general and vocational schools (2025) – 30 schools with three classes in each grade (mainly general secondary schools) with a total need for about 1080 additional classrooms.

In a short-term horizon – by 2010 – organizational and regulatory conditions should be ensured for opening 1 500 – 1 600 new places in child-care facilities in Sofia Municipality. This number does not include the currently existing shortage of places in the child-care facilities in the capital.

Optimistic version of the forecast

Need of new child-care facilities (2025) – 35 in the period after 2015. The need of new facilities under this version for the entire period (2005-2025) is about 185 child-care facilities..

Total need of new schools (2025) – 53 general secondary schools with three classes per grade or primary schools, high schools etc. with four classes per grade.

Updating of the forecast for pilot requirements

Trend-based version of the forecast

- Plots needed for newly proposed child-care facilities (2025) – for 75 new child-care facilities a total of about 18.0 ha. The average lot size for one child-care facility is in the range of 0.20 – 0.24 ha.
- Plots needed for newly proposed schools to overcome the existing shortage of classrooms (2025) – 18.0 ha. The minimum lot size for one school building is 0.6 ha.

Optimistic version of the forecast

- Plots needed for the newly proposed child-care facilities (2025) – a total of 44.0 ha
- Plots needed for newly proposed schools (2025) – 32.0 ha

Territorial orientation of the updated forecast estimates

On the basis of the forecast shortage of places (as a difference between the forecast and the actual number of places) and groups in the child-care facilities by administrative city-districts, the latter have been differentiated in through groups:

- Administrative city-districts in need of up to 5 new child-care facilities: *Vrabnitsa* (1), *Bankya* (2), *Izgrev* (2), *Vitosha* (2), *Oborishte* (3), *Poduyane* (3), *Kremikovtsi* (3), *Vazrazhdane* (4), *Sredets* (4), *Ilinden* (4), *Novi Iskar* (4), *Pancherevo* (4), *Lozenets* (5), *Ovcha Kupel* (5).
- Administrative city-districts in need of 6 to 10 new child-care facilities: *Nadezhda* (6), *Iskar* (6), *Krasna Polyana* (7), *Slatina* (8), *Triyaditsa* (8).
- Administrative city-districts in need of more than 10 new child-care facilities: *Krasno Selo* (11), *Studnetska* (11), *Mladost* (11) and *Lyulin* (12).

3.4.3. General forecast for the number of medical doctors and dentists

The updated forecast for the need of medical doctors and dentists in Sofia Municipality is based on the proposed updated norm requirements for a maximum number of listed patients of general practitioners, as well as the norms for number of medical doctors per 100 hospital beds.

Trend-based version of the forecast

- Number of medical doctors in the health care system (2025): 7 500 people, incl. GPs 990 people
- Number of dentists (2025 total): 1 900 people

Optimistic version of the forecast

- Number of medical doctors in the health care system (2025): 7 600 people, incl. GPs 1 150 people
- Number of dentists (2025 total): 1 950 people.

Forecast for development of hospital treatment

As indicated above, in the course of updating of the forecast for the needs of hospital beds different updated norm requirements as laid down in the approved strategic documents were taken into account – sickness rate, average stay per 1 patient (in days) in the hospital facility and as a resultant end norm requirement number of hospital beds per 1000 inhabitants of Sofia Municipality – 7.0.

Trend-based version of the forecast

Number of hospital beds (2025) – 9 800 (at 1330.8 thousand permanent inhabitants and 70 thousand treated sick persons from the country in the zone of influence of the city of Sofia).

Optimistic version of the forecast

Number of hospital beds (2025) – 11 380 (at 1556.1 thousand permanent inhabitants and 70 thousand treated sick persons from the country in the zone of influence of the city of Sofia) or 2 460 new hospital beds needed.

Territorial orientation of the updated forecast for development of the health care infrastructure

The territorial orientation (by administrative city-districts) of the new sites of the health care infrastructure envisaged for construction takes into account the already assumed principle concerning realistic possibilities for allocation of plots for large-area medical treatment facilities. In this respect account is taken also of the existing infrastructure and area capacities of the administrative city-districts in which such facilities are not existent or the existing ones have inadequate capacity:

- Triyaditsa City-District – on the area of the Academy of Medicine,

where the plots of the Pediatric Hospital and the Infectious Diseases Hospital are situated;

- The northern territories of city-districts *Novi Iskar*, *Nadezhda*, *Serdika* and *Kremikovtsi* (after liquidation of metallurgical manufacture) – for construction of hospitals for further treatment and rehabilitation and social-care medical facilities of the hospice-type.
- Pancherevo city-district – for new small hospitals and new hospitals for further treatment and rehabilitation, including of the hospice-type.

3.4.4. Updated forecast for development of culture and technical-economic parameters of its relevant infrastructure

Trend-based version of the forecast

Total number of seats in the culture facilities – 2025 (population 1 330.8 thousand people) – 26 616;

Total size of the area of exhibition halls, galleries, museums, public libraries – 90 500 thousand m², including of exhibition halls and galleries - 18 600 thousand m².

Optimistic version of the forecast

Total number of seats in the culture facilities – 2025 (population 1 556.1 thousand people) – 31 100;

Total size of the area of exhibition halls, galleries, museums, public libraries – 93.3 thousand m², including of exhibition halls and galleries – 21.7 thousand m².

The sites of general significance for the city, for which possibilities should be sought for provision of plots, are as follows:

- Multi-functional hall with a capacity of 3-5 thousand seats – required plot size 1.0 ha;
- New festival complex with a capacity of 3-5 thousand seats – required plot size 1.0 ha;
- Multi-functional cinema complexes – 5 off – required plot 0.5 ha each or a total of 2.5 ha (Part of the cinemas are envisaged to be component parts of the retail services sites of the MALL-type currently under construction, as well as of the business and commerce centers);
- Sofia-city cultural and information centre;
- Permanent circus campus (Sofia Circus) – 1.5 ha. This site may be situated within the boundaries of the Sofia attractions-and- entertainment complex;
- New grounds for the Museum of History of Sofia (Museum of Sofia) – in the building of the Sofia Mineral Public Baths (in the process of implementation);
- Museum of Modern Arts – 0.1 ha.

3.4.5. Updated forecast for development of the social care activities and technical-economic parameters of the relevant infrastructure

Trend-based version of the forecast

2025 (forecast population size 1330.8 thousand people) - 3860 placed and beds, incl. 1860 places in boarding houses for old people.

Optimistic version of the forecast

2025.(forecast population size 1556.1 thousand people) – 4510 places and beds, incl. 2180 places in boarding houses for old people;

The forecast for the necessary additional infrastructure for social care

activities on the area of Sofia Municipality envisages the need of the following new social-care facilities:

Trend-based version of the forecast - 2025

- 3 new boarding houses for old people with a capacity of 50 places each (a total of 150 places);
- 8 new daily care centres for retired persons with 30 places each (a total of 240 places);
- 3 new daily centres for social integration and rehabilitation of handicapped children and young people – with 30 places each (a total of 90 places);
- Crisis centre for temporary accommodation in the event of disasters and averages – capacity 100 places;
- 2 new shelters for waifs and strays with 30 places each (a total of 60 places);
- Expansion of the existing base for handicapped persons with a total of 70-100 places;
- Construction of a new shelter for homeless people with a capacity of 40 places.

Optimistic version of the forecast – 2025

- Construction of 5 small boarding houses for old people with a capacity of 50-60 places each (a total of 300 places);
- 13 new daily care centres for the aged with a capacity of 30 places each (a total of 390 places);
- 6 new daily centres for social integration and rehabilitation of handicapped children and young people – with 30 places each (a total of 180 places);
- Construction of 3 shelters for homeless people with a capacity of 40-50 places or a total of 120-150 places;
- 2 new crisis centres for temporary accommodation in the event of disasters and averages with a capacity of 100 places each (a total of 200 places).

The averaged forecast indicators concerning the necessary area for social care facilities under the two versions of the forecast is as follows:

Trend-based version of the forecast

2025 – a total of 1.0 ha (at the calculated need of 0.15 ha per boarding house for old people and 0.1 ha for the different day-care centres).

Optimistic version of the forecast

2025 – a total of 1.3 ha.

3.4.6. Forecast for development of sports and the technical-economic indicators of the relevant infrastructure

The total updated forecast needs of areas for sports of Sofia Municipality for the purposes of the Master Plan are justified mainly by the new demographic forecasts under the two assumed versions:

Trend-based version of the forecast

Updated forecast 2025 (population size 1330.8 thousand people)

- Forecast needs of outdoor sports grounds including in representative sites - 1330 ha;
- Forecast needs of indoor sports grounds including in representative sites - 212 ha;
- Forecast needs of indoor sports grounds including in representative sites - 53 ha

Optimistic version of the forecast

Updated forecast 2025 (population size 1556.1 thousand people))

- Forecast needs of outdoor sports grounds including in representative sites -1556 ha;
- Forecast needs of outdoor sports grounds including in representative sites -389 ha;

- Forecast needs of indoor sports grounds including in representative sites -248 ha;
- Forecast needs of indoor sports grounds including in representative sites - 62 ha;

Forecast for the sports infrastructure

The updated forecast for development of the sports infrastructure envisages reserving for the purposes of high sports achievements plots for additional construction of a certain number of representative sites, which have not been incorporated in the regulation studies for the Master Plan of Sofia Municipality:

- 2 big combined sports halls with a capacity of 20 thousand seats each. The required plots amount to about 2.5 – 3.0 ha each or a total of 6.0 ha. The territorial orientation of the halls is within the boundaries of the Northern Park (Obelya Housing Estate) and in the city-district Mladost (near the Mladost Business Park).
- 4 smaller sports halls with a capacity of 2-3 thousand seats each. The territorial orientation is in the northern and eastern ends of the compact city in combination with the green system of Sofia Municipality. The required plots are 0.6-0.8 ha each or a total of 3.0 ha.

4. CURRENT STATE AND SPATIAL DEVELOPMENT OF THE FUNCTIONAL SYSTEMS OF THE City of SOFIA AND SOFIA MUNICIPALITY

4.1. BASIC PRINCIPLES OF THE SPATIAL DEVELOPMENT OF THE TERRITORY

The concept about the spatial development of the territory, which is embodied in the new Master Plan of Sofia Municipality, approved by virtue of Decision 06/147 of the Council of Ministers, is based on the following basic principles, which have been preserved also in the draft for its amendment:

- Regional approach in the planning of the development of Sofia Municipality
- Equitability of all types of ownership
- Achieving balanced development of the compact city and the surrounding area;
- Sustainable development of the urbanized and the natural environment.

Guided by these basic principles the spatial development concept of the plan envisages the following:

- Limitation of the compact increase of the area of the city of Sofia. Renewal of the central city area and improvement of the living environment in the compact city through restructuring and refurbishment.
- Formation of linear-point urbanized structures along the five main “development axes” (Evropa Blvd., Tsarigradsko Shosse Blvd., Tsar Boris III Blvd., Botevgradsko Shosse Blvd. and Rozhen Blvd.) with an emphasis on the dominating northwest-southeast axis, traversing the entire territory of Sofia Municipality and reaching up to the “buffer cores” in the zone of active influence of the capital. Breaking up of the monocentric model through development of secondary centres in the periphery of the compact city along the five development axes.
- Regulation of the build-up in the southern territories through application of rules and norms approved by virtue of the Law on Regulation and Build-up of Sofia Municipality in order to prevent interruption of the green links of the city with Vitosha Mountains.

Preservation and further development of the “lungs of the city” – the big city parks.

- Formation of a new “development zone” along the routes of the Trans-European Transport Corridors in the northern end of the municipality. Activation of the settlements in the southern Balkan collar for diminishing the spatial lack of balance. .
- Conservation of the territories between the compact city and the northern arch of the Ring Road as a cultural landscape and reserve for future development.

4.2. SYSTEM “RESIDENCE AND HOUSING STOCK”

4.2.1. Current state and development of the infrastructure of the System “Residence”

The baseline of this analysis are the specialized studies of the System “Residnece” of the Master Plan of Sofia Municipality' conducted to date. The need of an updated analysis has been prompted by the dynamic changes in the quantitative parameters of the housing stock and its residents at grave lagging behind of the investments in the infrastructure, renewal of the panel-type housing stock and housing policy. This disparity serves also as the basis for review of the forecast model for development of the residential sector.

Changes in the housing stock

According to the official currently available statistics by the end of 2006 in the compact city there were 476 667 dwellings with 1 154 157 residents. In the surrounding area there are another 47 879 dwellings inhabited by 1 238 025 people. Compared to the baseline (2001) the share of dwellings in the surrounding area has diminished from 9.1 per cent to 8.6 per cent because of the significantly lower construction rates in the periphery. The table below illustrates the fact that during the last six years the construction activity in the periphery accounts for 2 per cent on the average of the municipality total (as compared to 9 per cent for the preceding period – 1991-2000). A growing trend of concentration in the compact city has been observed (the highest for the past 86 years!), contrary to the forecasts in the 2003 Master Plan. This development is the result above all of the failure to implement the promotional measures recommended in the above mentioned plan – advanced design of regulation plans and construction of the engineering infrastructure.

Rates of housing construction in the city of Sofia - 1920-2006 - Annual average number of dwellings per annum for the quoted periods:							
	1920 -1945	1946 -1960	1961 - 1970	1971 - 1980	1981 - 1990	1991 - 2000	2001- 2006
Sofia Municipality	1 483	3 603	9 091	13 405	14 091	5 117	1 784
The city of Sofia	1 378	3 058	8 098	12 199	13 133	4 666	1 744
Cities total	1 409	3 249	8 404	12 494	13 361	4 771	1 760
Villages total	74	354	688	911	730	346	25
Share of the city of Sofia	93%	85%	89%	91%	93%	91%	98%
Share of the surrounding area	7%	15%	11%	9%	7%	9%	2%

Source: NSI – Current statistics, expert procesing

The adequate measure to respond to that trend was the additionally

- 2 “Residence and housing stock” of the “Feasibility studies” phase of the Sofia Master Plan (basic study)
- Chapter II “Synthesis of the current state and development trends of the System “Residence” ...”, Scenario “B” (adds “broad territorial scope” of the study).
- “Specialized study of the state-of-repair of the residential buildings constructed under the large-panel housing construction method and their location on the area of the housing estates in the city of Sofia” (inventory of the panel housing stock and its problems)
- “Assessment of the current state and development trends of residential areas inhabited by compact groups of Roma population” (detailed investigation of the current state and problems of residential areas inhabited by compact Roma population)

conducted study and the specialized scheme “Guidelines for detailed planning”, by virtue of which the areas for which there was a need for working out of a full Detailed Regulation Plan, mainly on the basis of Art. 16 of the Law on Regulation of the Territory, had been defined. On the basis of these studies it is possible to work out municipal programmes for these territories with priority design of complex regulation plans and a phased plan for the territories, in which the municipality should mandatory construct the main engineering networks. Only afterwards efforts may be made for resorting to public-private partnerships.

So, the changes in the housing stock in the six recent years have been concentrated in the compact city. This fact provides grounds for trying to track them only on the area of the compact city. The most notable discrepancy is the huge difference between the newly commissioned dwellings (8 474 units) and the increase in the number of residents (67 863). In this way there were on the average 8 people per one new dwelling during that period. Obviously, the larger portion of the dynamically increasing population of Sofia had found accommodation also in the existing housing stock, causing in this way deterioration of the average statistical indicators about housing consumption. From 431 dwellings per 1000 inhabitants in 2001 now the inhabitants of Sofia have resort to only 413 dwellings per 1000 people. Significant reduction has been noted also in the average floor area per capita (from 16.83 2 to 16.28 м2) coupled with increased density – from 2.32 to 2.42 residents per dwelling. The table below illustrates the major quantitative changes in the housing stock and housing consumption.

DYNAMIC PROFILE OF THE HOUSING SECTOR OF the city of SOFIA 2001 - 2006					
	2006	2005	2003	2001	2006-2001
Dwellings	476 667	475 201	471 649	468 193	8 474
Residential buildings	58 241	58 120	57 892	57 866	375
Occupants	1 154 157	1 147 829	1 127 241	1 086 295	67 863
Dwellings per 1000 inhabitants	413	414	418	431	-18
Floor area per occupant	16,28	16,30	16,43	16,83	-0,55
Number of occupants per dwelling	2,42	2,42	2,39	2,32	0,1

The picture of the new construction in 2006 corroborates the outlined trend of concentration in the compact city. From a total of 1 598 new dwellings in 2006 those in the compact city are 1 568, i.e. 98.1 per cent. During the same year only one municipal dwelling was constructed and 13 units have been privatized, i.e. the policy aimed at higher access to housing has failed to be realized.

Changes in the housing demand

The calculated statistical deficits in the 2003 Master Plan amount to 60 000 conventional dwellings. During the period under review the absolute demand has increased by another 20 000 dwellings as a result of the advanced rates of mechanical population growth (by 67 863 people) at the background of the new housing supply (only 8 474 dwellings). At the same time the negative factors reported for 2001 have remained almost unchanged and some of them have even deteriorated. For instance, the fitness of the dwellings in the prefabricated panel buildings has been assumed conditionally, i.e. provided mass renewal were implemented, which has not been launched as yet. That sector alone affects more than 230 000 dwellings (more than 48 per cent of the total housing stock). Insignificant improvement has been observed for the dwellings without major amenities. Their number has diminished from 7 800 units in 2001 to 6 936 units in 2006. Judging by the absence of social housing policy and the inaccessible for the mass type of purchasing power market supply, one may assume that the number of crowded dwellings has increased (in 2001 more than 11 000 Sofioters inhabited dwellings with 3 or more occupants per room).

The changes in the major parameters of the housing stock and housing consumption in the compact city, surrounding area and the municipality as a whole are presented in the tables below. Compared with the situation in the compact city, the shrinkage in the surrounding area is more significant, since during the period under review a very small number of dwellings were constructed there for the account of the higher mechanical population growth.

Housing consumption 2001-2006			
The city of Sofia	2006	2001	2006-2001
Dwellings	476 667	468 193	8 474
Occupants	1 154 157	1 086 295	67 863
Living area	31 178 990	30 462 909	716 081
Floor area	38 023 159	37 149 889	87 3270
Dwellings per 1000 inhabitants	413	431	-18.0
Number of occupants per dwelling	2.40	2.32	0.1
Living area per person	16.28	16.83	-0.5
Floor area / dwelling per person	32.94	34.20	-1.3

Surrounding area	2006	2001	2006-2001
Dwellings	47 970	47 765	205
Occupants	84 082	79 770	4 311
Living area	3 103 183	3 078 721	24 462
Floor area	3 784 370	3 754 538	29 832
Dwellings per 1000 inhabotants	571	599	-28.3
Number of occupants per dwelling	1.75	1.67	0.1
Living area per person	22.14	23.16	-1.0
Floor area dwellings per person	45.01	47.07	-2.1

SOFIA MUNICIPALITY	2006	2001	2006-2001
Dwellings	524 637	515 958	8 679
Occupants	1 238 239	1 166 065	72 174
Living area	34 282 173	33 541 630	740 543
Floor area	41 807 528,05	40 904 427	903 101
Dwellings per 1000 inhabotants	424	442	-18.8
Number of occupants per dwelling	2.36	2.26	0.1
Living area per person	16.61	17.26	-0.6
Floor area dwelling per person	33.76	35.08	-1.3

Applying the methodology used for the 2003 Master Plan, the updated demand by 2006, which, if met, would lead to average statistical standard consumption, amounts to approximately 95 000 new dwellings. It should be noted that this demand is formed not by the indicator “Dwellings per 1000 inhabitants” but rather by the indicator “Floor area per occupant”. Compared to the approved standards Sofia Municipality possesses an adequate number of dwellings (there is even an excess of 4 600 units) but an inadequate floor area.

SOFIA MUNICIPALITY – STANDARD DEMAND AND DEFICIT - 2006				
	Standard	Availability	DEFICIT	
			Dwellings per 1000 inhabitants	Number of dwellings
Dwellings per 1000 inhabitants	420	424	-4	-4617
Floor area per person	40 м2	33,76 м3	6,24 м2	94 762
NEW DEMAND BY 2030 – AT FORECAST POPULATION 1 620 000 PEOPLE				
Dwellings per 1000 inhabitants	420	324	96	155 763

Mechanical population growth – 382 000 people	420	0	420	160 340
Total demand by 2030				255 102

At the forecast population growth of 382 000 people by 2030 the municipality shall be faced by an additional forecast deficit of a total of 160 340 dwellings (at an average number of 2.4 occupants per dwelling).

Therefore, the housing demand for the timeframe by 2030 as updated by 2006 amounts to about 255 000 conventional dwellings at increased graveness/urgency of the following three problems:

- ✓ Necessity of mass renewal of the panel dwellings;
- ✓ Necessity of implementation of large-scale programme for construction of social dwellings;
- ✓ Necessity of restructuring of the municipal housing stock.

Changes in the housing markets

Land markets

The picture in 2001 was as follows:

Typical for the Sofia land markets is that a very small part of the private and public land owners sell their land to the developers. The usual practice is conclusion of barter deals in which the “right to build” is conceded against a certain share of the built-up area of the future building (10-20 per cent of the floor area). In comparison with the housing market the land market is more stable. Preferred quarters for residential purposes are Boyana, Knyazhevo and Dragalevtsi. Demand in the central part of the city is connected to non-residential needs – for administrative and other purposes. The trend of marked withdrawal from the most prestigious quarters because of exhaustion of the “top” lots and the high prices continues. The demand is re-oriented towards Bankya, Bistritsa, Lozen, Pancherevo and the southern territories. The prices of the lots remain relatively unchanged.

Six years later the following more significant changes were observed:

- The number of barter deals has diminished sharply for the account of cash transactions;
- There was sharp increase in prices - from 5 to 10 times;
- The quantity of lots in the compact city is almost fully exhausted – frequently the offered lots are regulated real estate plots with useless buildings on them; it may be concluded that the available lots in the centre and the southwestern sector are exhausted;
- Despite the potentials, the offer in the northern sectors of Sofia is still moderate because of the difficult access, the stagnating influence of the *Kremiokovtsi* Combined Metallurgical Works and the absence of adequate infrastructure;
- The absence of infrastructure on unutilized plots increases the investment pressure in the housing estates and quarters *in situ*, thus aggravating the problems there – ecological, transport, related to the milieu.

The summary picture of the supply of lots for housing construction at the end of 2007 is presented in the table below. :

MARKET SECTORS	LOTS – QTY.	EUR/m2
WEST	115	222
EAST	158	302
NEAR VITOSHA MOUNTAINS	237	285
NORTH	66	154
NORTHEAST	45	232

CENTRE	78	2 724
SOUTHWEST	48	328
SOUTH	101	590
TOTAL:	848	530

Housing markets

At the beginning of the century the situation on the housing markets was also quite different from the current one:

New construction is most frequently realized through tripartite projects: private land-owners, individual investors (customers) and professional construction companies. It is the customers that bear the entire financial burden. The role of credits in new construction is negligible. The investment projects are usually small in scale (15-30 dwellings in buildings of medium-rise). The market of old dwellings is dominant for two reasons: first, their prices are closer to the mass solvent demand and, secondly, the supply of new dwellings is quite low. More than 90 per cent of the transactions in recent years were related to old private dwellings.

At present the following development is observed:

- Strong increase of the supply of new dwellings (according to data from the branch associations more than 20 000 dwellings have been waiting for their first buyer for more than a year);
- Strong increase in the housing credits – approximately 50 per cent of all the purchases are already effected through bank credits;
- Grave reduction in the “green purchases” – people already prefer to purchase finished or semi-finished dwellings rather than “in the design phase” or “under construction”.
- Although their share is smaller than that in 2001, the purchases of old dwellings continue to be dominant;
- The now cheaper credits and the increased purchasing power of the population have made the purchase of dwelling affordable to a considerably greater share of the potential demand – 20-25 per cent compared to 10-15 per cent six year ago;
- Nevertheless, almost all the segments of the current housing supply remain unaffordable for the mass demand – subsidized/ social segments are still absent from the market of new housing.

A unique basis for reliable short-term forecasting is the offer for housing under construction. 5 360 new dwellings will come on the market in 2008. This is a sharp increase in the supply as compared to 2006 (approximately 1 600 new dwellings). The distribution of this supply by zones is reflected in the table below:

Dwelings under construction - offers			
	by 2008	by 2011	Per annum
WEST	634	1 105	276
EAST	531	1 081	270
NEAR VITOSHA MOUNTAINS	675	1 165	291
NORTH	117	329	82
NORTHEAST	43	137	34
CENTRE	517	1 297	324
SOUTHWEST	502	987	247
SOUTH	2 341	2 500	625
SOFIA TOTAL:	5 360	8 601	2 150

As evident from the above table, nearly 44 per cent of the new supply for 2008 were in the southern sector of the capital². Together with the figures for the central and the eastern zones it means that 85 per cent of the new construction is currently concentrated there. .

² Beli Brezi, Borovo, Baxton, Vitosha, Gotse Delchev, Dianabad, Darvenitsa, Ivan Vazov, Izgrev, Krasno Selo, Krastova Vada, Lagera, Manastirski Livadi, Motopista, Pavlovo, Slaviya, Vitosha city-district, Strelbishte, Studentski Grad, Hypod-ruma

Updated “diagnosis” of the housing sector

In order to ensure a basis for comparison it is necessary first of all to recall the previous diagnosis:

- deteriorated housing affordability – the price/income ratio increases from 2.8 in 1989 to 10-18 in 2001;
- the normal reproduction in the housing sector has stopped: new construction is below the critical minimum of 2 dwellings per 1000 inhabitants;
- housing is left at the “mercy of the market”, which is affordable for not more than 10 per cent of the potential demand;
- the housing stock is deteriorating because of inadequate management and maintenance;
- the state has abdicated from its economic responsibilities with respect to housing – the amount of budgetary expenditures for housing is extremely small (about 1 per cent);
- absence of adequate system for crediting and subsidization.

At that background the following large-scale problems come to fore:

- helplessness of the homeless and the extremely poor;
- deterioration of the housing stock for lack of maintenance
- loss of housing stock because of unregulated transformation into commercial stock;
- the new construction is below the critical threshold for normal reproduction of the housing stock;
- low solvency level;
- absence of affordable housing;
- underdeveloped housing markets.

The principal findings and conclusions from this section, which have a direct regulation address, are as follows:

- in the nearest 20 years Sofia will rely above all on the existing housing stock;
- the housing estates of panel buildings may not be demolished – they should be restructured and refurbished;
- the resource attracted in the housing sector is extremely inadequate; the Sofia Master Plan should request active and adequate municipal housing policy;
- the territorial disparities and risk-bound unevenness in the utilization of the space in the region and its component zones (including in the surrounding area) have been disclosed;
- there is a risk of excessive urbanization of certain territories and deterioration of the natural environment there;
- there are significant reserves of plots for housing in the zone of active influence and in the outer zone of influence; their utilization would stabilize the local population and would take up part of the migration pressure on the capital;
- it is necessary to make efforts to overcome the contradiction between the attractiveness of living in settlements in the periphery and the underdeveloped infrastructure there (including accessibility by transport);
- a regional approach is needed in the field of the investment initiatives, comprising also new environment for residential purposes;
- there is a process of displacement of permanent residence by temporary (seasonal) residence in the human settlements of the two zones of impact;
- the cultural identity and architectural value of the human settlements with high rates of construction activities are threatened.

The diagnosis valid at the end of 2007 is to a high extent a replica of the previous one, but showing a certain aggravation of the social and spatial development problems:

- The average statistical affordability of housing continues to deteriorate despite the general increase of the income levels – the price/income ratio has increased from 18 in 2001 to 21 in 2006, i.e. 21 years of average household income (BGN 7 582) are now needed for the purchase of a dwelling of an average size (75 m2) at the price of BGN 158 000.
- The rates of new construction (on the average 1.4 dwellings per 1000 inhabitants) are still below the minimum for normal reproduction of the housing sector (2 dwellings per 1000 inhabitants).
- The housing markets develop without public intervention (subsidies) and continue to be unaffordable for the mass demand despite the tangible increase of the share of solvent customers – from 10-15 per cent in 2001 to 20-25 per cent in 2007.
- The inadequate management and maintenance of the housing stock, leading to accelerated depreciation, continues; the reform in the condominium facilities has not been conducted as yet; despite the existence of an approved National programme for renewal of multi-family apartment blocks (since 2005), the planned mass renewal (rehabilitation) has not started yet.
- The state and the municipalities continue to abdicate from their economic responsibilities in the field of housing (constituted in the National Housing Strategy, approved in 2004) – the amount of budgetary expenditures for housing is extremely low (less than 1 per cent).
- The development of the housing mortgaging market is among the small number of positive phenomena in the sector, but a system for housing subsidization is still missing.

At this background the large-scale problems identified six years ago have aggravated:

- Helplessness of the homeless and the extremely poor;
- Deterioration of the housing stock because of poor maintenance;
- Loss of housing stock because of unregulated transformation into commercial stock;
- Low solvency of the majority of occupants;
- Shortage of affordable housing.

The major findings and conclusions with a direct spatial development address have been corroborated:

- In the coming 20 years Sofia will have to rely above all on the existing housing stock;
- The panel housing estates may not be demolished – they should be restructured and refurbished;
- Despite the evident activation of new housing construction, the resource attracted in the sector is inadequate; the Master Plan should request more active policy in the fields of spatial development, infrastructure and housing;
- The territorial disparities and risk-bound unevenness in the utilization of the area and its component zones (including the surrounding area) continue to be gravely manifested;
- The excessive urbanization of the central and southern territories, as well as the deterioration of the natural environment in them are already a fact, despite the warnings and the proposed measures;
- The significant plot reserves for habitation in the zone of active

influence and the outer zone of influence remain untapped; any promotion of investments in housing in them would stabilize the local population and would take up the undesired migration pressure on the compact city.

- The need of overcoming of the contradiction between the attractiveness for habitation in the settlements of the periphery and the underdeveloped infrastructure (including accessibility by transport) is even more topical.

In summary, the major conclusions from the updated analysis are as follows:

- The population growth advanced at much higher rates than the supply of finished new buildings (67 863 new inhabitants as compared to 8 474 new dwellings) and generated a new shortage of 20 000 dwellings;
- The new construction is excessively concentrated in the compact city – more than 98 per cent;
- The market has already responded to the newly emerged demand and in 2008 the supply of new dwellings may be expected to be doubled;
- The average statistical housing consumption demonstrates a clear downward trend;
- At that background the need of social housing³ gets aggravated and increases.

Updated concept for development of the residential areas

For better visualization and clarity the updated concept for the 2008 Master Plan is presented in the form of amendments and additions to the respective aspects of the 2003 Master Plan.

Fundamental postulates

The spatial development concept of the 2003 Master Plan as regards the residential areas was based on the following fundamental postulates:

- Concentration of the effort above all in the *qualitative* rather than in the quantitative development of the residential areas. On one hand, the theoretical/subject-to-forecasting demand does not presume a radical turn to extensive development and, on the other hand, the inherited structural and functional “shortcomings” of the built residential areas need intensive targeted efforts.
- Development of new plots for housing construction is performed under the main/leading motif of “*activation of the surrounding area/opening of new prestigious markets*”, rather than “relieving of the compact city”.
- *Concentration* of the efforts in the compact city – up to 95 per cent. The motif is that it is namely there that about 94 per cent of the occupants and the housing stock, respectively of the problems of the residential environment are situated.
- *Concentration* of public investments in the infrastructure, spatial planning, organization and training.
- Initiator of all the action on the spatial development concept is the municipality. The responsibility for the implementation/investments is shared through partnerships with the private businesses (especially banks), the citizens and their associations.

The forecast used in the amendment of the 2003 Master Plan corroborates the above postulates and suggests the following additions:

- Development of new plots shall take place only after working out of Detailed Regulation Plans for entire regulation zones;

- Permits for high-rise construction on newly assigned plots shall be issued only after construction of the elementary infrastructure;
- The development and “cure” of the capital shall be realized following the principle of “integrated urban development”⁴

Development objectives for the residential areas

The main planning goal for the residential areas and the housing system was “Creation of conditions for construction of a balanced, high-quality and sustainable housing system in Sofia”.

The achievement of the main planning goal is pursued through addressing of the following package of specific objectives:

- Restructuring and renewal of the housing estates;
- Accelerated development of the housing markets;
- Revitalization of the social housing sector;
- Creation of conditions for construction of affordable single-family houses;
- Retention of the habitation in the central part of the city and its conflict-free integration with the business, administrative, cultural and other functions;
- Creation of active contact zones between habitation and business in all the parts of the compact city.
- Revitalization of the disadvantaged quarters and reconstruction of the depreciated ones;
- Achievement of competitiveness, adaptivity and integration of the peripheral residential areas.
- Decentralization of habitation for achievement of balance in urbanization and utilization of the reserves of the areas outside of the compact city and the adjacent surrounding area.
- Development of attractive for habitation areas, which till present have been deprived of infrastructure and alienated from modern activities.
- Territorial localization of the system’s elements in compliance with the major spatial planning goals of the macro-spatial restructuring and development of the city.

The draft for amendment of the 2003 Master Plan corroborates the above objectives and identifies no grounds for changes or additions.

Spatial planning policy

The recommended spatial planning policy of the municipality, expressed in key phrases, may be summarized as follows:

Central city area

- *Historical centre* – conservation, building renewal and infrastructure;
- *City* – implementation of large-scale planning operations related to reconstruction and revitalization, preservation of the residential function up to 30 per cent, planning of underground/multi-storey car parking facilities;
- *City Centre Northwest* – zone subject to rehabilitation – unified organized and conducted operation, preservation of the residential function up to 40 per cent.

Central City Area – immediately around the Central Zone – evolution-based market development, without large-scale planning intervention, replacement of the infrastructure.

Periphery – optimization of the urban structure, achievement of homogenous and equitable level of the housing standards. The leading factor in that zone is “optimum use of the capacity of the infrastructure”. Some of the specific planning interventions are:

- *Residential housing estates*: restructuring and renewal, preservation of the current build-up parameters (КИИТ and density);
- *Disadvantaged quarters (Roma neighborhoods)* – revitalization (regulation, public works, organized / supported “do-in-yourself” construction;
- *Inherited quarters with traditional build-up (former villages)* – evolution-based market development with preservation of the nature of build-up and insignificant surpassing of the planning parameters;
- *Compact inbuilt-up plots (southern areas)* – prevention of market pressure and excessive density – ensuring smooth transition to the Vitosha Collar and Vitosha Mountains, need of elementary infrastructure.

Surrounding areas – taking into account the leading goal of “activation” and the main limiting factor “ecology”, the planning policy in this zone is described in two major directions: application for infrastructure; specific rules and norms concerning build-up, guaranteeing penetration of the “green edges” and preservation of the nature of inherited build-up.

The Amendment to the 2003 Master Plan corroborates the above directions of the planning policy in the different zones of the city, while proposing the following additions, related to the surrounding areas:

- The requirement for “preservation of the nature of the inherited build-up”, formulated in the 2003 Master Plan, is retained with respect to the old settlement structures, but for the newly developed plots zones of high intensity are also permitted within the permissible indicators for low-rise build-up, including structures of “closed” build-up.
- The development of the surrounding areas becomes a priority, which is manifested in a public initiative for organization of the owners, elaboration of Detailed Regulation Plans for entire planning zones and construction of elementary infrastructure.

Planning measures

Taking into account the development of the housing system under market conditions the 2003 Master Plan emphasized that the management/administrative interventions continue to be a decisive necessity, but adapted to discrete market regulators, which orient investments indirectly towards the desired zones and spheres for enhancement of their activeness. Depending on the specifics and the picture of the problems the old plan proposed the following specific packages of measures:

Central zone – restoration – meaning in the first place restoration of the lost under the market pressure positions of residence in the centre and prevention of displacement of that function by business and office activities.

First territorial belt - optimization – meaning optimization of the urban planning indicators and planning structure of an otherwise quite inhomogeneous environment.

Second territorial belt – structuring – meaning introduction of planning and spatial order in a zone of distorted former human settlement structures.

Third territorial belt - activation – this vast zone needs activation of the communication and service activities with a view to enhancement of its attractiveness.

³ The notion “social housing” should not be interpreted as “municipal housing”. “Social housing” here means every housing, which has received public support in whatever form, irrespective of the type of ownership.

⁴ Through integrated programme for development of territorially differentiated part of the city, comprising everything necessary for setting in place a high-quality and sustainable living environment. Such programmes are eligible for financing under the Operational Programme “Regional Development” with support from the JESSICA instrument.

Housing estates – restructuring and renewal – for them active redesign of their plans and spatial structure is necessary in order to make them adequate to the modern conditions, as well as renewal/rehabilitation, in order to extend their physical and social life (and preserve/increase their market value – in a way the fixed capital for the majority of the residents)

Special attention is paid to the surrounding zone (third territorial belt). In this zone, which has the broadest territorial coverage, active intervention is needed for building the infrastructure, development of the public services and improvement of the communication accessibility. The zone should turn into an equitable residential environment in the network settlement structure of the Sofia Plain through active use of its recreation, agrarian, resort and other resources. It is necessary to open new markets for construction of single-family houses.

The motivation is rooted in the abnormally high ratio of “land price/costs of a single-family house” within the boundaries of the compact city (more than 50 percent) and the estimated solvent demand on the part of the emerging middle class in the first place. This measure is manifested in regulation of new plots in and around the villages, improvement of the road connections and building of the infrastructure. The recommended approach of the municipality is applicable in that case as well.

In addition to the purely planning measures, the package contains also the following:

Establishment of a municipal land bank – the demand for social housing, transition to the practice of “agglomerated urbanism”, balanced markets and the opportunity to implement large-scale planning operations impose the necessity of establishment of a municipal land bank. The Municipality becomes market “speculator” for public benefit. The investments in purchase of real estates and plots will be efficient for two reasons: the Municipality will take advantage of the low prices in zones outside the market focus at a given point of time and later will be able to implement without problems its housing policy and programme objectives at much lower costs.

Identification of “hostile” and integrating contact zones – in different parts of the city the residential areas happen to be in close “contacts” with “hostile” or presuming integration activities and processes. Hostile for the residential function are the transport corridors, the overloaded crossroads, points of concentration of poverty and criminality, noisy and polluting industries. The measures may range within broad limits as may also the nature of the conflicts. Some possible measures are creation of green or mechanical “shields”, “curing” of ghettos and evacuation of the function “Residence”. A matter of interest in respect of the integrating contact zones is their bordering on business in the peripheral areas. Business has been already penetrating in these zones, but more in a haphazard manner, as a matter of trade-off for itself and frequently in conflict with the function “Residence”. The provisions of the transport and macro-structural scenario, related to the transport corridor and the mighty northern axis with new economic activities, represents a specific requirement as regards habitation in the adjacent territories. The measures are manifested again in provision/reservation of building plots for targeted design and implementation (when the need for that becomes topical) of mixed structures – housing, offices, small hotels etc.

Construction of “soft” infrastructure in the peripheral housing estates. It contains a network of pedestrian/bicycle lanes and activity intersection points. For instance, in the integrated zone Nadezhda – Obelya – Lyulin – Ovcha Kupel – Boyana such points are the history museum, a mineral spring, parks, a city-district centre, a stadium. The implementation of the

thus proposed system will contribute considerably for raising the standard of habitation and will integrate in an easy and convincing/effective way the function “Residence”, the recreation and the cultural-and-historical heritage.

Administrative measures – housing policy

The draft for Amendment to the 2003 Master Plan reaffirms the above package of planning measures and expands it by the following:

- The stronger manifestation of the problems of “traffic, ecology, investment chaos, housing shortage at the background of unsold finished dwellings” is due not so much to errors in the 2003 Master Plan but rather to non-application of the prescribed and envisaged in that plan measures and policies.
- The new housing construction is implemented only in zones in which the adjacent infrastructure is available; its re-orientation towards desirable zones (the peripheral surrounding areas) may be achieved only through advanced design (Detailed Regulation Plans) and construction of the elementary infrastructure (technical and social).
- Although undermined, the chances for implementation of some of the measures recommended in the 2003 Master Plan (the “municipal land bank”, “soft” infrastructure, “hostile and integrating contact zones”) are still valid and for that reason they have been transferred to the draft for amendment of the plan.
- A new measure – “zone for integrated urban development” – has been added. It consists of territorial delimitation and creation of a new, up-to-date and addressee-based database. This measure would allow compilation of “programmes for integrated urban development”, eligible for financing under the Operational Programme “Regional Development”.

Typology and zoning of the residential areas

For the purposes of analysis, diagnostics and forecasting of the development of the residential area the 2003 Master Plan uses the following typology and zoning:

1. Zoning by location. Central Zone (Historical Centre, City-centre South, City-centre North), First Territorial Belt (the remaining part of the compact city with “islands” – housing estates, mixed zones, neighborhoods in crisis, compact vacant plots, capsulated villages), Second Territorial Belt (gravitating to the compact city human settlements – in 4 sectors), Third Territorial Belt (the rest of the human settlements of the municipality and its immediate zone of influence – in 4 sectors: western – resort and recreation activities; northern – the Balkan skirts, agrarian; northeastern – Kremikovtsi, stagnating; southeastern – Vitosha-Lozen skirts).

The conventionally differentiated zones (belts) have a pronounced concentric nature and reflect the relationship of the respective residential area to the core centre. The segmentation of these belts by sectors outlines zones of specific characteristics and problems. As a final result the assumed structural segmentation creates the basis for specific impacts of administrative, planning and regulatory nature.

2. Zoning by type of build-up. The type of build-up is determined by the combination of two leading indicators: height and situation of the buildings. Assuming the rule that the general type of build-up of a given planning units is based on the predominant in more than 75 per cent of the area type of buildings. The theoretically possible 12 combinations are reduced

to only 4 realistic ones: medium- and high-rise build-up on individual lots (predominant in the Central Zone); complex build-up (almost entirely in the first belt); mixed build-up (typical for the first belt), low-rise build-up (mainly free layout, it shapes the appearance of the second and third belts, presents the “islands” of capsulated villages and ghettos in the first belt). Although formally outside the structure of the presented typology, two more types of zones are included in it: compact vacant plots (mainly in the southern areas and the Vitosha skirts) and newly proposed residential areas (the Balkan foothills and the Lozen-Vitosha foothills).

3. Zoning according to the state-of-repair and the prescribed planning measures. The above mentioned typologies are loaded by one more characteristic – “specific use” and “state-of-repair”. The necessary measures for bringing them to the required state (in implementation of the planning objectives) are reconstruction for preservation of habitation (Centre-city North), reconstruction and renewal (housing estates – in 2 phases), revitalization of “crisis” quarters, areas for initial construction of infrastructure (Vitosha foothills and the southern areas), new plots for single-family houses, limitation of loading and improvement of the green system (resort and recreations zones), zone for environmental rehabilitation (the Kremikovtsi area).

In addition to the above zones, two new types of residential environment in the compact city are established by the sign “specific use” – the so-called “contact zones” – “hostile” and “integrating”. They are beyond the scope of the present typology and for that reason are not presented (they may be illustrated in detail in 1:10 000).

The Amendment to the 2003 Master Plan transfers the above typology but with certain substantial changes.

Zoning by location. The central macro-structure is retained, but the rest are distinguished as five sectors: northwestern, northern, northeastern, southeastern and southwestern. In this way in each of the sectors falls part of the diverse mosaic of the types of urban environment. The sectors reach up to the boundaries of the municipality and exclude the settlements of the immediate Zone of Impact. Their influence/capacity as regards habitation is reflected in the forecast about the capacity of the residential areas. There is significant change with respect to the zone around Kremikovtsi – from stagnating this zone becomes prospective (not only in terms of habitation), provided the planning re-designation is realized – from production enterprise into mixed-functional zone (Пп into Смф)

Zoning by type of build-up. In actual fact this is a reflection of the *status-quo* in the original plan. In the meantime the market has created a new type of “complex” build-up (the so-called “closed settlements”), which bears the regulation attributes of the traditional inherited housing estates, but not within their spatial and functional parameters – height, type of build-up, public services, accessibility. This development requires the introduction of new press-mark ((Жкн – housing estate – new) to denominate this type of build up.

Zoning according to the state-of-repair and the prescribed planning measures. In the draft for Amendment to the 2003 Master Plan this type of zoning is also copied with the following additions: the Balkan foothills is added to “areas for initial construction of infrastructure”; the areas proposed in 2003 Master Plan for “Municipal Land Bank for social housing programmes” are no more actual because of their build-up in the meantime and/or because of their re-designation for non-residential functions. The draft-Amendment of the 2003 Master Plan transfers the

proven need of such a bank, however the specification of the appropriate/possible plots for that purpose are left to the discretion of the Detailed Regulation Plans.

To summarize the above mentioned the draft for Amendment to the 2003 Master Plan corroborates and inherits the spatial planning concept of the old plan and at the same time introduces the following amendments and additions:

With respect to the fundamental postulates (принципните постановления). In order to achieve a change in the vicious planning practice (“piecework”) of the past; the newly assigned residential areas will be developed only upon elaboration of the Detailed Regulation Plans for entire zones under regulation; high-rise construction will be permitted only after construction of the elementary infrastructure. In addition, the principle of “integrated urban development is introduced as a governing principle of the implementation of the plan.

Objectives. The draft for Amendment of the 2003 Master Plan inherits entirely the package of objectives of the old plan. Its review has proven its completeness, correct orientation and topicality. Unfortunately, during the period under review no visible results in achievement of the specified objectives have been found.

Spatial planning policy. In this respect the old concept was evaluated as being topical and presuming correct development orientation for the residential areas. The only adjustment refers to the requirement to preserve the “characteristics of build-up” in the surrounding area. The draft-Amendment allows plots for zones having intensive indicators (in the framework of the regime Ж_м) and “closed build-up” (сключено застрояване).

Spatial planning measures. The reason for the deteriorated characteristics of the urban environment is not the 2003 Master Plan itself, but rather the failure to implement the measures prescribed in it. The project for their implementation copies them with the sole addition to establish “zones for integrated urban development” as a basis for application of the plan through “integrated programmes for urban development” eligible for financing from the EU funds.

Typology of the residential areas. The draft for Amendment to the 2003 Master Plan copies the 3-grade typology of the old plan – by location, by type of build-up and by state-of-repair/measures. Substantial amendment has been introduced in the first grade of zoning – by location. As different from the concentric belts and inner sectors envisaged in the old plan, the macro-structure of the draft-amendment plans 5 sectors and a core – Central City Area. Thanks to the territorial linkage of the database with the micro-structural units (quarters) that change does not require significant reconstruction of the information system of the new plan.

4.2.2.Updated forecast model for development of the residential areas

Forecaste model

The forecast model for development of the residential areas in the 2003 Master Plan contains three forecast scenarios based on non-implementation, partial implementation and full implementation of the measures/actions and policies prescribed in the spatial planning concept.

PESSIMISTIC FORECAST: “no-intervention development”

The recommended actions have failed to be realized:

- *Kremikovtsi* continues to be a strongly stagnating factor;
- The sewerage system in the southern territories is not constructed;
- The large-scale rehabilitation of the housing estates has not started;
- The reconstruction of the dark spots” (gravely depreciated neighborhoods and ghettos) has not been implemented;
- The infrastructure of the centre has not been entirely replaced;
- No provision has been made for vehicle parking spaces;

The projection for a high version of the demographic forecast is realized: population growth by 180 000 new inhabitants.

There is no adequate housing policy in force:

- Housing is not considered a priority as yet;
- There are no accessible mortgage tools;
- There is no sysem for housing subsidies;
- The municipality has not undertaken organizational, planning and investment functions with respect to regenration of the residential environment;
- The municipality has not set up a municipal land bank;
- The privatization of the land in the housing estates has not been completed;

There are no developed housing markets:

- Residential mobility continues to be low;
- The market is “shallow” – it extend only over a thin layer of the potential demand;
- The currently existing vacant plots are only partially built-up;

The situation of the existing crisis areas is deteriorating further, new ones emerge.

REALISTIC FORECAST. “Sustaining of the current position” – the recommende actions are partially realized:

- The negative impact of Kremikovtsi is parially neutralized;
- The sewerage system in the southern territories is partially constructed;
- Up to 30 per cent the panel housing stock is reconstructed;
- The crisis processes in the Roma neighborhoods are coped with through partial public works and small-scale new construction;
- Reconstruction of residential quarters, adjacent to the break-through along Todor Alexandrov Street is partially implemented.
- The present crisis areas (Hristo Botev, Phillipovtsi, City Centre – Northwest, Orion) are stabilized, and the new forecasted ones (Obelya, Iliyantsi, Levski, Mladost 4, Rabotnicheski Zhilishta etc.) are subject to observation and control.
- The infrastructure of the city centre is not replaced up to 70 per cent (не е подменена до 70%);
- Car parking is not yet resolved.

The medium option of the demographic version is realized – population growth by 80 000 new inhabitants.

Housing has become the object of policy attention and conditions are created for attraction and accumulation of capital for housing construction:

- The mortgage instruments are accessible to 15-20 per cent of the potential applicants;
- The system of subsidies is still underdeveloped;

- The housing problem is institutionalized, however the required measures are not addressed;
- The municipality has undertaken organizational, planning and investment in the field of housing regeneration;
- The municipality has taken steps towards establishment of municipal land bank for social housing;
- Privatization of the land has been effect in the regenerated housing estates;
- Maintenance and management of the apartment blocks has been institutionalized.

The development of the housing markets is advancing:

- Housing mobility is on the increase, although still far from the European levels;
- The market features a larger number of segments, however it covers a relatively thinner layer of the potential demand as yet;
- The currently existing vacant plots are built-up.

OPTIMISTIC FORECAST. “Sofia – an European city”

The recommended actions are being implemented:

- *Kremikovtsi* is no more a hot-spot of large-scale environmental pollution;
- The environmental parameters of the northern territories are within the norm requirements;
- The sewerage system and the other infrastructure of the shouthern territories are fully constructed;
- The housing estates are reconstructed up to 70 per cent;
- The infrastructure in the city centre is fully renovated; Инфраструктурата в центъра е напълно подменена;
- The reconstruction of the areas along the western axis is completed;
- The present crisis areas have been “cured”, the newly emerging ones are under survey and any negative processes are handled timely.
- The density of build-up in housing estates with inner land reserves is increased and thier use is changed from solely residential into mixed one.

The pessimistic version of the demographic forecast is realized: 80 000 -10 000 new inhabitants.

An active and adequate housing policy is being implemented:

- The housing problem is institutionalized;
- A well-developed system of subsidizing of housing construction is introduced;
- New housing sectors have emerged – social housing for low-income groups, young couples and workers;
- Supply of affordable housing loans;

The housing markets are developed and active:

- The housing mobility is still below the European levels;
- Real housing demand accounts for 40 per cent of the potential demand;
- All currently vacant plots are already developed;
- New fields of investment activity is identified;
- New zones emerge on the high-end market.

Taking account of the realities during the past 6 years we may conclude that the housing system is developing under the pessimistic forecast. Irrespective of the delayed start, the stakes in the draft-Amendment to the 2003 Master Plan are laid once again on the optimistic forecast since it is

the only one that gives meaning to its objectives and rationale.

Forecast maximum capacity and untapped potential of the residential territories

The 2003 Master Plan contains a theoretical reserve* for about 260 000 dwellings and 400 000 new inhabitants, allocating a total of 15 777 ha residential areas (including summer house areas). The draft-Amendment to the 2003 Master Plan expands the allocated areas for housing to 16 821 ha, including 1 071 ha for “development in the long-term horizon”. The aggregate comparative balance of the residential areas is shown in the two tables below.

Residential areas (ha)	Basic plan 2001	2003 Master Plan	Draft-amendment of the 2003 Master Plan	2008-2002
Sofia Municipality	13 955	15 777	16 820.71	1 043.71
Compact city	7 115	8 650	8 753.70	103.70
Surrounding area	6 840	7 127	8 067.00	940.00

Draft-Amendment (ha)	City	Surrounding area	Municipality
TOTAL	8 753.70	8 067.00	16 820.71
Жг	524.05	0.00	524.05
Жк	2 367.44	82.30	2 449.74
Жс	863.25	75.79	939.04
Жм	2 204.67	3 242.46	5 447.13
Жм1	179.31	806.17	985.47
Жм2	1 399.74	797.01	2 196.75
Жм3	523.20	144.05	667.25
Жв	136.91	1 923.83	2 060.74
Ц1+Ц2+Ц3	479.03	0.00	479.03
Жмд	50.67	546.30	596.97
Жм2д	0	205.42	205.42
Жвд	25.44	243.68	269.11

Applying the principle of limited development of the territories and with due account of the “conservative structures”, i.e. zones, which will retain their current relatively low parameters, the calculated forecast capacity of the residential areas in the 2008 Master Plan is as follows:

In the 2003 Master Plan forecast construction of more than 18 500 dwellings was assumed. Despite the observed market expansion the achieved rates of new construction (approximately 1 700 dwelling*year on the average) were more than two times below the forecast value (3 700 dwellings/year). The mechanical population growth rates turned out unexpectedly to be higher. Although the matter is the subject of the socio-economic forecast, we will highlight here one of the primary causes for that undesired process – the absence of a competitive living environment in the small and medium-size cities in the country and in the villages (labour markets, the cost of labour and services). The updated forecast is built on the assumption that the havoc urbanization will be gradually reduced by the impacts of the launched cohesion policy at the regional level.

The current reaction of the housing construction market is called for by the estimated avalanche-like demand, accompanied by mass migration towards the capital (on the average some 15 000 people per year, which means anticipated demand for about 6 000 dwelling/year). The new dwellings offered on the market are only within the price range of highly solvent demand, which covers not more than 20 per cent of the potential demand. As a result, more than 20 000 new dwellings or dwellings under

construction are waiting for their first buyer for more than a year.

Although with the inherent for the construction industry inertia-based delay of several years, the appearance of the above mentioned stagnation factors (solvency and drop in the migration rate) will inevitably lead to drop in investment initiatives, caused by the expected demand by the new migrants. At the same time the solvent demand among the current inhabitants will increase and will “consume” the outpacing supply. All in all, the revised forecast of the draft-amendment is similar to that of the 2003 Master Plan, but contains a smaller number of estimated housing of new construction during the period 2008-2027.

Instead of the nearly 104 000 dwellings in 20 years, forecast six years ago, now only 85 000 units are proposed/forecast. The grounds for that reduction are as follows:

- ✓ The investment resource will increase, but it will be distributed more evenly between new construction and renewal (currently the ratio is 90/10 while the estimated ratio by the end of the period is 60/40);
- ✓ The estimated fading out of the migration drive and the gravely negative natural population growth do not provide grounds for the expected rates of more than 4 000 – 4 500 new dwelling per year.

As far as the forecast concerning the territorial distribution of new housing construction is concerned, it is close to that of the old plan. Irrespective of the promotional measures for re-direction of investments towards the northern sector of the city and the surrounding area, the southern sector will continue to be dominant since from the point of view of the timeframe it is quite ahead with respect to development status and established image. Anyway, the “frightening” advantage of the southern sector will be moderated considerably and the northern sector will achieve a market share of 20-22 per cent as compared to the current 6 per cent. The table below illustrates the forecast distribution of new construction and the respective utilization of the so-far untapped reserve by macro-zones.

FORECAST FOR THE NEW HOUSING CONSTRUCTION DURING THE PERIOD 2008-2027

MACRO-STRUCTURES	RELATIVE SHARES				NUMBER OF NEW DWELLINGS 2008-2027	RESERVE (UNITS)	FORECAST DENSITY
	2008-2012	2013-2017	2018-2022	2023-2027			
City centre	12%	9%	8%	7%	7 350	17 732	41%
Northwest	13%	14%	14%	13%	11 500	26 168	44%
North	4%	6%	8%	9%	6 050	17 004	36%
Northeast	5%	5%	5%	6%	4 500	9 973	45%
Southeast	31%	31%	30%	30%	25 850	98 593	26%
Southwest	35%	35%	35%	35%	29 750	100 454	30%
TOTAL	100%	100%	100%	100%	85 000	269 925	37%
FORECAST	15 000	20 000	25 000	25 000	85 000		
MACRO-STRUCTURES	NUMBER OF NEW DWELLINGS				NUMBER OF NEW DWELLINGS 2008-2027		
	2008-2012	2013-2017	2018-2022	2023-2027			
City centre	1 800	1 800	2 000	1 750	7 350		
Northwest	1 950	2 800	3 500	3 250	11 500		
North	600	1 200	2 000	2 250	6 050		
Northeast	750	1 000	1 250	1 500	4 500		
Southeast	4 650	6 200	7 500	7 500	25 850		
Southwest	5 250	7 000	8 750	8 750	29 750		
TOTAL	15 000	20 000	25 000	25 000	85 000		

Conclusions

The conclusions drawn from the above are as follows:

- The capacity of the existing residential areas in Sofia exceeds the forecast shortage of the total number of conventional dwelling units for the period 2008 – 2027;
- The city needs new residential areas outside the boundaries of the compact city in order to alleviate the excessive investment pressure and ensure new markets for single-family housing;
- Even under the most optimistic forecast concerning the rates of new housing construction, the capacity of the residential territories in Sofia will be filled up to 37 – 40 per cent on the average;
- Even under the most optimistic forecast concerning the rates of housing construction in the near 20 years, neutralization of the forecast statistical housing shortages (at the assumed as a baseline European standard of housing consumption) would not be possible.
- The biggest volume of housing construction under the optimistic forecast will be realized in the southwestern macro-structure (about 30 000 dwellings) and in the northwestern macro-structure (about 26 000 dwellings); in the event of timely implementation of the prescribed measures (Detailed Regulation Plans and infrastructure), some 11 000 new dwellings will be constructed in the northern and northeastern macro-structures.
- About 70 000 dwellings in panel apartment blocks in the housing estates should be renewed by 2027.
- Investments in the infrastructure will be the decisive factor for the realization of the forecast.
- Conducting of a comprehensive national and municipal housing policy is a must for the implementation of the realistic forecasts.

4.2.3. Comparative analysis of the currently enforced Master Plan and the Draft-Amendment to the Master Plan with respect to the balance of the residential areas

As a whole, the areas of pure residential spatial planning functions (Жг, Жк, Жс, Жм, Жм₁, Жм₂, Жм₃ and Жв) increase very little as compared to their size depicted in the approved Master Plan.

Enforced Master Plan: 15 412.36 ha

Amended Master Plan: 15 676.33 ha

The increase amounts to 263.97 ha, which represents 1.712171 per cent.

The areas of the individual sub-types of residential spatial planning zones are changed as follows:

- Zones increasing their area:
 - residential zones with low-rise build-up in natural environment (Жм₁) – by 4.24 ha;
 - residential zones with low-rise build-up under specific additional requirements (Жм₂) – by 214.18 ha;
 - residential zones with low-rise build-up under limited parameters under limitation parameters (?? ограничителни параметри) (Жм₃) (the most significant increase) – by 249.60 ha.
- This type of zones are concentrated above all in the contact territories with the Vitosha Park, those in the River Iskar security protection zone, the territories bordering on the NATURE 2000 zones, the security protection zones of the mineral springs and in the northern territories of Sofia Municipality.
- Summer house zones (Жв) – by 122.15 ha.

Conclusion: The envisaged increase covers residential zones possessing high standard of habitation in the individual lots, with low-rise build-up in natural environment and featuring exclusive consideration of the

* Theoretical reserve (capacity) is the sum of floor area in the residential areas, which is obtained when all the residential plots (net) are built-up at the maximum permissible Kint without taking into account the existing build-up.

environment-related factors.

- Zones reducing their area:
 - Residential zones with predominant complex build-up (Жк) – by 17.2 ha. What is important here is that the scope of these zones as a whole is increased but as a result from taking into account of all the non-residential sites belonging to the Oo regulation zone the area has diminished.
 - residential zones with predominant medium-rise build-up (Жс) – by 160.71 ha;
 - residential zones with predominant low-rise build-up (Жм) – by 236.65 ha (the most significant reduction).

There is a significant potential as regards residence in the central spatial planning zones (Ц₁, Ц₂ and Ц₃) with a total area about 458 ha. As regards the area envisaged in the 2003 Master Plan there is a minimum reduction by about 25 ha as a result of more accurate specification of certain plots, whose designation has been changed into zones for public services (Oo) and green areas (Tro). In the central spatial planning zones in principle there are no limitations concerning the ratio residential/non-residential functions in percentage, so that the needs and demands as such under market-based conditions would determine these ratios.

An aspect, which has a very great importance in terms of its influence on the total housing potential of Sofia, is the considerable increase of the territories with mixed multi-functional spatial planning zones – Смф, Смф₁ and Смф₂.

Total for Sofia Municipality these territories increase by 1402.54 ha (by approximately 44 per cent) as regards the provisions in the currently enforced Master Plan.

This increase is the greatest for the planning zone Смф – from 849.45 ha according to the Master Plan they become 1704.79 ha according to the Amended Master Plan or almost doubled. .

The same as in the central spatial planning zones, within the Смф zones there is not strict delineation between residential and non-residential functions, which means that in the event of increased demand for housing it would be possible to meet these needs

For the period beyond the planning horizon of the Master Plan forecasts (after 20 years) the so-called “territories for use in the distant future” are set aside as a reserve.

With respect to the system “Residence” considerable amount of territories have been envisaged, which are situated in the surrounding area of the city of Sofia and consist only of spatial planning zones with low-rise build-up (Жм, Жм₁, Жм₂ and Жм₃) and summer house zones Жв – an aspect complying with the trend towards an ever growing future demand of high-category habitation in natural and environmentally clean zones. The distribution of the territories for residential use in the distant future is as follows:

- Territories for residential use in the distant future with predominantly low-rise build-up (Жмд) – 483.78 ha. This compensates and even exceeds the reduction in the Жм zones in the Amendment to the Master Plan. .
- Territories for residential use in the distant future with predominantly low-rise build-up in natural environment (Жм1д) – 228.24 ha.
- Territories for residential use in the distant future with predominantly low-rise build-up with additional specific requirements (Жм2д) – 125.74 ha.
- Territories for residential use in the distant future with predominantly low-rise build-up with limitation parameters (ограничителни параметри) (Жм3д) – 720.91 ha. This represents the most significant reserve in the territories with low build-up density at maximum preservation of the natural environment, which presumes the highest standard of habitation. .

-Summer house zones for use in the distant future (Жвд) – 493.17 ha.

The sum total amounts to 1558.67 ha for low-rise residential build-up and 493.17 ha for summer house build-up.

In terms of territorial location the zones for use in the distant future are oriented above all towards the northern part of the city (the Balkan foothills) in compliance with one of the primary objectives of the Master Plan – balanced development of the city in northern direction.

4.3. SYSTEM “WORK” (SECONDARY SECTOR)

4.3.1. General provisions

The spatial planning development of the industrial and warehousing zones, the System “Work”, is based on all the studies conducted so far in the process of elaboration of the Sofia Master Plan, completed in April 2003 and approved by virtue of Decision No. 147/2006 of the Council of Ministers.

It reflects the stipulations, parameters and priorities related to the adequate development of the system in the forecast period. All these are linked to an optimum extent with the District Development Strategy and the Municipal Development Plan, as well as with Bulgarian and European programmes in the context of integrated national, regional and European economic space.

The period between the elaboration of the plan (2003) and its enforcement (January 2007, the Law on Regulation and Build-up of Sofia Municipality, Paragraphs 11 and 14), coincided with an unseen before investment activeness and large-scale foreign investments in the capital, which within several years changed to a significant extent its appearance and made some of the envisaged developments sound obsolete. This applies to the largest extent to the industrial zones, which were subjected to restructuring and changes in their functional designation.

That trend was expected and promoted in the 2003 Master Plan and it was for that reason that in the Transitional and Closing Provisions of the Law on Regulation and Build-up of Sofia Municipality (Paragraph 2, Item 2) was laid down a possibility for change of any spatial planning zone in the event of restructuring of industrial zones on its area.

What the 2003 Master Plan failed to (or did not dare to) envisage was to estimate properly the pace and the scale of these processes – they were expected to set in during the second half of the forecast period of the plan, but in practice many of them started prior to its enforcement. .

This amendment of the Master Plan of Sofia Municipality aims at reflecting, additional promotion and regulation of the restructuring processes, which are already underway.

4.3.2. Current state and trends in the development of the secondary sector – the System “Work”

General characteristics

The analysis in the 2003 Master Plan made the following conclusions concerning the current state of the secondary sector – the System “Work” – in the capital:

- The city of Sofia and Sofia Municipality have leading functions in the national socio-economic complex. Developed on the area of the region

are all sectors of material production.

- There is an insufficient balance in material production with respect to the internal relationships and the relationships economy-resource. The structure of production is resource-intensive and area-intensive.
- The development of a number of activities contradicts the requirements for balanced and sustainable urban environment and protection of the environment.
- Certain sectors of the heavy industry account for disproportionately high share in the economic structure of the city, which is incompatible with the development of the capital as an administrative, educational, R&D and cultural centre.
- The process of de-industrialization is strongly manifested. It is characterized by drop in the production output of almost all the subsectors and restructuring in favour of services. With sufficient employment in the tertiary sector (nearly 78 per cent), the socio-economic complex of the capital begins to acquire the employment characteristics typical for the capitals of the developed states.
- In sectoral aspect there is a trend for more significant employment in such sectors of the non-production sphere like wholesale and retail trade, transport, communications and tourism, which stand out as the most rapidly developing service activities in the city of Sofia. The number of the persons employed in R&D and high-tech activities is decreasing.
- Typical for the local situation is the transition from employment in large-scale industrial facilities to employment in small and medium-size enterprises and micro-companies.

All these characteristics are still valid today. One may supplement them by the following processes observed during the period between the elaboration of the 2003 Master Plan and its enforcement in 2007:

- The leading role of Sofia in the national socio-economic complex has been further strengthened. About 1/3 of the national GDP is generated in the capital, nearly 1/2 of the direct foreign investments in the country are concentrated on its area. .
- There is a steady drop of the unemployment rate in Sofia and by mid-2008 it has reached 1.8 per cent, which is below the healthy thresholds from the point of view of the economy, as well as with respect to increase of migration towards the capital from the other parts of the country.
- The tertiary sector continues to play a leading role in the Sofia socio-economic complex. A large portion of the direct foreign investments is in the financial sector, commerce and real estate transactions.
- The role construction plays in the economic structure of the city is on the rise. The large-scale foreign investments in the construction of trade and business centres, housing estates etc. led to unseen before upsurge in activity in the construction sectors and the accompanying activities – production of and trade in building materials, furniture, door and window frames etc., as well as development of specific services – design, legal services and brokerage
- The increased construction- and investment-busy development led to drastic increase in the prices of building plots – more than tenfold in the period 2003-2008. Shortage of such plots suitable for new construction, especially of large compact real estate plots under regulation provided with infrastructure *in situ* began to take shape.
- Bulgaria’s accession to the European Union placed additional ecological requirements before the industrial enterprises from the point of view of permissible pollution levels.
- The development of trade and services predetermines the need of considerable warehousing and logistics areas in the outskirts of the city, close to the main highways and entrance-exit arteries.

Territorial and quantitative indicators

In the period from the 1950's till the end of the 1980's a large number of spatial concentrations of industrial-warehousing infrastructure and service activities were developed and established:

- 26 industrial zones, located around the railway areals and the entrance-exit highways. Despite the changes that had ascended in the product range structure and the stagnation of production they continue their existence in terms of building stock and infrastructure *in situ*;
- Transport-communication zones: airport complex, six larger railway station complexes, eight bus terminals;
- Zones of concentration of service activities in the field of higher education (*Studentski grad*), R&D activities (BAS complex – 4th kilometer), medical services (Medical Academy complex), zone of concentration and finance and credit, business and government structures (city-centre of the capital), etc.

The quantitative parameters of the operating industrial zones in the Sofia territorial-industrial complex are as follows:

- total number of the existing zones: 26
- total area: 2 711 ha
- total build-up area: 6 186 000 m².
- total number of jobs (employed persons) (1999): 78.4 thousand
- maximum capacity of jobs: 150 thousand people
- reconstruction opportunities: 20-40 per cent of the territorial capacity of the individual zones

The analyses of the industrial concentrations in the zone of active impact reveal the existence of certain reserves for development, as follows:

- Kostinbrod – 7 500 dca
- Elin Pelin – 3 233 dca
- Gorna Malina – 1 280 dca

Major conclusions

The 2003 Master Plan made the following conclusions about the state of the industrial-warehousing zones of Sofia:

- The share of industrial territories in the compact city is considerable (nearly 20 per cent as compared to 10-12 per cent in the developed European capitals); a relatively large part of them is situated in immediate vicinity to the centre of the city. .
- The utilization of the area of the industrial zones is inefficient. In the predominant part of the zones the industrial facilities operate at capacity loading in the range of 40-60 percent and significantly reduced number of employees.
- A small part of the zones possesses a reserve for development of new plots. .
- The predominant part of the zones needs large-scale rehabilitation and reconstruction. The infrastructure *in situ* is depreciated, although there is still a reserve of main supply infrastructure networks and services (energy, water, roads etc.).
- Not all zones possess conditions for rapid realization of any investment initiatives on the part of either the “owner” or the “user”, related to utilization of the designated plots, building stock and infrastructure at the specified regime of use and build-up.
- As different from the other modern capitals, in which the existence of development zones influences the opening of new industries and contributes in a decisive manner to the modernization of the industrial structure and creation of new jobs, the city of Sofia does not possess existing plots of the necessary quality and infrastructure facilities for boosting of the business initiative and enhancing the dynamics of production and employment.
- The chaotic “mushrooming” of the city with small and micro enterprises

as a result of the increased number of private companies, the absence of clear rules and control, etc. lead to spatial planning problems.

- A large number of the human settlements in the Zone of Active Impact might take up from the capital different production-related functions. The crisis in the economic development of these settlements has in a way formed a “new potential” of plots, building stock and capacities for services and production activities.
- There exist significant land reserves for development of small and medium-size production facilities on the area of the former co-operative farm yards in the settlements of the surrounding area.

All these conclusions continue to be to a high extend valid nowadays as well. The analysis of the processes and trends in the period between the elaboration of the 2003 Master Plan and the present lead to the following additional conclusions:

- Despite the reduction of the share of industrial areas in the structure of the city, they continue to occupy a significant portion of the territory. A great portion of them represent large compact plots, situated near the central parts of the city, well serviced by transport (including public transport) and engineering infrastructure. Such are for instance the areas of the industrial zones *Sredets*, *Vitosha*, *Orion-Zaharna Fabrika*, part of the *Zadgarov* Sub-district, etc.
- Similar situation exists with respect to certain special-use plots for defense and security ((for instance the military plots at the 4th kilometer), for some railway stations (for instance *Pioneer*, *Service*, etc.), as well as other special-use plots, the need of which is no more topical.
- The significant “leap” in land prices and the exhaustion of the suitable plots for new construction made economically feasible the “recycling” of these territories and development on them of big trade and business centres and housing estates for the purposes of converting them into real secondary and tertiary urban centres.
- The processes of restructuring of such territories already underway need to be promoted, including through expansion of their spatial planning parameters. The low build-up norms proposed in the 2003 Master Plan for certain parts of the city in need of reconstruction undermine their attractiveness for investors and may act as barriers to their renewal. The city has no need of shabby and ineffectively used areas in its core.
- Restructuring and more intensive use of these zones, amply supplied with infrastructure, is in full harmony with the European principles of sustainable urban development, since it would attract investments which would otherwise get oriented towards development of new territories not provided with infrastructure (“green areas”) and in that way would reduce the general economic and environmental “price” of the city. Their key location along main urban radial or ring arteries will convert them into the backbone of a new and more efficient polycentric urban structure.
- The existence of the *Kremikovtsi* Combined Metallurgical Works in its present state is becoming ever more problematic from both economical and environmental point of view. The required investments for meeting the strict European ecological norms are enormous. The economic effect from continuation with the metallurgical production is inconsistent in view of the huge debts, which the combined works continue to accumulate all the time. The frequent change of owners and the absence of a long-term strategic investor are indicative for the problems, which the combined works are faced with. The environmental “price” paid by the for its continuing operation is enormous.
- At the same time the area of Kremikovtsi represents a huge reserve for the development of the city. The availability of a compact plot of 10 000

dca in immediate vicinity of a big capital, perfectly serviced by road and railway infrastructure and provided with a powerful engineering infrastructure is unique for the territory of Bulgaria (and probably for the Balkan Peninsula).

4.3.3. Objectives and tasks

The development objectives of the System “Work” are set in the context of “*Building a balanced, good-quality and sustainable work environment*”.

- To create conditions for building a competitive *economic structure at regional and continental level*.
- To create conditions for building and establishment of the city as a *regional information-and-telecommunication junction*.
- To create conditions for further development of the functions of the city as a capital of the state and advance of iits supra-national functions until its transformation into a *regional institutional and business centre*.

These major objectives, laid down in the 2003 Master Plan, have been retained also in this Amendment of the Master Plan.

The concrete tasks for achieving these objectives comprise the following:

- Development of Euro-strategic productions through restructuring and selection of the existing material-and-technical environment for industry, the transport and technical infrastructure, commerce and services.
- Curtailing of the development of labour-intensive industries, causing pollution of the natural environment and uninherent for the characteristics of the capital city.
- Raising of the technology level and development of high-tech industries through creation of a new material-and technical environment, based on the symbiosis between the universities and R&D centres, and containing techno-parks, branches of multi-national complexes, chambers of trade and industry, business centres, business-incubators, market places, companies for consultancy and marketing services, etc.
- Construction and development of a universal transmission information environment. Connection to the global digital network for transmission of information. Application of the information-and-communication technologies in the industrial and services sectors. Development of manufacture of components for the information-and communication technologies.
- Development of new warehousing-and-logistics and industrial zones.
- Territorial location of the system elements in compliance with the primary spatial planning objectives of the macro-spatial restructuring and development of the city.

4.3.4. Concept for development of System “Work” – Secondary sector

Territorial organization structure

There are 26 industrial zones and a large number of dispersed sites and facilities on the area of the city of Sofia. The 2003 Master Plan introduced a new territorial organization of the industrial areas depending on their area and production characteristics.

- Industrial districts
- Industrial sub-districts

- Dispersedly located industrial groups and clusters
- Separate industrial enterprises

With this Amendment to the Master Plan the industrial territories are distinguished in three major groups depending on the model of future development and spatial planning (Please refer to Scheme “Concept for development of the industrial zones):

- Production zones for restructuring and functional re-designation. These are industrial zones situated near the central city parts, where development of industrial production is not suitable. Restructuring of and functional re-designation of these zones to mixed multi-functional zones is envisaged – for development of trade, business, residence, green system etc. It comprises the industrial zones *Sredets, Vitosha, Orion, Zaharna Fabrika, Iztok*, part of the *Zadgarov* Sub-district etc.
- Industrial zones for reconstruction and modernization. These are areas, which continue to operate mainly as industrial zones. Retention of their spatial planning status is envisaged. Renewal of the building stock, engineering and social structure is necessary. Under this group fall large sections of the Northern Industrial District and the Southeastern Industrial District, as well as individual industrial groups and clusters – Kazichene, Gorublyane, Obelya etc.
- New industrial and logistics zones. These are new zones in the periphery of the compact city, situated along the outer city ring and the main entrance-exit highways. Development above all of warehousing-logistic and servicing activities is envisaged.

Industrial structures in the compact city:

In the compact city are isolated three industrial districts, several sub-districts and individual territorial groups of enterprises. There are two clearly distinguished districts: Northern district and Southeastern district. The third industrial district is a system of industrial sub-districts and housing clusters – Western Industria-Residential District.

Northern Industrial District:

This district is formed of the following industrial sub-districts: **Zadgarov Subdistrict, Iliyantsi-Zapad, Iliyantsi – Iztok, Voenna Rampa – Iztok, Voenna Rampa – Zapad, Hadji Dimitar – Malashevtsi and Sgurootvala.**

Part of the area of the district is occupied by housing stock, which is inadequate from environmental and architectural point of view and is subject to upgrading through public works (20-25 per cent of the area).

The Master Plan Amendment envisages restructuring and re-designation from **Пс** (Mixed industrial zone) to **Смф** (Mixed multi-functional zone) of the territories located in immediate vicinity to the Central city part (parts of the **Zadgarov Sub-district** and **Hadji Dimitar – Malashevtsi**).

The Zone for High-tech Industries in **Iliyantsi-Iztok** is retained and a new Zone for High-tech Industries **Iliyantsi-Zapad** is envisagd. .

The rest of the territory is envisaged for reconstruction and upgrading and retains its predominant spatial planning status - **Пс** (Mixed industrial zone).

Southeastern Industrial District

It comprises the sub-districts **Hristo Botev-Slatina, Iskar-Sever, Iskar-**

Yug, Iztok and Gorublyane.

According to the Amendment to the 2003 Master Plan the territory of Iztok Sub-district is re-designated for **Смф** (Mixed multi-functional zone). Its location along a main urban artery (*Tsarigradsko Shosse Blvd.*) among large housing estates makes this sub-district suitable for development of business and service activities, as well as for industries and services related to the information and communication technologies.

The remaining part of the district (sub-districts **Hristo Botev-Slatina, Iskar-Sever, Iskar-Yug** and **Gorublyane**) is envisaged for reconstruction and renewal, whereat they retain their predominant spatial planning status.

Western industrial-residential district

This district consists of territories with predominantly residential structures and dispersed industrial sub-districts – **Zaharna Fabrika, Orion-Vrabnitsa** and **Obelya**.

The Amendment to the 2003 Master Plan envisages localization of high-tech industries and services in sub-districts *Zaharna Fabrika* and *Orion-Vrabnitsa*, which are re-designated to mixed multi-functional zones (**Смф**).

Obelya Sub-district retains its predominant spatial planning status and functional specialization as transport yards, light industry and services.

Beside the three established industrial districts, on the area of the compact city are situated several **dispersed industrial sub-districts** as well: **Sredets, Vitosha, Izgrev, Yugozapad** and **Boyana**.

The location of these industrial territories in the core of the compact city, with their well-developed infrastructure and closeness to main urban arteries, makes them suitable for development of trade and business, public services and residence. The overwhelming majority of the industrial enterprises in these zones have been closed since a long time, whereat in many cases their most valuable asset is the land, on which they are situated.

The re-designation of these territories for mixed multi-functional zones in the Amendment to the Master Plan will promote their restructuring and more efficient use with the aim to convert them into real multi-functional urban centres.

Industrial structures in the surrounding area

Four main structures are reviewed:

- The territories along the northern arch of the Ring Road – the Northern Arch
- The southeastern and northwestern complexes for high-tech, transport-and-warehousing and service functions
- The *Kremikovtsi* Combined Metallurgical Works
- Former co-operative farm yards

The Northern Arch

Several types of industrial groups are situated along the Ring Road, in the zones of intersection with the main radial directions towards the city:

- small and medium-size manufacturing and service enterprises;
- warehouses for wholesale trade and market places for

- agricultural produce;
- transport yards;
- construction yards;
- enterprises, connected with human settlements in the vicinity of the Ring Road.

These sites are dispersedly located and divided by green wedges going down deom the mountain towards the compact city. The market places are situated close to the two belts for agricultural production – the southeastern belt and the northwestern one. The construction and transport yards are situated on the main communication junctions linking the central core to the national and international transport corridors.

The manufacturing and service enterprises, as well as those connected with the settlements along the Ring Road, are integrated with units of the public services and guarantee the vitality of these territories.

Southeastern and northwestern high-tech and transport-and-warehousing complexes

The following will be developed on the territories of the southeastern high-tech and transport-and warehousing complex:

- Industrial enterprises for high-tech products;
- Centre for high-tech information products in the fields of tele-communication, electronics, instrument enegineering and machine-tools engineering;.
- Greenhouse plant-growing on the basis of geo-thermal waters;
- Experimental fields for intensive vegetable-growing and grain crops;
- Intermodal transport terminals;
- Cargo yards;
- Warehousing yards;
- Production facilities of small and medium-size enterprises; Sites of public services and services

The following is envisaged for development on the territories of the northwestern high-tech and transport-and warehousing complex

- Industrial enterprises for pilot technologies – in the short-term horizon (food-and-beverages industry, bio-technologies, soil science);
- Industrial enterprises for pilot technologies – in the long-term horizon (food-and-beverages industry, bio-technologies, soil science, pharmaceutical industry);
- Experimental fields for intensive vegetable-growing and grain crops;.
- Intermodal transport terminals;
- Cargo yards;
- Warehousing yards;
- Production facilities of small and medium-size enterprises;
- Sites of public services and services.

Kremikovtsi Combined Metallurgical Works

The existence of the *Kremikovtsi* Combined Metallurgical Works in its present form is unthinkable in the capital in a long-term horizon. Irrespective of whether the metallurgical production will continue in the future or not, large-scale investments will be needed for environmental protection measures, clearing of considerable areas, rehabilitation of the soils around the combined works from past pollution etc.

Part of the cleared territory might be occupied by communal services sites (plants and installations for solid waste treatment etc.), construction yards,

warehouses, etc.

In a long-term perspective the territory of the *Kremikovtsi* Combined Metallurgical Works will be a huge reserve for the development of new zones for business, trade and residence and in practice might transform into a satellite-city of Sofia. For the purposes of promoting the processes of conversion and restructuring of the area, the Amendment to the Master Plan envisages the establishment of the territory of the *Kremikovtsi* Combined Metallurgical Works as a mixed multi-functional zone in a long-term perspective (**СмФД**).

Former co-operative farm yards

The areas of the former co-operative farm yeards are envisaged to be restructured and converted into zones of small and medium size manufacturing and services enterprises. In this way an opportunity is created for realization of business activities of the population and for ensuring the economic viability of the surrounding area.

4.3.5. Sectoral balance of the territory

Balance of the territory – System “Work” 2003 Master Plan

Types of territories	Sofia Municipality		City of Sofia Compact city		Surrounding area	
	ha	%	ha	%	ha	%
Industrial areas	5377.6	4.0%	2115.3	10.1%	3262.4	2.9%
Areas for public services	2830.0	2.1%	1533.4	7.3%	1296.6	1.1%
Mixed and multi-functional zones	3696.4	2.8%	2287.3	10.9%	1409.1	1.2%

BALANCE OF THE TERRITORY – SYSTEM “WORK” MASTER PLAN AMENDMENT

TYPES OF TERRITORIES	Sofia Municipality		City of Sofia Compact city		Surrounding area	
	ха	%	ха	%	ха	%
Industrial areas	4701.6	3.5%	1609.0	7.7%	3092.6	2.7%
Areas for public services	2640.6	2.0%	1503.4	7.2%	1137.2	1.0%
Mixed and multi-functional zones	5073.8	3.8%	3050.2	14.6%	2023.6	1.8%

The comparative analysis between the balance of the territory in the 2003 Master Plan and that in the Amendment to the Master Plan reveals that the percentage of the zones with industrial designation is reduced from 4.0% to 3.5% on the territory of the municipality as a whole. This reduction is particularly sensitive in the compact city, where their area is diminished from 10.1% per cent to 7.7 per cent, which is a normal value for a big capital city and is comparable to the situation in other big European cities. In the surrounding area the reduction of the industrial territories in negligible – from 2.9 per cent to 2.7 per cent.

4.4. SPATIAL PLANNING STRUCTURE, SYSTEM OF CENTRES AND TERRITORIAL ORGANIZATION OF THE TERTIARY SECTOR

4.4.1. Spatial planning structure

Principles of macro-spatial structuring

The macro-spatial structuring of the territory should ensure optimal conditions for implementation of the strategic objectives of the city. Every macro-spatial unit should at the same time ensure the following:

- *Balanced and sustainable development* of all the urban systems and components of the living environment within the boundaries of the territory. It is a guarantee for the relative autonomy of the macro-spatial

- unit as an aggregate spatial organism.
- *Priority development of specific functions and activities of urban and supra-urban significance, contributing to the sustainability and competitiveness of the city as a whole.* In this way every macro-spatial unit is integrated in the urban space, so that the city may represent an aggregate organism.

Boundaries of the proposed macro-spatial units

The macro-spatial structural division, proposed in the 2003 Master Plan, is retained, and thus the territory of the municipality comprises 6 macro-spatial units:

- **Central**, comprising the area of the Central City Area, enclosed between the *Evlogui Georgiev Blvd.*, the main railway areal, *Skopije St.*, *Konstantin Velichkov Blvd.*, *Dimitar Nestorov St.* and *Bulgaria Blvd.*
- **Northwestern**, with *Slivnitsa Blvd.* as a structuring axis. It comprises the districts *Ilinden*, *Lyulin*, *Vrabnitsa* and *Bankya*.
- **Northern**, with *Rozhen Blvd.* as a structuring axis. It comprises the *Serdika District* less the part in the Central City Area, as well as the districts *Nadezhda* and *Novi Iskar*.
- **Northeastern**, with *Botevgradsko Shosse Blvd.* As a structuring axis. It comprises *Poduene District*, the portion of *Slatina District* to the north of the railway track, as well as *Kremikovtsi District*.
- **Southeastern**, with *Tsarigradsko Shose Blvd.* As a structuring axis. It comprises parts of the districts *Oborishte* and *Sredets* outside the Central City Area, the portion of *Slatina District* to the south of the railway track, the districts *Izgrev*, *Studentska*, *Mladost*, *Iskar* and *Pancherevo*, as well as part of *Vitosha District* between *Simeonovo Quarter* and the village of *Pancherevo*.
- **Southwestern**, with *Tsar Boris III Blvd.* As a structuring axis. I comprises the districts *Krasno Selo* and *Triaditsa* less their parts in the Central City Area, a small part of *Vazrazhdane District* beyond the boundaries of the Central City Area, and the districts *Lozenets*, *Krasna Polyana*, *Ovcha Kupel* and *Vitosha*.

The proposed macro-spatial structuring takes maximum account of the existing administrative division of Sofia Municipality in compliance with the above listed principles. Using the data from the last population census (2001) the following data have been calculated for the population of the macro-spatial units:

Macro-spatial units	Area (ha)	Population
1. Central	1 136.57	125 252
2. Northwestern, incl.	12 664.32	207 560
In the construction boundaries	2 335.38	193 702
In the surrounding area	10 328.94	13 858
3. Northern, incl.	25 441.93	112 239
In the construction boundaries	2 232.79	85 464
In the surrounding area	23 209.14	26 775
4. Northeastern, incl..	28 066.53	105 265
In the construction boundaries	1 897.95	84 673
In the surrounding area	26 168.58	20 592
5. Southeastern, incl.	47 436.37	331 973
In the construction boundaries	6 064.63	306 202
In the surrounding area	41 371.74	25 771
6. Southwestern, incl.	19 438.86	287 254
In the construction boundaries	7 302.77	281 875
In the surrounding area	12 136.09	5 379
TOTAL	134 475	1 174 431

Substance and role of the macro-spatial structuring

The city is viewed as a functioning system of six macro-spatial structural units – a central one and five situated along the main radial directions. Balanced development of the major urban functions – residence, work, recreation and services – is sought in each macro-spatial unit through optimum management of the human, material and natural resources. The objective is not to close the cycle within the macro-spatial unit, but rather to strike a balance as a condition for the sustainability of the environment. At the same time every macro-spatial unit features its own specifics and priority directions for development at the urban and supra-urban level. The incorporation in the macro-spatial units of certain parts of the compact city and the surrounding area allows integrated development and management of the entire territory of the municipality. The priority functions and high level complex services are concentrated (both spatially and functionally) along the structural axis – a main urban artery – and penetrate diffusely in depth the area of the respective macro-spatial unit. The boundaries between the individual macro-structures are rather conventional and ensure mutual exchange of resources and smooth move of activities and human flows.

The proposed macro-spatial units are optimal territorial structures, which are able to develop relatively independently as spatial organisms with their structural axes, sufficiently big population for organization of high-level services and 2nd level urban centres, as well as their own specific hinterland in the surrounding area. For that reason the macro-spatial units are optimal territorial structures for management of the urban planning processes and the spatial development of the city. They represent the intermediate planning level (territorial and possibly administrative), on the basis of which the application of the Master Plan can be ensured – implementation programmes, monitoring, analysis and management of the urban development.

4.4.2. The system of centres

The Amendment to the Master Plan accepts fully the major principles for construction of a system of service centres in Sofia Municipality as laid down in the 2003 Master Plan. The proposed system of centres for the city and the municipality serves the realization of transition from a strictly monocentric system to a developed *hierarchical system of centres*. Although the settlements in the Sofia metropolis are smaller and despite the still active strongly dominant position of the city of Sofia, the principle of polycentric development is anyway applied under measures for “concentrated de-concentration”. In this way an opportunity is created to alleviate considerably the central parts of Sofia and to improve the urbanistic balance within the scope of Sofia Municipality as well as in the Zone of Active Impact of Sofia. The opening of the system of centres towards the periphery of the city permits better and more equitable provision of services to the population. The aim is to raise the living standard in the settlements of the surrounding area and enhancement of their attractiveness parallel with the creation of conditions for optimum use of the available social infrastructure on their area. At the same time it provides an opportunity to reduce considerably the daily traffic with all the resultant positive economic and environmental consequences. In order to achieve this objective it is necessary to orient investments primarily to development of the public engineering and social infrastructure and mass public transport, as well as improvement of the practice of public-private partnerships initiated by the municipality. The new 2nd-level centres thus become the contact zones for linkage and exchange of resources between the compact city and the adjacent territory.

Two types of public service centres, forming a united system are proposed: *complex services centres* and *specialized services centres and environments*.

Complex services centres

The complex services centres possess to a higher or lesser extent a full range of service functions. The system of complex services centres features a hierarchic structure of co-subordination and mutual complementarity among the individual levels – main/central city centre, 2nd- and 3rd-level services centres. The principal structuring element of the system is the transport network of the city. The five main radial arteries are axes of saturation with high-level services and public facilities, along which opening up and smooth transfer of functions and activities is effected from the main city centre towards the 2nd-level service centres at the periphery. The remaining large radial, ring and tangential routes are the backbone of the network of the 3rd-level service centres spread over the entire territory of the city.

Main city centre – 1st level

This is the historical core of the city, housing the most representative and prestigious sites at the national level. Its scope is incorporated in that of the central city part as defined by the Law on Regulation and Build-up of Sofia Municipality. Despite the ongoing processes of deconcentration and evacuation of some activities from the main city centre, it retains its leading role and significance for the development of the city and the region.

Prerequisites for establishment: it is a thousand-years-long centre of social and economic activities, predestined from its strategic crossroads location, the availability of favorable natural and climatic conditions, mineral springs etc.

Functional contents: representative administrative and management structures, political, cultural, financial, commercial and entertainment functions of national, regional and city-level significance.

Degree of linkage with the remaining centres in the hierarchy: it plays a leading role in the hierarchy of centres; its adequate functioning depends on the degree of development of the system. .

Development priorities:

- Alleviation from activities non-inherent to the main city centre
- Processes of reconstruction, regeneration and renewal
- Development oriented in western direction – business, financial and commercial services, office areas
- Accute need of measures for resolution of the problem with parking spaces and garages
- Optimum development of the underground spaces
- Preservation and exhibition of the unique architectural heritage above and below the surface

In spatial planning aspect it is realized through development of zones of the type Central (L) and public services zones (Oo).

Complex service centres – 2nd level

According to the provisions of the 2003 Master Plan they are localized along the main radial transport directions of high urban activity level – Northwestern (*Slivnitsa Blvd.*), Northern (*Rozen Blvd.*), Northeastern (*Botevgradsko Shosse Blvd.*), Southeastern (*Tsarigradsko Shosse Blvd.*) and Southwestern (*Tsar Boris III Blvd.*) in their zones of intersection with the Ring Road transport loop. They are established as new contact zones of exchange of activities and human flows between the compact city and the surrounding areas. An active urbanized environment of a new type should be created – featuring optimized infrastructure and a balance of public services, business, commerce and high-tech jobs. From the point of view of significance for the city and time period of construction, the Southeastern

and the Northwestern 2nd-level centres will be the most powerful, with the highest structuring role and fastest development rates, flowing in territorial and functional aspects across the administrative boundary of Sofia Municipality into the neighboring Bozhurishte Municipality.

Prerequisites for establishment: exhausted potential of the compact city and need of a new territory, equipped with better infrastructure (particularly transport infrastructure) and lower price of land with opportunities for taking up inappropriate for the Main City Centre activities and development of new activities, active exchange with the compact city and the adjacent areas, trend-based processes of growth of the main city arteries with service and commercial sites, socio-economic prerequisites (restructuring of the economy, higher mobility of the population, increased leisure time, anticipated future increase of the purchasing power of the population, etc.). With the Amendment to the Master Plan the rank of the complex centre formed along the *Tsar Boris III Blvd.* is lowered because of the lack of territorial resources for its development.

Functional content: structuring sites of trade and services (large-scale retail and business centres, wholesale complexes, market places, etc.), existing and new nuclei of transport infrastructure (providing services to the transit transport flows and buffer terminal zones); they feature no explicitly emphasized administrative and management functions, they are not characterized by functional complexity like the 3rd-level service centres and do not carry the social charge of the latter in the initial stage of their development. The experience of other countries shows that in the course of time they gradually attract the full range of public services.

Degree of linkage with the other centres in the hierarchy: they take up the periodical and ad-hoc supply of the inhabitants' demand of goods and services by alleviating the Main City Centre from non-inherent activities; they feature a convenient transport connection with the 3rd-level centres and direct link to the town and village centres in the periphery.

Development priorities:

- Infrastructure provision and creation of quick and convenient transport links to the Trans-European corridors
- Creation of a new type of urban environment, featuring concentration of business, trade and high-tech jobs in an environment of ample greenery
- Development in the direction of universality, flexibility, modular nature of the planning solution.

In a spatial planning aspect it is realized through development of mainly zones of the mixed multi-functional type (**Смф2, Смф1**) and public services zones (**Oo**).

With the Amendment to the Master Plan phased closure of the polluting and emitting harmful emissions production activities in the *Kremikovtsi Combined Metallurgical Works* is envisaged. On its place a *Kremikovtsi complex regional-level centre* will be established, with its own specifics. Structure-defining in it will become trade and business, supplemented by a technology and science park, sports and recreation and cultural activities, etc. This planning zone is designated to be a mixed multi-functional zone in the long-term perspective. By virtue of this planning instrument an opportunity is provided for economically more effective and full reconstruction.

Complex service centres – 3rd level

They are formed as a consequence of point and linear concentrations of

public services of a variable intensity around the major transport routes and nodes on the basis of sufficiently big contingent of serviced population in the adjacent territories. . The main characteristic feature of the 3rd level centres is the complexity of the services, irrespective of their market or public nature. In the previous plans some of them were designated as 2nd-level centres.

Prerequisites for establishment: on the basis of existing and spontaneously emerged concentrations of public service activities along the main transport arteries, well-established nodes, trade and sports nuclei, etc.

Functional content: they are established at a maximum degree of complexity, comprise all functions of public services provision; they are characterized not so much by their representative nature as by the complex nature of their functional coverage..

Degree of linkage to the rest of the centres: they operate in network through optimized and well-developed urban transport along the radial and concentric city arteries; in terms of the hierarchy they are subordinated to the Main City Centre and the 2nd-level services centres. Two conventional sub-types have been defined: *structure-defining* and *supplementary*. The structure-defining ones feature relatively larger area, on a large portion of which are localized offices and activities, which do not serve directly the population of the adjacent territories. In the second type the share of direct services for the population and social services is greater.

Priority development directions:

- Operation in network, flexibility, alternative approaches, interrelation and exchange of resources at mutual complementarity
- Structure-defining nature with respect to the establishment of the social infrastructure at a lower level
- Guaranteeing of urban viability and sustainability

With the Amendment to the 2003 Master Plan the localization of these centres is specified more precisely. The factors, which led to the need of change are linked to the ever stronger manifested processes of conversion and restructuring in the direction above all of the service activities of the tertiary sector in the former industrial zones in the compact city, especially those featuring more central location. The clearing of the large area occupied by the Ministry of Defense on the *Tsarigradsko Shosse Blvd.* from its “special-use regime” provided grounds to envisage its conversion into a structure-defining city centre, capable of taking up some of the representative governmental institutions and supplemented by a wide range of other service functions. As a structure-defining have been envisaged also the centre starting to develop in northern direction from the Central Railway Station, that of the territory of the former industrial zones *Zaharna Fabrika-Orion* and *Sredets*, as well as *Hladilnika-Cherni Vrah Blvd.-Kableshkov*. In a spatial planning aspect this is realized by defining a new regime of mixed multi-functional zones in place of the former industrial zones as per the previous plans. The introduction of higher spatial planning parameters provides an opportunity to make restructuring more profitable for investors and hence to ensure acceleration of that process.

Because of the importance of applying the regional approach and the principles of polycentric development of the entire Sofia Metropolis the smaller settlements at the periphery are grouped to form **local centres**. In this way public investments in social infrastructure may be optimized and achieve better impact from them with minimizing of commuter trips. In the Amendment to the 2003 Master Plan these are duly revised.

General peculiarities of the system of complex service centres

THE PRINCIPLES, taken into account in the course of justification of the feasibility of establishing the functional and territorial model of the system of centres in the 2003 Master Plan of Sofia have been retained in its amendment as well:

- **Hierarchic ranking** of the service centres, affecting the functional and territorial characteristics of the system. In functional aspect there is a certain peculiarity and limitation of the range of activities in a downward hierarchic order (from the main city centre towards the 2nd- and 3rd-level service centres) while preserving the complex nature (coverage of all the tertiary sector sub-sectors: health care, education, culture and spiritual life, communal services, trade and public catering, elements of administration and security, sports and recreation, integrated in the green system of the city). As far as the quantitative and qualitative indicators are concerned, they are not equivocal for the different types of centres. For instance, in the main city centre are concentrated representative and prestigious sites in the field of governance, culture, science and education, open public urban spaces of national significance etc., which is not characteristic for the 2nd- and 3rd-level centres. On the other hand, in certain directions, such as trade, sports and entertainment etc., the 2nd-level centres have higher quantitative parameter and a larger-scale of the individual sites.
- **Openness of the system:** prerequisites are created for promotion and development of the potential of the service centres and their capacity to take up a new service function in terms of quality and permanent optimization and enrichment of the range of activities in the direction from the higher hierarchic level to the lower-level ones. .
- **Differentiation of the level of availability** of the socially guaranteed service activities and functions – in the direction towards the lower hierarchic levels the number of mandatory social elements in their structure increases and there is a higher reconciliation of market- and socially-oriented activities. The 3rd-level complex centres are structure-defining for the social infrastructure set in place at the lower hierarchic levels.

Specialized centres and environments

THE SPECIALIZED CENTRES are an addition to, extension of and supra-structure on the 2nd and 3rd-level complex service centres and feature general urban, regional and national significance. They are the material expression of the priority directions of development of the city – *science and education, health care and balneology, culture, sports and entertainment, trade and business*. The designation and attractiveness of these centres is predetermined by one principal dominant function, accompanied by auxiliary functions, which guarantee the sustainability of the system..

The establishment of specialized centres is determined by a leading function at city and supra-city level. The sites of the lower tier do not have sufficient functional and planning significance to form centres. Usually they represent part of the complex of specialized centres or are independent elements of the social infrastructure.

The experience of other countries shows that the economic levers for establishment of the specialized centres are most frequently based on mixed financing by private and public capital. Quite often the municipalities participate in the investment process with plots which are municipal property. Wherever the excess of the corporate interests would distort the social character of the services, there is predominance of public funds and active municipal involvement. The criteria for spatial efficiency of the

specialized centres are as follows:

- provision of plots
- accessibility by public and private transport
- linkage to the green system of the city
- due account of the natural and cultural-historical circumstances.

Representative institutional sites of the legislative, executive and judicial authorities

In the main city centre are situated the complexes of the National Assembly (the Parliament), the Council of Ministers, the Office of the President of the Republic, Ministries, the Supreme Court, the Chief Prosecutor's Office etc., which form a top level specialized centre. With the Amendment to the Master Plan shifting of certain ministries to the *Tsarigradsko Shosse* Blvd. is envisaged, thus forming a new specialized centre of that kind.

Health care and social activities

- **Health care.** The health care centres are formed on the basis of the existing traditions in the field of health care, the availability of material facilities and high-skilled medical personnel. That is a priority/strategic direction with high development potential. The ongoing trend of populating ageing in Europe and in other developed countries will predetermine the ever-greater increase of the expenditures for medical services and represents an opportunity for the country, and in particular for Sofia, to take advantage of that development. The financing of the health care centres is provided by means of mixed involvement of budgetary means and private capital at predominance of the public sector.

The national-level centres are financed mainly from the state budget, while those at the city and regional level – mainly from the municipal budgets. Enhancement of the participation of the private sector in the financing and development of the health care centres and services is needed. All in all, the health care centres provide hospital treatment, preventive health care, educational and research activities, whereby rehabilitation and cure activities, medical training, information activities, trade and services may be developed as supplementary activities.

The complex of the Academy of Medicine is the biggest centre of that kind in Bulgaria. Its realization is the result of a well-justified concept and territorial model, which at the beginning had seemed to be too big in view of the then size of the city of Sofia. In the course of the time its original functional layout scheme has been developed further and enriched. In the scope of this specialized medical centre are enclosed the University of Medicine Sofia, the Military Medical Academy, several specialized and multi-profile hospitals and several health care centres (National Centre for Hygiene, Medical Ecology and Nutrition, National Centre for Health Information, National Centre for Public Health). The specialized health care centre is based on a general layout scheme. The management of the majority of the health care facilities is performed by the Ministry of Health Care. The total capacity of the health care facilities in this centre is 1 758 *hospital beds*. In the zoning plan the determined spatial planning regime is Oo – for public services.

In the vicinity of the central Railway Station is formed another medical care centre of a more dispersed type. Located there are the Transport Hospital (Transport Institute of Medicine), Second Multi-profile Hospital for Active Treatment, Fifth Multi-profile Hospital for Active Treatment, Institute of Epidemiology and Hygiene, diagnostics-and-consultancy centres.

A specialized health care centre exists also on the area of Gorna Banya. It comprises a Specialized Hospital for Active Treatment in Orthopedics SP plc, a Specialized Hospital for Active Treatment for further treatment, prolonged treatment and rehabilitation of the locomotory system SP plc and a City Multi-profile Hospital for Children.

After the year 2000 the territories in the eastern and southern parts of the city of Sofia turned out to be particularly attractive for the investment capital. This applies to the peripheral zones of the Hunters' Park (*Tokuda Hospital Sofia* Multi-profile Hospital for Active Treatment plc, St. Lazar Specialized Obstetrics Hospital for Active Treatment and Vitosha Specialized Hospital for Active Treatment in Traumatology plc). The location of the above mentioned three private hospitals, which are very close to one another, forms a new specialized medical centre in that part of the capital.

- **Centres for balneological and climatological treatment.** They are established on the basis of the available natural and climatological characteristics (geothermal waters, favourable climate), the availability of skilled personnel and the material stock *in situ*. They are envisaged for implementation on the basis of mixed financing by public and private capital. Besides the leading functions of balneological/climatological cure they develop also sports and recreation, tourism, services and other auxiliary services. They are reviewed in detail In the specialized material with the Master Plan concerning the utilization of mineral waters. Priority in terms of development are the centres in Bankya, Pancherevo, Gorna Banya, Ovcha Kupel, near Lokorsko, Lozen etc.
- **Social care activities.** The prerequisite for their establishment is the increased number of people in inequitable social situation (low-income families, handicapped persons, retired persons, single mothers, etc.). The development of the social protection centres and improvement of the access to public spaces of the permanently handicapped is a necessary condition for enhancement of the quality of the urban environment. The social care establishments do not form their own centres, but rather represent independent sites or complementary elements of the health care and balneologic/climatic treatment facilities.
- **Education and science**
- **Higher educational institutions and research centres.** They are established on the basis of the existing traditions, personnel and material stock in the field of higher education and science. This is a priority strategic direction with extremely high potential for the development of Sofia. The information society predetermines the increasing role of education and science for the development and prosperity of a city or a nation. The state should continue to take part in the financing of education and science, however with increasing role of self-financing – the autonomy of universities and paid education, financing of research in the framework of European programmes, by the private sector, etc. Alignment of higher education with the European standards is necessary, as well as the introduction of higher flexibility in compliance with the trends of the labour market – introduction of innovative subject fields and modern educational curricula, student and teaching staff exchange programmes, attraction of branches of European and world universities etc.

The specialized centre for research and development (in the BAS complex – 4th km) has been established as one of the biggest centres for fundamental and applied R&D activities in the country in a broad range of scientific fields. A total of 38 *R&D institutes, research units* and *laboratories* with about 5 000 employees are situated there. The

centre is situated on a compact area of about ===== ha, with a joint infrastructure and common management – the Central Management Board of the Bulgarian Academy of Sciences (BAS).

A specialized centre for higher education is formed within the boundaries of *Studentski Grad* (University Campus). Its beginning was laid down in the period after 1970 under the principle of “*planned regulation*”. Added to the then three existing higher schools (the present day University of Chemical Technology and Metallurgy, the Mining and Geology University and the Forestry Engineering University) were three more universities, moved from the central city area (Technical University, National Sports Academy and University for National and World Economy). Parallel with that were constructed service facilities – student hostels, sports halls and stadiums. The capacity of the specialized centre under review is more than *45 000 students*. Unfortunately, the build-up of restituted plots with inappropriate for Studentski Grad sites in recent years resulted in deterioration of the properties of local environment. In the zoning plan the principle assigned regime is **Oo** – for public services. In the context of the need of de-concentration and application of the principle of polycentric development at the regional and the national level it is reckoned as recommendable to limit the increase of the number of higher educational establishments/students in Sofia and evacuation of some subject fields or universities towards other centres of education outside Sofia Municipality for the purposes of their strengthening.

- **Vocational high school education.** It is developed in the form of individual sites all over the area of the city, without the establishment of independent centres. Setting up of professional educational complexes and expansion of the network of sites for vocational education and retraining is envisaged. It is reviewed in the specialized part related to the tertiary sector of the economy and in the updated databse of ГИС of the Mster Plan. In the graphic part of the Master Plan these facilities are reflected with spatial planning regime **Oo** – for public services.
- **High-tech centres (techno-parks).** This is a qualitatively new type of environment, based on the symbiosis between R&D activities and high-tech manufacturing. They should be formed on the basis of the existing prerequisites for development of high-tech industries in Sofia and the region – information technologies and telecommunications, electronics, biotechnology, etc. The techno-parks will comprise facilities for R&D innovation activities, enterprises for experimental applied research and high-tech clean manufactures, administrative and information services, as well as high-category housing for the employees, sports and recreation in green environment, hotels, trade, public catering, services, etc. The financing of the high-tech parks will be provided by the private sector at substantial participation of the public sector with direct investments and/or tax preferences and subsidies. The Master Plan creates reconstruction-related prerequisites for establishment of such centres under special spatial planning regime – **Птп**. In terms of localization of such facilities several options are suggested – near the village of Lozen, to the east of *Ilientsi* Railway Station, at the *Pushkarov* Institute etc.

Culture, religion and cultural and historical heritage

- **Centres of culture.** Culture is one of the priority directions for development of the city. Among the development prerequisites should be mentioned the centuries-old cultural traditions, the availability of talented authors in the field of arts, the existence of valuable museum collections and artefacts, etc. The forms of financing of the centres of culture comprise self-financing (market-based principle of management of cultural sites), state subsidies and patronage. The role of the NGO

sector in management and financing of certain cultural activities will grow.

The zone with the highest concentration of cultural institutions is situated to the east of the Largo and comprises representative sites of the functional system “Culture” from both the Central City Area and the adjacent territory. These are the National Archeological Museum, the National Art Gallery, the Sofia City Art Gallery, the Gallery of Foreign Art, the Ethnographic Museum, the *Ivan Vazov* National Theatre, the National Opera House, The Army Theatre, the State Musical Theatre, the Theatre of Youth etc. theatres, the National Museum of Natural Science, the National Public Library and a number of other buildings of cultural institutions.

A more recent nucleus of complex cultural functions is the complex of the National Palace of Culture.

- **Religion and cultural and historical heritage.** They are developing on the basis of the centuries-old cultural and historical heritage, the traditions in religious and cultural tolerance of Bulgarians, the rich and unique folklore. Measures are proposed for preservation and reconstruction of the cultural and historical heritage, as well as a policy aimed at its promotion and more efficient use through development of cultural tourism, culture itineraries etc. Landmark buildings are the *Alexander Nevski* Memorial Cathedral with the Crypt and the *St. Sofia* Cathedral. The Main City Centre contains a large-scale religious centre, in which co-exist close to one another temples of the most important for the population of Bulgaria religions – Christianity, Islam and Judeism. The specialized environment of the Bulgarian *Sveta Gora* is saturated with “soft infrastructure”, aimed to provide accessibility, exhibition and incorporation in a suitable manner of the churches and monasteries that have preserved the Bulgarian religious and cultural traditions in the course of the centuries.

Sports, recreation and entertainment activities

- **Sports centres.** The prerequisites for their development comprise the traditions and high achievements in many sports, the availability of a relatively well-developed material stock, the trainer resources, specialized medical staff etc., as well as the favourable natural and geographic conditions for development of winter sports, the high consumer interest among the population. The sports centres provide conditions for development of both high sports achievements and of mass sports activities. Among the accompanying activities one should mention recreation and tourism, hospitality, entertainment and attraction activities, trade, public catering and services at proper integration with the green system.

The established in the natural environment of the *Borisova Gradina* city park large sports centre comprises two stadiums, tennis courts, sports halls etc. Another big centre of saturation with sports facilities is *Studenetski Grad* with the material stock of the National Sports Academy, the Winter Palace of Sports and *Hristo Botev* Sports Hall. The *Aleko* ski track is outside the coverage of the Master Plan, since it is situated within the boundaries of *Vitosha* National Park and is regulated by the Plan for Management of *Vitosha*, but from a functional point of view it services the capital.

The Plan envisages construction of new big sports centres in the undeveloped till now part of the Western Park, in the vicinity of *Lyulin* Housing Estate, in the zone of the Northern Park at *Obelya* Housing

Estate, within the boundaries of the *Iskar* Water Park, in the Eastern and Northeastern Park etc. The new facilities will be subject to the general concept for development of recreation. The Dobroslavtsi airfield and other plots, which were so far used for the specific needs of the defense sector, are envisaged to be developed for sports activities at the urban and supra-urban level. The golf grounds in Bankya, Katina etc. form specific centres.

- **Entertainment and attraction centres.** The main prerequisites for the development of these centres are related to the demand – increased purchasing power of the population, higher mobility and increasing amounts of leisure time. They are developed predominantly with private investment capital. Participation of the municipality by contribution of plots on the joint-venture principle of participation in their management is possible. The entertainment and attraction centres will be developed under conditions of integration with sports and recreation, the green system, trade, public catering and services.

- **Hydro-thermal recreation and rehabilitation centres.** With the Amendment of the 2003 Master Plan these centres are treated as an important element of the nre typology group. :

Resort activities, balneology, SPA

- **Hydro-thermal recreation and rehabilitation centres.** Their development is predetermined by the favourable natural and geographic conditions – geothermal waters and climatic conditions. These centres are developed with mixed participation of private and public capital. The leading functions of the centres will be rehabilitation, balneological preventive treatment, recreation and sports. Health care and balneo-treatment, hospitality and tourism, public catering and services at proper integration with the green system may be developed as accompanying activities. Development of hydro-thermal beaches and swimming pools in the surrounding area is also proposed. The establishment of this group as an independent one has been dictated by the need of special attention to and optimum use of the ample nature resource for both recreation of the inhabitants and as an important economic potential.

The traditional centres – Bankya, Gorna Banya, Ovcha Kupel and Pancherevo – lag behind in terms of development of their specific infrastructure from the point of view of the contemporary requirements. Among them Bankya and Pancherevo possess the best opportunities for new development in a territorial aspect and the Master Plan has identified concrete plots under adequate regime for that. Larger new centres in high-quality natural environment are proposed in the surrounding area – within the boundaries of the *Iskar* Water Park, near the villages of Lokorsko and Lozen. Other centres of a smaller scale are laid down near the village of Gnilyane, Kremikovtsi, Mramor, etc. .

- **The hostelry functions** are developing in the recent 4-5 years ever more as *linear centre functions* along the main radial boulevards of Sofia – *Tsargradsko Shosse* Blvd., *Tsar Boris III* Blvd., *Bulgaria* Blvd., *Slivnitsa* Blvd. and *Cherni Vrah* Blvd. A specific centre is getting established near the *Simeonovo* cable lift station, where the range of offered services in the direction of recreation, SPA, sports for entertainment etc. is gradually expanding. Hotel and summer house villages are emerging near the golf grounds.

Commerce and business

- **Trade centres.** They develop on the basis of the growing consumption demand – increased purchasing power and mobility of the population,

penetration of foreign trade chains, de-concentration of trade, etc. They are developed with the participation of private investment and turnover capital. Besides wholesale and retail trade they comprise a number of services, catering, entertainment etc. .

The density of commercial facilities is still the highest in the Central City Area. At the same time emergence of new centres is clearly observed. The specialized trade centre along the *Tsarigradsko Shosse Blvd.* – 7th - 9th km – is based on the two structure-defining trade sites “Metro-1” and *Boila* Department Store. In and around this territorial localization of leading trade functions are constructed service sites of other functional systems (National Exhibition Centre), which provides grounds to reckon that with the development of the territory in compliance with the above mentioned principle of self-regulation in the coming years the currently emerging trade centre might get transformed into centre for *complex services*. It resembles much the principle under which the 2nd-level complex centres are currently developing. The specialized trade centre Iliyantsi is an illustrative example of the influence of market-based mechanisms for forcing the location of a specific function on a specific territory. The Southern Arch of the Ring Road is developing as a linear concentration of trade sites for more odd-size products. Trade centres of a lower tier are formed in the city malls.

- **Business centres.**

Their development is predetermined by the growing role of the tertiary sector in the metropolitan socio-economic complex, the penetration of foreign investments and the need to create a high-quality business environment with the respective modern infrastructure facilities. Their construction is financed entirely by the private sector, whereat participation of the municipality in the form of contribution of plots and involvement in the management is possible. The major activities to be developed there are above all business activities, financial services, congresses and exhibitions, hotels etc., supplemented by trade, catering and services.

Well-established in the recent 4-5 years as the biggest and compact specialized business centre in Sofia is the *Business Park* in Mladost, Housing Estate, which continues to expand in territorial aspect, attracting a growing number of representative offices of companies, foreign and Bulgarian investors in the field of commerce, banking, hostelry, etc. On their part these major functions attract other, complimentary functions, and hence the range of provided services is being enriched all the time. .

Logistics

- **Logistic centres, intermodal terminals**

Their separation as an independent group in the Amendment to the Master Plan is based above all on the need of significant territorial resource and direct high-level transport servicing, in the majority of cases by means of combined transport. From economic point of view they are of key importance for the big cities.

In the city of Sofia a big logistics centre is being developed near Sofia Airport and *Iskar* Railway Station. Appropriate for that function are also the plots near *Kremikovtsi* Railway Station, which feature rapid links to *Hemis* Highway, *Trakiya* Highway and the Airport. Such opportunities exist also for the plots along the Northern Arch of the Ring Road and at *Voluyak* Railway Station with planning regime of mixed multi-functional zone (**Смф2**).

THE SPECIALIZED ENVIRONMENTS represent a complex element

of the social infrastructure of diffused type, extending over vast zones of the territory of the city and the surrounding area, where the natural and geographic conditions and the cultural and historical heritage are a prerequisite for higher concentration and saturation of the territory with service sites and activities with a specific orientation. The specialized environments comprise as an inherent characteristic the so-called “soft” infrastructure with ample provision of a network of pedestrian and bicycle routes, vegetation, public services, sports facilities of a local type etc. Proposed in the 2003 Master Plan are a *specialized environment for cultural tourism* at the southern slopes of the Balkan, a *specialized environment for health tourism and winter sports* in Vitosha, and a *specialized environment for water sports and entertainment* along the River Iskar and the River Lesnovska valley.

The specialized environments are retained with certain precision of some of the details in the Amenmdnet to the Master Plan as well, taking account of the new requirements related to protection of the natural environment and in the context of the new protection zones in the framework of the European network Nature 2000. The Amendment adjusts the boundaries of the recreation environment and the localization of certain centres for sports and entertainment along the River Iskar and River Lesnovska valley by orienting such facilities towards conflict-free areas.

The environment for cultural, pilgrimage and curing tourism “Sofia *Sveta Gora*” is expanding and covers ever more fully the churches and monasteries, which form the material stock for its establishment. .

4.4.3. TERRITORIAL ORGANIZATION OF THE TERTIARY SECTOR

On the basis of the analyses and forecasts and the territorial orientation of the system of centres, localization of the plots for the tertiary sector activities has been made. In the 2003 Master Plan have been identified planning zones for public services alone – mainly of the “social services” type - where no other activities will be allowed. The principle of mixed land use is broadly applied, i.e. a large number of the sites and activities of the tertiary sector fall under mixed planning zones, where development of two or more functions is allowed – central planning zones, mixed multi-functional zones, mixed industrial zones, industrial zones for small and medium enterprises and services, high-tech industrial zones, zones for public services and vegetation, zones and plots for sports and entertainment.

With the Amendment to the Master Plan the existing schools, child care and health care facilities are distinguished under the spatial planning regime “Public services” (Oo), although in certain cases they are relatively small *vis-a-vis* the scale of the plan. The database of the sites of these types has been updated and specific schemes have been worked out for their spatial localization. In this way planning prerequisites are created for retention of their social function with the time irrespective of the form of ownership.

As a result of the public debates and on the basis of the enriched database the planning regimes of some of the territories were specified more precisely.

4.5. GREEN SYSTEM

4.5.1. General stipulations related to the amendments of the currently enforced Master Plan of Sofia Municipality in the part “Green System” according to Paragraph 2 Item 2 of the Transitional and Closing Provisions of the Law on Regulation and Build-up of Sofia Municipality and Decision No. 693/19 July 2007 of Sofia Municipal Council.

The necessity of certain amendments and additions to the approved and already enforced Master Plan of Sofia Municipality is the consequence of the following facts and circumstances:

- After many years of work, which has passed through different phases, the Master Plan, including its part “GREEN SYSTEM” was approved by the Sofia Municipal Council in August 2003 and endorsed in 2006 by virtue of Decision No. 06/147 of the Council of Ministers. It was enforced as of 27 January 2007 in compliance with Paragraphs 11 and 14 of the Law on Regulation and Build-up of Sofia Municipality.
- During that period of more than three years (August 2003 – December 2006) the spatial planning of Sofia and Sofia Municipality was performed on the basis of partial amendments of Detailed Regulation Plans, which had resulted in changes in a number of planning zones.
- The processes of restitution, although in an attenuation phase as compared to the first decade after the approval of the respective laws (the end of 20th c.), introduced serious adjustments in part of the territories envisaged for green areas, especially within the construction boundaries of the city.
- The analysis of the graphic materials of the Master Plan revealed also certain errors of a technical nature, which is inevitable when one is dealing with such a vast and complicated territory. These errors represent inaccuracies in the marking of a number of territories of smaller area /boundaries, regimes, degree of development/.
- During that period there was also a change in the picture of the demographic state in the capital and in Sofia Municipality in the direction of increase of the forecast population size.
- The new demographic forecast, compared to the territorial changes in the scope of the elements of the green system, led to amendments in the norm setting calculations and indicators on the territory of Sofia and Sofia Municipality.
- The years, which have elapsed since the completion of the plan and its approval, led to amendment of the designation of certain planning zones (partial or full) as a consequence of submitted claims or declared investment intentions, which have been reviewed and honoured by a commission specifically set up for that purpose.

The above mentioned facts and circumstances in their entirety imposed the need of review and more precise specification of certain elements of the structure of the green system as a result of:

- changes that have emerged from the real regulation practice
- changes ensuing from the investment intentions related to concrete plots
- change in the designation as a result of governmental or supra-institutional decisions (for instance concessions)
- recommendations, applications and other public reviews
- graphic changes of technical nature
- designers’ team proposals for additions to the final draft
- territorial allocations for specialized programmes, Nature 2000 and other.

The GREEN SYSTEM is one of the systems of the urban organism, for which concrete parameters are set up. The changes that have ascended in the demographic development of the city of Sofia and Sofia Municipality in the direction of increase of the permanent residents, as well as the changes in the territorial boundaries of the compact city (the construction boundaries) of the city, have a strong impact on the norm-based calculations, expressed in percentage (%) of green areas of the total urbanized territory and m²/inhabitant public green areas for the forecast timeframe.

The Green System concept, which was defended in the already approved

and enforced Master Plan of Sofia Municipality, deals primarily with the territorial and spatial structure of the Green System and its functional organization.

The Green System is treated as an aggregate of spatially linked urban and surrounding areas for vegetation planting. The territorial arrangement is determined by the variety (in terms of types and categories) green areas, forests and forest parks, protected areas, water areas etc. in the city of Sofia and Sofia Municipality.

The Green System performs specific functions (urbanistic, ecological, recreation, aesthetic). The functional organization of the system is based on the major principle of integration with the other functional systems.

One of the main tasks of this plan is to find out to what extent the imposed changes affect the conditions for preservation, restoration and development of the elements of the Green System and its realistic functionality.

Prior to reviewing the analysis of the changes by elements of the Green System the following reservations should be made:

- The zones specifically designated for sports and attractions and marked in the plan with the respective press-mark “Ca” in the two scopes of the Master Plan (construction boundaries and Sofia Municipality) are singled out as independent, outside the elements of the Green System, and are analyzed and specified more precisely in the elaboration of the System “RECREATION”. They are included in the balance of the Green System but the norm requirements and the indicators for them are discussed separately. In some of the elements of the Green System are located sports grounds and playgrounds, which being outdoor sites and facilities continue to be part of the Green System and respectively are included in the balance of the green areas.
- The elements of the Green System in the surrounding area represent a territorial potential for the activities and the sites of the System ‘RECREATION’ and hence the detailed analysis and assessments for them have been developed in it.

4.5.2. Analysis of the amendments by elements of the Green System

The amendments in the scope of the green system are analyzed and assessed by spatial planning zones at the following territorial levels:

For the compact city (the city of Sofia within the construction boundaries, total area 20 914 ha)

- changes in the city parks (3п)
- changes in the plots for local gardens and greenery (Tro)
- changes in the parks for special use (Тзсп)
- changes in the plots for green links and greenery along streets, river gullies, open canals (Тзв)
- changes in the plots for cemetery parks (Trn);;

For the surrounding area (within the scope of Sofia Municipality)

- changes in the territories for greenery, including green links, gullies, servitudes, canals (this covers all the elements of the green system of the settlements from the surrounding area)
- changes in the territories for sports and attractions (Ca)
- changes in the territories for rivers and open water areas (it is assumed that the servitudes around them might take up some functions of recreation or get incorporated as elements of the Green System (Трк)
- changes in the forest territories (Г)
- changes in the territories for nature protection (P).

The results from the analysis of the changes in the scope of the Green

System are presented below in identical order to all the elements. The structure of the study covers the following:

- Identification of change in the boundaries of the individual elements of the green system
- Localization of the territorial changes in the respective planning zones.

Changes in the elements of the green system within the scope of the compact city (the city of Sofia within the construction boundaries).

Changes in the big city parks (3п):

Zapaden (Western) Park - boundaries

- The change in the boundary of Western Park ensues from the exclusion of parts of the territory as a result of supra-institutional decisions and allocation for other needs – residential use in long-term perspective (Жмзд): 32.82 ha

Localization of changes

- Regime “residential use in long-term perspective” (Жмзд) (36.85 ha) is introduced for a plot previously allocated for sports and attractions (Ca2) (to the north of the River Suhodolska). This is the reason for exclusion in substance of the plot from the park area and for the proposed changes in the boundaries of the park.

This change is not assessed as favorable for the pak itself, since on one hand it contradicts the provisions of the Law on Regulation and Build-up of Sofia Municipality and, on the other hand, it leads to substantial reduction of the area of the park and to disruption of the possible territorial and functional link in western direction with the rest of the elements of the Theme Park “Life-giving Water”. In terms of partial compensation the regime of the territory to the west of the *Suhodolsko ezero* (Suhodol Lake) is proposed to be changed from **Ccn** to **3пд**; the extension of *Montevideo* St. on territory of the park along the River Studella gully and tangential to the forest park part is postponed. This link is part of the inner transport ring and connects Ovcha Kupel with *Lyulin* Housing Estate; this change is also assessed as unfavorable to a certain extent, since it contains a potential risk of future build-up of the portion of the park between this communication and the Ring Road.

Balance of the Western Park – Zone **3п** = 416.75 ha
1st part: *Hristo Smirmenski* Park – **3п** = 48.57 ha
2nd part: Forest park - **3п** = 368.18 ha
Zone for sports and attractions - **Ca** = 36.85 ha

Severen (Northern) Park

Boundaries: no change in the territorial scope of the park

Localization of changes

- There are no substantial structural changes beside the increase of the zone under regime **Ca2** (18.0 ha) in the northern end of the park between *Lomsko Shosse* Road and the railway track for the expense of the park zone (3п) with a view to construction of big sports hall on the basis of concrete investment interests;
- The *Bakarena Fabrika* cemetery is expended in northern direction and its area becomes 50.09 ha;
- The route of the inner street connecting Obelya Quarter with Vrabnitsa Quarter is changed and is proposed to run parallel to the route of the tramway line with a view of the engineering requirements related to the construction of the Metropolitan as

well as for servicing the cemetery ground.

Balance of the Northern Park:

- Zone **3п** (all parts) = 161.32 ha
- cemetery ground (**Trn**) = 50.09 ha
- nursery-gardens (**Тдр**) = 2.37 ha
- Zone **Ca2** = 28.67 ha

Severoiztochen (Northeastern) Park

There are no changes in the boundaries, the entirety of the park structure is preserved.

Balance of the Northeastern Park:

- Zone **3п** = 135.78 ha.
- plot (**Тск**) = 21.76 ha.

Borisova Gradina

The boundaries of the park are changed as a result of:

- *incorporation of territories*: it is envisaged that part of the territory of SofiaLand shall be incorporated in the area of the park after postponement of the street running “along the diagonal” (the extension of *Srebarna* St. and its linkage with *Yavorov* Blvd. – 1.23 ha
- *exclusion of territories*: another part of the territory of SofiaLand is transferred to regime **Смф** and excluded from the area of the park

Localization of the changes:

- the designation of the plot of SofiaLand as a plot for specific use is cancelled and it is transformed into two planning zones – for a park (**3п**) and a **Смф** Zone
- the sports zone of *Yunak* Stadium and the *Maria Luiza* Swimming Pool (Ca - 20 ha) xa.) are changed to planning zone **3п** with a view to protection against build-up in the future.

Balance of Borisova Gradina Park

Park zone 3п = 263.56 ha
Sports zone Ca2 = 22.20 ha

Vartopo Park, Iztochen (Eastern) Park and Yuzhen (Southern) Park – 4th part, expansion

The boundaries of these parks are not changed. There are no structural changes either, except for the zones running tangential to the Ring Road. In the case of the Eastern Park and the Southern Park there is a favorable change in their planning regime – from **O31** to **O32** (planning zones with lower parameters according to the texts of the Law on Regulation and Build-up of Sofia Municipality). The same change is envisaged for the *Vartopo* Park.

Balance of Vartopo Park

Zone **3п** = 168.26 ha
St. *Iliya* Monasterty (**O32**) = 16.65 ha

Balance of the Eastern Park

Zone 3п = 107.27 ha
Zone Тск = 11.36 ha

Southern Park – expansion (Part V)

Zone 3п = 58.89 ha

Southern Park Part III

The change in the boundaries of the park ensues from *exclusion of territories* (newly constructed residential buildings and neighborhoods along *Kozyak St.*, the plot of the Governmental Hospital and that of the US Embassy).

Localization of changes:

- the envisaged communication connecting *Vaptsarov St.* with *Gotse Delchev St.* Is eliminated;
- part of the area of the park, in the southern end at *Srebarna St.*, is changed from a planning zone with lower build-up parameters (**Ca2**) into **Ca1** for construction of a sports hall (about 3 dca) with declared concrete investment intentions.

Balance of the Southern Park:

Part I (NPC) – Zone **3п** = 14.28 ha

Part II – Zone **3п** = 34.88 ha

Part III - Zone **3п** = 108.00 ha

Part IV - Zone **3п** = 58.89 ha

Changes in the plots for local gardens and greenery (Tro)

- The structure of the territory between *P. Yavorov Lane*, *Cherni Vrah Blvd.* and the extension of *Srebarna St.* is specified more precisely and together with the existing afforested areas are assigned the planning regime **Tro**;
- All church yard gardens are protected through assignment as green planning zone (Tro);
- Part of the existing garden in the *Zapaden Park* Housing Estate – on *Naycho Tzanov St.* – changes its planning regime from **O31** to **Tro**, since obviously a technical error has been made in the currently enforced plan;
- The boundaries of the existing afforested territories, to the south of the *Malashevtsi* Cemetery, have been adjusted from planning zone **Пмс** to planning zone **Tro** (2ha);
- The actual situation of already built-up territories, which had been envisaged for green areas and of existing green areas, which had been envisaged in the plan for other types of activities, have been reflected in the Amendment;
- The local green areas (existing) not reflected in the currently enforced Master Plan have also been reflected in the Admendment with their appropriate planning regime (for instance the garden opposite to the *Hemus* Hotel);
- Part of the plot of the Physics and Mathematics Faculty is changed from planning regime **Oo** to regime **Tro** for the purposes of future protection against build-up and preservation of the existing high-stem tree vegetation.

Changes in the special-use parks (T3cn)

- Vrana Park* with the statute of monument of park-and-gardening art, The boundaries of the park are not changed. In the buffer zone, to the north and east of the park are situated the plots for a new cemetery (**Trn**) – 72.57 ha;
- Zoo – There are no changes in the boundaries of the park;
- Sofia Spiritual Academy. The entire plot shifts from regime **Oo** to regime **T3cn** with a view to preservation of the valuable tree and park vegetation and limitation of future build-up there, as well as preservation of the identity of the complex.

Changes in the plots for green links and greenery along streets, rivers, gullies, open canals (T3в)

- In the *Malinova Dolina* Housing Estate the green link is released

from plots assigned to planning zone **O31** and remains entirely subject to a more favorable for the Green System greenery regime – **T3в**;

- The green link in the landslide plot in the *Karo* Locality is expanded along its entire length (planning regime **T3в**) with a view to ensuring room for implementation of the necessary consolidation activities;
- With the changes in the road communications changes have been made in planning zones **T3в** related to the specific routes and nodes;
- In the structure of the northern territories and the city of *Novi Iskar* the new green links (**T3в**) and park areas (**3п**), as well as the water areas, proposed in the preliminary draft for amendment of the Master Plan, have regained their regime of agricultural land areas (in response to the claims of NGOs with definite ecological bias).

Changes in the plots specifically designated for sports and entertainment (Тск)

SofiaLand, situated in the extension of the *Borisova Gradina Park* in the *Pogrebite* Locality, has been eliminated as a planning site for supra-institutional reasons and its area is assigned different planning regimes - **Смф** and **3п** (Please, refer to “Changes in the big city parks”).

Changes in the plots for cemeteries (Trn)

With the Amendment to the Master Plan of Sofia Municipality plots for new cemeteries and expansion of the existing ones are envisaged:

- The envisaged in the approved Master Plan cemetery at *Busmantsi* (about 30 ha) is cancelled;
- Central cemetery: expansion in western direction is envisaged (11 ha) – on plots of former greenhouses;
- Bakarena Fabrika* Cemetery: expansion in northern direction is envisaged (total area 50.09 ha);
- A plot of 72.57 ha for a new cemetery is envisaged to the north and northeast of *Vrana Park*;
- Cemetery in a long-term perspective is envisaged to the northwest of *Lyulin* Housing Estate (area 64.8 ha).

Changes of the elements of the Green System in the scope of the surrounding area

Changes in the territories for greenery, including green links, gullies, servitudes, canals

This covers all the elements of the green system of the settlements of the surrounding area. There are no changes in their parameters.

According to the provisions of the Law on Regulation and Build-up of Sofia Municipality, planning regime **T3в** has been assigned to the green strips along all the river valleys and has been technically correctly marked in the plan in compliance with the recommendations of the institutions and commissions submitted in the process of review of the preliminary draft of the Amendment to the Master Plan.

In the preliminary draft of the Amendment to the Master Plan the territories on both sides along the river *Iskar* valley are envisaged to be **3п** (aimed to take up the spillage in the event of disasters and averages), which is no more valid and they remain under **Сс6** regime. From the enforced Master Plan and the preliminary draft is discarded also the envisaged planning area in long-term perspective (**3пд**) (between the river *Lesnovska* and the river *Iskar*) because of forthcoming legalization of the concession for extraction of inert materials.

The green wedge (**3п**) between the villages of *Chepintsi* and *Negovan*, proposed in the preliminary draft of Amendment to the Master Plan, is discarded in the final draft at the request of ecological NGOs.

Changes in the territories for sports and entertainment (Ca):

As already noted in the “Fundamental postulates”, the changes in the territories for sports and entertainment are reviewed in detail under the changes in the functional system “Recreation”.

In general in may be noted that these territories undergo internal restructuring within their construction boundaries in terms of shift from one planning sub-zone into another, but all in all the increase of their area is insignificant – by 18 dca.

In the scope of Sofia Municipality the increase of the territories for sports and entertainment is more significant – by 740 dca, which is due to the plots envisaged to have planning regime **Ca1** with capacity for construction of large sports complexes.

Changes in the territories for rivers and open water areas (Трк);

It is assumed that the servitudes around them might take up certain functions of recreation or get incorporated as elements of the green system.

Changes in the forest territories (Г);

The forest territories as a green system resource are highlighted in the first place in the spatial characteristics of the system, by above all they represent a territorial potential for the recreation-related activities. They are analyzed in detail under the section “Recreation”. The general structure and territorial scope of these areas have undergone no change. Their total area is 3 6271.89 ha.

The changes in the territories for nature protection (P), less those under Nature 2000, are also insignificant, i.e. their area is increased by 15.5 dca.

The group of areas under nature protection is from the range of protected areas and in its case the planning is performed in accordance with the provisions of the Law on Protected Territories and on the basis of management plans and other regulation plans.

On the area of Sofia Municipality fall the nature reservations *Bistrishko Branishte* and *Torveno Branishte*, part of the *Vitosha* Nature Park, protected localities and nature landmarks.

In the plan for Amendment of the Master Plan of Sofia Municipality the regimes of the territories for nature protection are duly honoured. The changes in the protected territories during the period that has elapsed have been outlined through marking of the boundaries of the territories for Nature 2000.

In its capacity of a network of protected areas in Europe, Nature 2000 aims at ensuring long-term conservation of specifically identified valuable flora and fauna species, as well as their habitats. Bulgaria is one of the richest countries in terms of biodiversity in Europe.

As a contribution to the European ecological network NATURE 2000 our country has to protect more than 80 types of plant-species habitats, as well as the most important habitats of 100 plant species and 226 animal species, identified by European directives.

The zones under NATURE 2000 related to habitats in the scope of the city

of Sofia and Sofia Municipality are: Vitosha Mountains - BG0000113, area 27 360.00 ha; Plana Mountains - BG0001307, area 2 785.71 ha; Lozen Mountains - BG0000165, area 1 296.04 ha. The common objectives of three protected zones above consist in preservation of the natural state of the natural habitats and the habitats of the species subject to conservation within the framework of the protected zone.

According to the Directive concerning birds NATURE 2000 within the boundaries of Sofia Municipality extends to:

- The breeding-ponds in Chelopechene - Code BG 0002114)-OBM Code BG 114, area 65.19 ha. The protected zone is created with the objective to protect, restore and maintain the habitats of endangered bird species during the period of nest building, migration and survival in winter, protection and maintenance of biodiversity in the region; nature-friendly use of natural resources and sustainable community development, guaranteeing favorable nature protection status of the species, which are the object of preservation.
- The wetland near Dolni Bogrov – Kazichene, Code BG 0002004)-OBM Code BG004, area 2251.16 ha. The protected zone is set up with the aim to maintain the habitat of nest-building of endangered bird species, identified in Annex No. 2 of the Law on Biodiversity.

CULTURAL AND HISTORICAL HERITAGE

With respect to the green areas - monuments of culture – the respective additions of green areas under protection regime have been reflected in the scheme “Cultural and historical heritage” by a contour in ochra (according to the attached list) in compliance with Protocol No. 3 of the meeting of the Expert Council of the National Institute on Monuments of Culture, appointed by virtue of Order dated 29 February 2008. The total area of these green areas is 249.39 ha. Also reflected are the amendments made after the updating of the boundaries and regimes of the following::

- Group historical and urban planning monument of culture:
- Historical zone “Journalists’ Negiborhood”, *Lozenets* Locality III 4 (Quarters N 61, 62, 62A, 62Б, 62B) and zone Г-14 – the city of Sofia.

The National Institute on Monuments of Culture has submitted no other requests for amendment of the spatial planning concept concerning preservation and development of the cultural and historical heritage on the territory of Sofia Municipality.

1.1.3. Comparative analysis and conclusions from the balance of the territory

Comparative balance of the elements of the green system

The comparative balance of the green system is based on the comparison between the enforced Master Plan and the worked out final draft of the amendments in compliance with Paragraph 7, Item 2 of the Transitional and Closing provisions of the Law on Regulation and Build-up of Sofia Municipality and Decision No. 693/ 19 July 2007 of Sofia Municipal Council.

The balance has been drawn for the two scopes (Annex) as follows:

The city of Sofia within the construction boundaries with a total area

of 20 914 ha and permanent population of 1 377 690 inhabitants:

- The zone of city parks and gardens has diminished by 17.28 ha and features a total area of 2 464.30 ha. The territories for greenery feature a total area of 3 622.29 ha and as a whole have increased insignificantly (by 49 ha) and that mainly of the category “local gardens and greenery” (by 52.88 ha) and plots for cemeteries (by 20.13 ha). The latter expansion covers the plots of the Central Cemetery, *Bakarena Fabrika* Cemetery and *Malashevtsi* Cemetery.
- Territories for sports and entertainment of a total area of 410.44 ha. In quantitative terms the increase is insignificant (by 1.82 ha), but in terms of specifics one may note that the plots for sports and entertainment have undergone internal restructuring meaning that those of higher parameters (**Ca1**) have increased by 64.22 ha as compared to the **Ca2** plots, which have diminished by 60 ha.
- The territories for nature protection have been increased by 0.67 ha.

Sofia Municipality extends over a total area of 134 168 ha and its forecast permanent population is 1 485 617 inhabitants:

- The territories for greenery in it as a whole have increased by 319.54 ha or constitute a total of 10 265.26 ha – 7.65 per cent of the total area of the municipality. This is for the account of increase of the plots for green links (**T3в**) by 490.26 ha and reduction of the zone of city parks and gardens (**3п**) by 277.7 ha. The latter have been shifted to the regime “development in long-term perspective”.
- The plots for cemeteries have increased by 79.51 ha or constitute a total of 373.42 ha, including those designated for new cemeteries. These are mainly the two plots for new cemetery situated to the north and east of *Vrana* Park with an area of 725 dca and the cemeteries at *Botunets* Quarter (25 dca) and at the village of *Voluyak* (77 dca). Expansions are envisaged for the cemeteries *Kremikovtsi-Seslavtsi* (25 dca), *Botunets* Quarter (22 dca), the village of *Bistritsa* (24 dca), *Gorna Banya* Quarter (20 dca), the village of *Mramor* (6 dca) and the village of *Malo Buchino* (5.5 dca). The plot for cemetery at *Kazichene* is cancelled.
- The territories for sports and entertainment in the surrounding area amount to 1 163.51 ha and have increased by 73.6 ha, which is due mainly to those of planning regime **Ca1** (46.29 ha);
- There are no changes in the forest and protected areas with certain minor exceptions – plots for forest-tree nurseries.

Territories for development in long-tern perspective

Development in long-term perspective of the below listed zones is envisaged for the purposes of development of the elements of the green system and sports:

- Zone for parks and gardens (**3пд**) - 997.1 ha
- Zone for sports and entertainment (**Ca2д**) - 543.8 ha
- Plots for cemeteries (**Tгпд**) – 64.8 ha

This regime provides opportunities for reserving territories for future development bound to the existing elements of the green system and recreation in a long-term horizon (2030).

From the **3пд** and **Ca2д** zones within the scope of Sofia Municipality correlated to the permanent population (1 485 617 inhabitants) one may idenetify that the planned reserve for future development is 10.37m²/inhabitant with respect to the green areas and sports and entertainment areas and 0.4 m²/inhabitant with respect to **Tгпд**.

Efficiency indicators of the green system

Norm-setting concerning the quantitative parameters of the green system is determined by three indicators correleated respectively to the two scopes.

- For the city of Sofia

Level of greenery. It is defined by the ratio in percentage of all the types of territories for greenery, forest areas, areas for nature protection etc. as related to the gross area of the city of Sofia or Sofia Municipality. This indicator defines the environmental efficiency of the green system, since it comprises the biggest quantity of areas occupied by high-stem tree vegetarion (vegetation volume) of the green system, which has a direct impact on the complex ecological zoning of the city and the municipality.

Degree of greenery. It is defined by the ratio of the total of all the types of green areas (Σ_3) to the number of inhabitants of the city of Sofia and Sofia Municipality in m²/inhabitant.

The first and the second indicators for the environmental efficiency of the green system have been optimized in the direction of increase whereat the sum of the percentage of greenery in the zones for residence, work and the system of centers as defined in “Planning parameters” and quoted in the planning regimes of the Master Plan of Sofia Municipality are added to the quantity of green areas (Σ_3).

Recreation saturation. It is defined by the ratio of the green areas for recreation and general use to the number of inhabitants of the city of Sofia and Sofia Municipality. This indicator defines the recreation efficiency of the green system for each of the two scopes.

Norm-setting for the green system in the scope of the city of Sofia – Master Plan 2009 (amendment)

Level of greenery. It is defined as the ratio of the percentage of the total of all types of greenery areas to the gross area of the city of Sofia.

The quantity of the green areas of all the types is formed by the sum $\Sigma_3 = 3п + Tro + T3в + T3сн + Trн +$ the total sum of the percentage of the greenery in the zones for residence, work and the centre system as per the “Planning parameters” laid down in the planning regimes of the Master Plan of Sofial Municipality.

This indicator defines the environmental efficiency of the green system since it comprises the biggest quantity of areas occupied by high-stem tree vegetation (vegetation volume) of the green system, which has a direct impact on the complex ecological zoning of the city.

The quantity of all types of green areas is 9 792.45 ha.

The level of greenery of the city of Sofia is 46.8 per cent (area of the city of Sofia 20 914 ha).

Degree of greenery. 71 m²/inhabitant (at compliance with the percentage of greenery for all the planning zones according to the Law on Regulation and Build-up of Sofia Municipality).

Recreation saturation. 21 m²/inhabitant (on the basis of 2 882 ha green areas for recreation).

Norms for the territories for sports and entertainment (**Ca**) are set only with respect to the zones for sports and entertainment (**Ca1** and **Ca2**) – outdoor and indoor material stock area total 367 ha or 2.66 m²/inhabitant for the population of Sofia within the boundaries of the compact city. No norms are set for the plots specifically designated for sports and entertainment (**Tск**).

Norms for the plots for cemeteries (**Trn**) are set separately in accordance with a specific regulatory framework. For the population of the city of Sofia at the assumed number of 1 377 690 people within the construction boundaries of the city (20 914 ha) this norm is 1.52m²/inhabitant.

Norm setting for the green areas in the scope of Sofia Municipality

The green system around the human settlements is formed by all the types of green areas within the planning territories of that scope as well as by the recreation forests and land areas, which within the scope of Sofia Municipality have been defined as a green zone. It comprises also the existing forest parks, plots for tree-nurseries, for greenery along rivers, gullies and open water canals, protected nature areas, agricultural zone under specific regime. The sum of these green and afforested territories (88 507 ha) correlated to the area of Sofia Municipality (134 168 ha) in percentage defines the level of greenery of Sofia Municipality, which is 66 per cent of its area.

The ratio of the sum of forest areas, land areas under specific regime (20 per cent tree vegetation) and those for nature protection (57 780 ha), correlated to the area of the surrounding area (113 158 ha), defines the indicator for woodiness of the territory, which is nearly 51% and is considered to be very good.

The indicator for *recreational capacity* of the green system of the surrounding area is formed by the sum of the greenery areas, the green zone of Sofia Municipality and that of the protected nature areas (less the reservations) or a total of 48 099 ha, correlated to the number of inhabitants of Sofia Municipality (1 485 617 permanent population) is also high – 32.4 m²/inhabitant.

The plots for sports and entertainment are 5.13 m²/inhabitant in the territorial scope of Sofia Municipality, those for specific use are 2.7 m²/inhabitant.

The norms for plots for cemeteries (Trn) are set separately in compliance with a specific regulatory framework. For the population of Sofia Municipality (1 485 617 inhabitants) within the scope of Sofia Municipality (134 168 ha) this norm is 2.54 m²/inhabitant).

From the comparative analysis of the different indicators for quantitative assessment of the green system the following conclusion may be made:

- With respect to the ratio in percentage of the territories for greenery in the two scopes of the Master Plan of Sofia Municipality the 2009 Draft-Amendment notes insignificant changes:
For the city of Sofia: from 18.2 per cent (in the plan currently in force) to 17.3 per cent in the Draft-Amendment;
For Sofia Municipality: from 7.8 per cent (in the plan currently in force) to 7.65 per cent in the Draft Amendment.

From that fact one may conclude that from a territorial point of view in the draft for amendment of the Master Plan of Sofia Municipality the balance between green areas and build-up areas is generally not undermined.

- A considerable increase of the envisaged green areas in the residential areas with high parameters for greenery is noted. For the city of Sofia a value of 27 m²/inhabitant has been reached for that indicator (as compared to 10.6 m²/inhabitant according to the plan currently in force). The aim is to improve the quality of the residential environment.
- The assessment of the qualitative indicator for the green system – “recreational saturation” – reveals that for the city of Sofia there is a significant decrease – 21 m²/inhabitant (as compared to 33.2 m²/

inhabitant in the plan currently in force) as a result of the number of the forecast permanent population.

On the basis of the analysis of the territorial scope of the elements of the green system with respect to the 2009 amendments of the Master Plan a summary conclusion may be made that the undergone changes have not resulted to drastic amendment of the CONCEPT (the contents and laid down development concepts) of the green system. The forced and approved changes, however, have their strengths and weaknesses because of the fact that certain decisions have been made on the spur of the moment or as a subordination to the requirements of other urgent programmes.

Strengths of the plan for amendment of the Master Plan of Sofia Municipality:

- The majority of the parks retain their boundaries and scope;
- The boundaries of the planning zones with regimes **Tro** and **T3B** are specified more precisely;
- The plots for cemeteries obtain considerable expansion;
- A new category is formed – plots for development in the long-term perspective, which permits to realize in the future the envisaged expansion of the coverage of the green system and, in the event of proven investment intention, even at shorter timeframes;
- The boundaries of the green areas protected by virtue of the Law on Monuments of Culture, as well as those falling under NATURE 2000, have been marked;
- The technical errors have been repaired, including more precise graphic delineation of the boundaries of the planning zones.

One of the important proposals of the Master Plan with respect to the reserves for development of the green system in the direction of increase of the total area of public green areas, which are subject to norm-setting, was the incorporation in the currently enforced Master Plan of Sofia Municipality of one portion of the service-type green areas in the housing estates as belonging to the category “green areas for broad public use”. This prospect is retained in the Amendment to the Master Plan of Sofia Municipality as well and its implementation has already begun through restructuring of the area of the housing estates and identification of real estates under regulation with regime **Tro** – green areas for local gardens and greenery.

In implementation of the above to date part of the Detailed Regulation Plans for the area of the housing estates (*Mladost 1, 1A, 2, 3 and 4* Housing Estates; *Druzhdza 1 and 2* Housing Estates, *Obelya, Studentski* etc.), in which these ideas have been applied, have been assigned, worked out and certain already approved. In many quarters real estates under regulation have been identified for green areas under **Tro** regime. These have been regulatory envisaged and laid down in the Master Plan and participate in the balance of the green system with increase of 528.8 dca within the construction boundaries, which will lead to improvement of the indicators for efficiency of the green system.

In implementation of recommendations from the Report on the Environmental Impact Assessment for the Master Plan of Sofia Municipality (2003) investment projects for sanitary-protection belts around sites and facilities for solid urban waste treatment gave been assigned and implemented: *Khan Bogrov* in the *Malo Livade* Locality, Kremikovtsi city-district (area 93 dca) and *Sadinata* Locality, Kremikovtsi city-district (area 354 dca).

Assigned and elaborated is an investment project for sanitary-protection belt around the *Bakarena Fabrica* cemetery in the Northern Park, The first stage of this project has been already implemented.

“Assessment for compatibility” procedure is envisaged in the zones under NATURE 2000. Whatever the investment intentions in the approved zones under the European Environmental Network NATURE 2000, performance of any activities without the above mentioned coordination procedure is not permitted.

Weaknesses of the plan for Amendment to the Master Plan of Sofia Municipality:

Change in the designation of parts of the area of big city parks – examples: the proposed changes in the territorial scope of the Western Park with isolation of a new planning zone lead not only to reduction of the area of the part, but also plugs the possibilities for development of the green system in western direction and that would have an unfavorable impact in environmental aspect as well as in terms of break in the continuous line of green system; the change in the designation of parts of the Borisova Gradina Park (within the scope of the cancelled zone SofiaLand) etc.

The implementation of sites of the green system within the scope of the surrounding area as a result of the allocation under long-term consession contracts of certain uninherent to the system activities (quarries along the River Iskar Valley and the River Lesnovska valley) and shift of these territories to territories for development in long-term perspective.

Summary conclusions:

The macro-structure of the green system in the spatial planning aspect undergoes no change as a result of the amendments of the Master Plan of Sofia Municipality.

The major mark structures – the big city parks – are retained.

Territories for development of the green system in long-term perspective are reserved.

Formation of new green areas from the reserves emerging during restructuring of the other functional systems.

In conclusion, development in three directions is necessary for establishment of a functioning green system of the city of Sofia and Sofia Municipality, for realization of its design indicators:

- Simultaneously with the high-rise construction, which forms the “urbanized tissue” of the city, to build also its “green content”;
- Pre-term forestation of the design park areas - “draft park layouts” - for the purpose of reservation and conservation.
- Short-term and long-term municipal policy with concrete measures for building of the green system. .

Generally speaking, the CONCEPT for development of the green system has undergone no great changes as compared to the plan currently in force, since the major opportunities for development of its elements within the boundaries of the compact city and in the surrounding area have been preserved.

4.6. SYSTEM “RECREATION”

4.6.1. Prerequisites for analyses and assessments related to the amendments in the System “Recreation” of the Master Plan of Sofia Municipality

In the period 2003-2006 the spatial planning of the city of Sofia could not be stopped and it used to be realized by the Sofia Municipality on the

basis of partial amendments of Detailed Regulation Plans and of certain violations of the legal provisions, which resulted in errors causing grave changes in the forecasts for the planning zones in the Master Plan.

Changes occurred also in the demographic situation in the capital – increase in the forecast population size and territorial changes, which caused changes in the balance of the territory of the city of Sofia and Sofia Municipality. During the past 3-year period a number of submitted claims, established and corroborated investment intentions etc., which created prerequisites for adjustments in certain details, were justified and logically honoured by a specialized commission.

In the majority of cases this is related to changes of different scope in the designation of the planning zones.

Changes occurred also in administrative aspect – the management bodies in the system of Sofia Municipality as well as on a national scale – which affect the realism of the Master Plan forecasts.

The work with the graphic materials revealed certain technical errors as well. Some of them are the result of design inaccuracies, others are due to omissions in the computerized processing because of the multi-layer graphic illustration of the territory under review.

All of these facts and several other, which have emerged in the course of numerous discussions and reviews, highlight the circumstances, under which the need of a new review of the materials related to the Master Plan of Sofia Municipality has emerged, based on specific analyses, conclusions and proposals for adjustments to the appropriate extent.

This is the primary objective of this material entitled “Amendment to the Master Plan of Sofia Municipality in the part “Recreation””. Of course, all amendments have been made in a territorial linkage with the contact planning zones and above all with recognition of certain specific dependences from the green system and the existing forest areas in the surrounding area zone.

The system “Recreation” is not subject to strict setting of parameters and the value indicators are connected with the territorial balances as a consequence from the indicators of the green system. That is why we view the changes in the balance of the theme parks as insignificant for the approved concept for the system “Recreation” in the Master Plan of Sofia Municipality as well.

4.6.2. Changes and trends in the functional system “Recreation”

Being a component of the urban development, the System “Recreation” is subordinated to the general strategic trends of the Master Plan of Sofia Municipality related to structural units, priority directions, internal balance etc. In substance it is expression of the following:

- responsibility of the system, not limited in functional aspects – recreation is everywhere, manifested in a variety of modalities of activities;
- conservation of nature elements through development, which is subordinated to the principles of landscaping, ecological and functional requirements and correlations of sustainable development;
- searching for integration linkages between natural and anthropogenic components, their orientation towards theme-based forms of recreation and tourism making the best use of the available resources and organizational opportunities;
- achievement of integration linkages, reconciliation between the territories and regimes of the cultural and historical heritage;
- use of the green system as a major territorial potential, charged with opportunities for multi-facet activities;

- comparison of the quantitative and qualitative indicators with the trend related to the formulation of the respective regulatory framework.

The concept for territorial and functional formulation of the System “Recreation” takes account of the existing European programmes and is oriented towards actions for Sofia’s joining the family of EU capitals.

The territorial and spatial development of the System “Recreation” is based on the design solution embodied in the approved Master Plan of Sofia Municipality concerning the establishment of recreation environments called “Theme parks”.

The amendments in the System “Recreation” are analyzed and evaluated by planning zones as well as by individual specialized nuclei and concrete sites at the following territorial levels:

For the compact city (the city of Sofia within its construction boundaries):

- Territories of theme parks in general and by their component parts;
- Territories for sports and entertainment (**Ca1**, **Ca2** and **Tck**);
- Territories for the Green System (3);
- Territories for protection of the cultural and historical heritage – monuments of park and gardening art;

For the surrounding area (within the boundaries of Sofia Municipality):

- Territories for theme parks in general as well as by their component parts;
- Territories for sports and entertainment (**Ca1** and **Ca2**) and plots for special use (**Tck**);
- Territories of the Green System (3);
- Territories for protection of the cultural and historical heritage – monuments of park and gardening art;
- Forest territories (**Гз**, **Гр**, **Глп**, **Гдс**, **Гс** and **Гтр**);
- Agricultural territories (**Ссп**, **Сст** and **Топ**);
- Territories for nature protection (**Рзп**, **Зпп** and **Рдз**).

Before passing to the critical analysis of the amendments in the System “Recreation”, let us remind that some of the theme parks (mentioned in the Master Plan of Sofia Municipality) are situated entirely on the area of the compact city (“The Green Memory of Sofia” and “Studentski”) and the rest (“*Poleto*”, “*Sofiyska Sveta Gora*”, “*Iskar*”, “*Life-giving Water*”, “*Vitosha*”) fall on the area of both the compact city and the surrounding area and therefore are treated under the two territorial scopes.

The concept for regulation and organization of the System “Recreation” of the approved and enforced Master Plan of Sofia Municipality is based on the condition to set in place a balanced, high-quality and sustainable recreational environment through preservation, revitalization and development of the nature features.

The main principles of that concept, as well as the objectives of functional and spatial planning orientation, are retained and developed further in the Amendment to the Master Plan of Sofia Municipality.

The specific objectives of functional orientation comprise creation of conditions for:

- Sustainable development and reproduction of the landscape system;
- Enhancement of the attractiveness of the system;
- Coordination and management of the processes of integration with Europe through joint programmes and actions, including through creation of conditions for linking of the nature spaces of the Metropolitan area with the European network of green spaces;

The formulated major activities for recreation and tourism in terms of their use as a resource or as a field of human actions are retained. These are as follows:

- activities in nature environment;
- rehabilitation and recreation activities related to water and mineral water sources;
- sports activities;
- entertainment activities;
- cultural and cognitive activities;
- scientific and cognitive activities;
- agricultural activities, connected to tourism..

The territorial-spatial development of the System “Recreation” is based on the already approved in the enforced Master Plan of Sofia Municipality structure for creation of recreation environments – theme parks, which is aimed at:

- expansion of already established recreation environments and attraction of territories with different functions but oriented towards recreation;
- development of territorial-spatial structures, which have priority under a certain recreation-related theme (parks and forests, cultural and historical heritage, sports and entertainment, mineral waters and water areas);
- highlighting of the surrounding mountains and the nature potential of all mountains within the scope of Sofia Municipality;
- reconstruction and further construction of sites of the green system of the human settlements;
- conservation and adaptation of the cultural and historical heritage within both the boundaries of the city and of Sofia Municipality;
- reconstruction and development of the environments and sites for sports and entertainment;
- efficient use of the mineral waters and hydro-thermal resources of the capital and the entire region;
- highlighting and utilization of the water resources and improvement of the state of the adjacent plots along the river valleys – in the first place the River Iskar valley, the valleys of the Vitosha foothills and the numerous micro-dams in the Sofia Plain;
- formulation of the priorities of the system “Recreation” and their ranking depending on the stage of development of other functional systems;
- creation of prerequisites for regulation, control, management and financing of recreation under the conditions of sustainable development and EU-integration.

4.6.3. Analysis of the amendments in the elements of the System “Recreation” in the general context of the amendments of the Master Plan of Sofia Municipality

The reasons for these amendments are of varying nature: declared investment intentions towards concrete territories; changes in the designation resulting from governmental or supra-institutional decisions (for instance concessions contracts signed by the state), recommendations, applications etc. from public reviews, graphic changes of technical nature, proposals by the design team, specialized programmes, NATURE 2000, etc. The proposed amendments take into account the main range of objectives of the System “Recreation” as well as the maximum preservation of its structure and the thematic range of its major components.

Amendments in the theme parks

The results from the analysis of the amendments in the theme parks are presented in an identical manner for all the parks. The structure of the study comprises:

- identification of any changes in the boundaries of the theme parks as a consequence of inclusion or exclusion of certain territories;
- identification (localization) of the changes by functional zones situated within the scope of the theme parks;
- identification of any changes in the layout and structure of the individual sites for recreation.

Iskar Water Park with a total area of 20 023.2 ha

Amendment of the boundaries of the theme park as a result of:

- inclusion of territories:
 - to the south of the village of Chepintsi - as territories under regime for development in long-term perspective as park areas (**Зпд**);
 - to the south of the village of Krivina – territories defined under regime for local gardens and greenery (**Тро**);
 - below the village of Botunets near the lake - the territories to the right and around it are assigned the planning regimes **Тзв**, **Ссп** and **Зпд** with a view to formation of a zone for development in a long-term horizon, when the *Kremikovtsi* Combined Metallurgical Works will change its statute to **Смф** planning zone; .
- exclusion of territories:

Part of the territory of the theme park, running along the *Botevgradsko Shosse* Road and the junction of the Ring Road is excluded, since a big service centre will be formed there as planning zone **Смф** and the boundary will be transformed (Annex: Scheme to Part “Recreation”).

Localization of the amendments by planning zones:

- the area between the rivers Iskar and Lesnovska, to the south of the village of Svetovrachane, leased under 30-year concession contract, changes its planning regime from planning zone **Зпд** to agricultural territory under special regime (**Ссп**) by virtue of a decision of the Sofia Municipal Council for reasons of procedure inconsistencies;
- the new territories to the south of the village of Chepintsi and some from the existing quarry lake obtain the regime “Zones for development in long-term perspective” for park and sports areas **Зпд** and **Сад**;
- the territories below the village of Botunets, which are proposed for change within the boundaries of the *Iskar* Theme Park, are reported also as shift to planning zones **Тзв**;
- along the banks of the *Iskar* Dam all the territories having planning regime **Оз1** are shifted to planning regime **Оз2** – more favorable for development of recreation environment.

In certain territories additional sports zones **Ca2**, for which there are declared concrete investment intentions (the former base of *Hydrostroy* in the section between the *Tsarigradsko Shosse* Road and the Ring Road), as well as agricultural land areas restructured into zones for sports and entertainment, are incorporated.

The entire route of the boulevard running along the river is restored as a boundary and an opportunity for access to the theme park, which also serve to limit uninherent for the park construction activities.

“Poletoto” Theme Park with a total area of 5 397.4 ha

Amendment of the boundaries as a result of:

- inclusion of territories:

inclusion of two zones under planning regime **Оз2** at the village of Mramor;
- exclusion of territories:

two planning zones (**Тсн** and **Тс**) at the village of Trebich are excluded from the scope of the park and included as zones for parks and gardens (**Зп**).

Localization of the amendments by planning zones:

- Part of the territory designated for “Ethnographic settlement” is shifted from planning zone **Зп** into planning zone **Жвд**;
- we find it feasible for the territory between the two newly envisaged zones and the plot for the ethnographic settlement to remain under planning regime **Зп**;
- the plot of the military airfield at the village of Dobroslavtsi changes its regime from special-use plot to plot for sports and attractions (**Сад**);
- expansion of the *Bakarena Fabrika* cemetery in northern direction with break-through for the route of a new street along the tramway line towards *Obelya* Housing Estate is envisaged in the structural scheme of the Northern Park;
- the territories at the approaches to the Balkan Mountain Range, designated as planning zone (**Жвд**)*, are press-marked to be subject to special requirements as regards recreation (according to the Law on Regulation and Build-up of Sofia Municipality);
- the territories in the new nodes are marked as being under planning regime **Тзв**.

“Zhiva Voda (Life-giving water)” Theme Park with a total area of 8 855.5 ha

Amendments of the boundaries as a result of:

Exclusion of territories

- on the territory of the Western Park the most significant changes in its structure are determined by the shift of vast zones for sports and entertainment (**CA2**) and park areas (**Зп**) to zones for housing plots in the long-term perspective (**Жмзд**). For that reason this territory is excluded from the area of the Western Park, which is within the scope of the “**Zhiva Voda**” Theme Park.
- Part of the territory adjacent to the *Suhodolsko* Lake (to the south), which was shifted from agricultural (**Ссп**) into residential. It is proposed that the boundary shall be determined by the width of the buffer zone and will be under regime **Тзв**;
- to the west of the lake a territory under regime **Ссп** is shifted to regime **Зп** with a view to creating a green area and separation of the residential zone from the water area.

Inclusion of territories

- to the west of Phillipovtsi in the boundaries of the theme park are included zones under regime **Ca** (sports and entertainment) and **Tro** (city parks and gardens).

Localization of the amendments by planning zones

The territorial changes are insignificant.

“Studentski” Theme Park with a total area of 446.5 ha

It covers the area of *Studentski Grad*, the existing outdoor and indoor

material stock, the “*Vartopo*” Park and the Dendrarium with the Forest Engineering Institute.

Amendment of the boundaries as a result of:

Exclusion

The boundary of the theme park is changed in the portion between *Sekvoya* St. and *Lyapchev* St. On top of a micro-district park with regime **Зп** is imposed regime **Оз1**. The boundary remains to run along *Kipriyan* *Kipriyanov* St. .

Localization of the amendments by planning zones:

- the zones along the Ring Road, which fall within the boundaries of the parks and are under regime **Оз1** should undergo a shift to regime **Оз2**;
- the above is valid also for some territories to the north of the American College;

“Sofiyska Sveta Gora (Sofia Holy Forest)” Theme Park with a total area of 13 297.9 ha

It covers the southern slopes of the Balkan Mountain Range, including the forest parks “*Lokorsko-North* and *South*”, “*Murgash*”, “*Katina*”, monasteries, churches, the “*Katinski Pyramid*” Locality, historical places, nature landmarks, outstanding landscapes – the River Eleshnitsa valley, settlement environments – the settlements Katina, Voynyagovtsi, Lokorsko, Zhelyava. .

Amendment of the boundaries as a result of:

Inclusion – all the changes are made at the proposal of the design team and refer to inclusion of forest areas with a view to their conservation (as parts of the theme park) and because they are suitable for development of different modalities of recreation activities.

- existing forest territory to the west of Zhelyava;
- existing forest territory to the north of (above) Bukhovo;
- forest territory to the west of the brownfield;
- forest territory above Seslavtsi;
- to the west of the afforested brownfield at Lokorsko - **Ca2** and **Смф2**

The amendments of and additions to the functional and territorial development of the theme park are the result from the specialized programme for the northern territories – central part, developed as integral part of the Master Plan.

Comprehensive historical research and numerous legends, as well as the existence of ruins, consecrated grounds, historical locations etc. define this territory as the bearer of the historical memory and part of the “*Sofia Mala Sveta Gora* (Sofia Holy Forest Minor)”, which is formulated in the Master Plan of Sofia Municipality specifically as *History* Theme Park. The combination of the two priorities – nature and cultural and historical heritage – determine also the contents of new recreation sites, which in the territory under review are as follows:

- Suburban balneo-curative centre with a spa zone, hotel part, catering complex and park environment for physical activities and curative sport activities;
- The specialized site “*Branichovitsa*”, related thematically with history and the name of the village of Voynegovtsi (or Voynikovtsi, back during Tsar Kaloyan's rule, when a military detachment stationed there used to control the then active routes from Sofia towards the fortresses in Northern Bulgaria). In close proximity

are situated also the “*Turchenitsa*” Locality and the “*Karvavets*” Locality, which have witnessed grave events for the Bulgarian population during the 17th c.

In modern context on this territory, defined in the Master Plan of Sofia Municipality as an area for sports and entertainment, the core “*Branchovitsa*” is envisaged to be equipped with several theme zones with indoor and outdoor facilities:

In close vicinity to the Podgumer Monastery “Sveti Dimitar” the establishment of a specialized theme site “Mediaeval Monastery Gardens” as a supplement to the envisaged Christian Orthodox spiritual centre is planned. It will contain an exhibition of the characteristic principles of planning, composition and vegetation species, including “medicinal herbs”, as well as an indoor exhibition area and information illustrating the most typical monastery gardens in Bulgaria. This site will be planned in a common recreation nucleus with the “*Sofiyska Sveta Gora*” visitors’ information centre. (?? интерпретативния посетителски център)

The forest parks “*Lokorsko – North and South*” are proposed for expansion and uniting of the two parts into one holistically planned park with a joint composition and links between the sites and the networks of footpaths, construction of tourist chair lift. The characteristic for those territory monuments of the partisan movement are preserved as historical memory of that period with “Toshkovi Koshari” and “Shumnatitsa” are core sites. New recreation sites are the tourist complex, the “Kashlata” folklore centre and the river-bank zone for recreation along the River Lokorska. Also envisaged is a sports-and-entertainment zone “Scouts camp”, combined with the near-by rocky landscape.

The existence of ample range of sites related to the cultural and historical heritage – churches, monasteries, historical locations connected with concrete historical events (*Branchovitsa*, *Karvavets*, *Krasta* etc.) corroborate the correctness of the concepts for development of a recreation infrastructure connected with this thematic, The integration of the two priorities (nature and cultural and historical heritage) determined the need of harmonic combination and structuring of the different theme sites into a holistic functional and territorial organization.

These sites are fragments of the overall structure of the green system and the sites of the “Northern Arch of Recreation”. This determines the relationships and their impact on the sites belonging to the System “Recreation” (*Katina* Golf Course, Ethnographic village, *Dobroslavtsi* Entertainment Park etc.), the public centres (Novi Iskar-Katina), entertainment zones and sites from other functional systems.

“The Green Memory of Sofia” Theme Park with a total area of 610.5 ha

It comprises: parks and gardens in the Central City Area, representative part of the *Borisova Gradina* Park, archeology, churches, museums, the *Lozenets* Residence, *Slaveyfov’s* oaks, the Seminary, part of the urban environment in Lozenets Quarter bearer of unique identity.

Amendment of the boundaries as a result of:

Inclusion of the forest park zone, in which are situated the dendrarium, a monument of the park and gardening art (between the *Tsarigradsko Shosse* Blvd., *Nezabravka* St. and *Dragan Tsankov* Blvd.), identified as a buffer zone of the cultural and historical heritage.

“*Vitoshki*” Theme Park with a total area of 27 817.6 ha

It covers the *Vitosha* Nature Park, the *Knyazhevo* pine forest, the *Boyana* Residence, the Botanical Garden, churches and monasteries in Vitosha Mountains, the Southern Park – parts I, II, III and IV, and the green wedges along the water courses of the Vitosha rivers. .

Amendment of the boudaries of the park as a result of:

Exclusion of the new residential buildings and quarters along *Kozyak* St. in the Southern Park, the Governmental Hospital and the American Embassy are excluded from the boundaries of the park.

Inclusion of plots specified as territories under regime **3п** along the boundary between the built-up territories and the *Vitosha* Nature Park. .

Note: The boundary of the *Vitoshki* Theme Park does not overlap with the boundaries of the *Vitosha* Nature Park.

Amendments in the plots for sports and entertainment:

The territories for sports and entertainment in the balance of the Amendment of the 2009 Master Plan are split between the two scopes as follows:

In the compact city: 238.2 ha;

In Sofia Municipality: 411 ha;

Territories to the amount of 345.8 ha are envisaged for the long-term development horizon (2025).

The total area of the theme parks is 76 448.6 ha or 57 per cent of the territory of Sofia Municipality.

The amendments in the plots for sports and entertainment (planning zones Ca1, Ca2 and Tck) in the two territorial scopes are localized as follows:

In *Iskar* Hydro-park

- The plots of the former base of *Hydrostroy* and agricultural plots are restructured into zones for sports and entertainment;
- The new territories to the south of Chepintsi and the existing ballast quarry are assigned the long-term development perspective for sports and park territories under regimes **3нд** and **Сад**.

In the Western Park

- One of the main elements of the territories for sports and attractions, envisaged as a multi-functional complex for servicing *Ovcha Kupel* Housing Estate (according to the 2003 Master Plan) is excluded and is restructured into a zone for housing construction in long-term development perspective (**Жмзд**).

In *Hristo Smirnenski* Park

- The zone for sports and entertainment (**Ca2**) is located on the plot of the cancelled entertainment sector with maximum density 10 per cent, Kint 0.15 and minimum greenery area 50%, which provides an opportunity for development of appropriate activities in the spirit of the old traditions of that location.

In *Borisova Gradina* Park

- The zone for sports of *Yunak* Stadium and the *Maria Louiza* outdoor swimming pool change their regime to planning zone for parks and gardens (**3п**) with a view to protection against build-up in the future. The plot for entertainment *SofiaLand* according the enforced 2003 Master Plan is restructured and reassigned different planning regimes (**Смф**, **Ca** and **3п**). .

- Larger plots for sports are envisaged on the plot of the **former airfield at Dobroslavtsi (Tcn) and are assigned regime Ca2**. Development of sports and entertainment of similar thematic orientation (glider flights, parachutism, extreme sports, bungee, paintball etc.)

In the Northern Park

The zone under regime **Ca** is increased for the expense of the zone **3п** with a view to construction of a multi-functional sports hall, meeting the requirements of professional sport (volleyball, basketball, box, figure skating, eurhythmics etc.). The plot is situated in the northern end of the expansion of the Northern Park, near *Lomsko Shosse* Blvd. and the railway line Sofia-Kalotina, because of the suitability of the territory for building of a sports and entertainment complex. Construction of outdoor sports ground for use by the residents of the adjacent housing estates is also envisaged.

Amendments in the forest territories

A considerable part of the forests on the territory of Sofia Municipality has long traditions in their use for sports and tourism. Since decades the land of the *Vitosha* Nature Park, of the Lyulin, Plana and Lozenska Mountains, the southern slopes of the Balkan Mountain Range and the River Iskar valley has been designated and used for recreation.

The general picture with respect to forests is determined by the identified 79 tree and bush species, whereat the areas of deciduous species predominate (72.8 per cent) and the areas occupied by coniferous species are about 27.2 per cent. In the total balance of forests the share of mixed deciduous forests is the biggest. The forest areas on the territory of Sofia Municipality amount to 36 272 ha.

The Forest Act lays a strong emphasis on the multi-facet and multi-functional use of forests. This comprises also their use for recreation, which provides opportunities for the Master Plan of Sofia Municipality to seek in the domain for forest use conditions for establishment of a system of recreation under different modalities and for different categories of visitors.

During the 1950's by virtue of a Council of Ministers' Decree all the forests on the territory of Sofia Municipality had been declared as the “Green zone” of the city.

During the recent years as a result of the incurred changes in the forests of Sofia Municipality a number of problems emerged, which are in the process of development and resolution through partial solutions. These are issues related to ownership rights on forests, their re-categorization, forest management, maintenance and future development.

In 2003 a Municipal Enterprise “Management of municipal land and forests” was set up with Sofia Municipality with functions directly orientated towards management of and care for the forests in Sofia Municipality. It had its own programme aimed at introducing order in municipal forests. In the course of the years a number of changes have taken place in the forest stock on the territory of the municipality, which have had a positive impact on the development of the forest economy.

At this stage one significant problem is the identification of the ownership rights on the municipal forest stock. This change and the forthcoming restoration of the ownership rights on forests require periodical reflection of the cadastre amendments not only on the maps of forests but also on the planning basis of the Master Plan of Sofia Municipality.

After 2004 the activity of the Management of municipal land and forests resulted in the creation of new afforested territories of mixed tree species - 481.53 dca. They are located mainly in the northern territories – 74 per cent and the majority is located in the land area of Bukhovo – 233.83 dca, which is expected to produce a specific ecological effect.

The territorial distribution of the new forest plantations with respect to the theme parks is as follows: “*Life-giving water*” Park – 58 dca; *Vitosha* Park – 40 dca (in the vicinity of Zhelezniitsa) and in *Iskar* Water Park – 28 dca (Dolni Passarel). Working out of a new forest regulation plan for the forests municipal property in Sofia Municipality has been assigned for the purposes of improvement of the state of the forests and their better management.

This assignment is not linked to the Master Plan of Sofia Municipality at this stage, but probably in the process of elaboration of the plan it will become necessary to make the adequate formulation of the principles regulating the relationship “man-forest-recreation” in management and planning aspects.

The forests around the city of Sofia need to be upgraded to have the properties of forests with multi-functional designation and that needs a lot of preparatory work. They satisfy a public need and to a considerable degree take up the functions related to recreation in the light of the current and future development of Sofia.

The new forest regulation plan in the scope of municipal forests is particularly important and useful for the resolution of certain problems of ecological nature and also of issues related to landscaping. It may be expected that once this plan is prepared there will be some changes in the categorization of forests in Sofia Municipality. The use of the forest resources around Sofia need to be subordinated to the principles of continuity and orientation towards sustainable development. In this respect coordination of the planning activities concerning forest areas is an important requirement for the projections of the Master Plan of Sofia Municipality and the activities of the Municipal Enterprise “Management of municipal land and forests” with Sofia Municipality.

The team, which has worked out the System “Recreation”, approves and will approve any amendments resulting from the efforts of the forestry institution, which do not contradict the main conceptual solutions in the Green System and System “Recreation” of Sofia Municipality. This is particularly valid with respect to the theme parks, whose parameters have already been permanently fixed and for which the issues related to their functional designation have been resolved. Това важи особено за тематичните паркове, които са вече стабилно параметрирани и функционално решени.

Amendments in the agricultural territories under specific regime (Ccn)

The comprehensive studies conducted for the Master Plan of Sofia Municipality revealed that a significant portion of the agricultural areas, especially those in western and northern direction, are suitable for linkage of agricultural activities with those of recreation. This fact has been corroborated with the specialized programme for the “*Poleto*” Theme Park, approved with the Master Plan.

The existence of components like mineral resources, monuments of culture, nature landmarks, valuable plants etc. parallel with agricultural land under

specific regime, create preconditions for integration of the environment with complex planning solutions oriented towards the functions of recreation.

For these land areas with complex planning under the Master Plan of Sofia Municipality by virtue of the Law on Regulation and Build-up of Sofia Municipality was created regime “Agricultural zone under specific regime” (3cn), which in substance defines these areas as agricultural with permit for additional service functions related to agrarian tourism and recreation. The designation of part of these agricultural areas is changed considerably in the scope of the “*Life-giving water*” Theme Park and is assigned development in long-term perspective envisaging housing construction. No significant changes have been noted with regard to the land areas under specific regime within the scope of the other theme parks. Changes may be expected with respect to the ownership on the land and amendments ensuing from regulation aimed at spatial planning of the landscape. These will be changes resulting from the Master Plan, which would lead to no contradictions.

The agricultural territories laid down in the Master Plan under specific regime contain decisions based on the principles of preservation of the productivity of the land and the yield, protection of nature and planning of a cultural landscape for meeting the demand of specific locations for recreation and agrarian tourism.

Of, course, specific regulatory provisions will be needed for realization of recreation in agricultural land in order to specify its national significance and promote persistent efforts for sustainable development.

SITES OF THE CULTURAL AND HISTORICAL HERITAGE

The sites of the cultural and historical heritage form an independent system and are the object of a separate part of the Master Plan of Sofia Municipality, in which there are no changes of legislative nature. What we deal with here are only those fragments, which are related to the role of the cultural and historical heritage in the arrangements for the System “Recreation”.

A considerable number of the sites of the cultural and historical heritage on the territory of the city of Sofia and especially in the surrounding area create preconditions for development of recreation in the domains of cognitive and religious tourism. This fact provides grounds for review of any possible changes in the spatial linkage of these sites with the recreation-related environment.

The change, which is worth noting in the amendments to the Master Plan, is the worked out structural scheme of the central part of the northern territories. It is an accompanying part of the Master Plan and puts forward certain concrete requirements concerning the formation of the recreation environment, some of the components of which are the monuments of culture.

In the general composition related to the functional and territorial organization of recreation in mountainous natural environment part of the southern slopes of the Balkan Mountain Range and the two forest parks - “*Lokorsko-South*” and “*Lokorsko-North*” – have an important role to play. These are parts of the “*Sofiyska Sveta Gora* (Sofia Holy Forest)” Theme Park, for which specific planning activities have already been outlined in the scheme, some of which are oriented towards sites of the cultural and historical heritage – churches, monasteries, historical locations connected with concrete events (*Branchovtsi, Karvavets, Krasta*, etc.)

In the surrounding area the sites of the cultural heritage are situated on territories, which become attractive for recreation in zones of different scope with complex environment or specialized sites for targeted visits. In both cases the changes point to linkage in theme-based itineraries which had overcome the differences between urban and suburban (or country) environment.

The theme parks area comprises a total of 58 728 ha. This balance is, to a certain extent, of a conventional nature, since the plan does not introduce hard, “administrative” boundaries for the theme parks, but according to the provisions of the Law on regulation and Build-up of Sofia Municipality all the agricultural land areas within the scope of the theme parks should change their regime to special regime Ccn. It is exactly that regime that is one of the leading criteria for tracking the scope of the theme parks.

With the Amendment to the Master Plan the primary structure of the System “Recreation” is retained and the organization of the recreation sites in the seven theme parks within the administrative-territorial boundaries of Sofia Municipality. There are no substantial changes in the major priorities and activities in them except for the incorporation of territories related to NATURE 2000, namely:

“The Green Memory of Sofia” Park

Scope: parks and gardens in the Central City Area, representative part of the *Borisova Gradina* Park, archeological sites, churches, museums, the Lozenets Residence, the Slavaykov's oaks, the Seminary, part of the urban environment featuring specific identity.

Measures: conservation, protection, rehabilitation, regulation, special statute.

Activities: cognitive and religious tourism, culture, entertainment, recreation.

Sports park “Studentski”

Scope: the territory of Studentski Grad, indoor and outdoor sports facilities, “Peace and Friendship” Park, “*Vartopo*” Park, Dendrium at the Forest Engineering University.

Measures: conservation, new development and spatial planning.

Activities: summer and winter sports, specialized sports, entertainment, bicycle routes, free recreation

“Vitoshki” Nature Theme Park

Scope: *Vitosha* Nature Park, *Knyazhevo* pine forest, Boyana residence, Botanical Garden, Vitosha churches and monasteries, Southern Park – Parts I, II, III and IV.

Measures: special status, preservation, protection, rehabilitation, spatial planning, new construction.

Activities: cognitive and religious tourism, culture, nature protection, eco-tourism, winter sports, summer house recreation.

“Life-giving Water” Climatic and Balneology Park

Scope: resort settlements Bankya and Gorna Banya, Lyulin Mountains, *Suhodol* Lake, Western Park, *Ovcha Kupel* Park, mineral springs, Bozhurishte (airfield, horse-riding centre, gold course).

Measures: reservation and protection, rehabilitation, new construction and spatial planning.

Activities: balneo- and spa treatment, beaches, water sports and entertainment, “health” itineraries, angling, horse-riding, eco-tourism, specialized sports (golf, etc.)

“Poleto” Entertainment Park

Scope: Dobroslavtsi airfield, well-established settlement milieu – human settlements Mirovyane, Mramor, Dobroslavtsi, Balsha and Trebich, mineral springs, Northern Park, churches and monasteries, agricultural and water landscapes.

Measures: reservation of new territories, security, rehabilitation, new construction.

Activities: air-borne sports and entertainment, specific sports, water attractions, exhibition of mineral water sources, folklore and handicraft, tourist itineraries.

“Sofia Holy Forest” Historical Park

Scope: southern slopes of the Balkan Mountain Range, including the forest parks “*Lokorsko-North*” and “*Lokorsko-South*”, “*Murgash*”, “*Katina*”, monasteries, churches, “*Katinski Pyramid*” protected locality, historical localities, nature landmarks, outstanding landscapes – the River Eleshnitsa valley, residential milieu – the settlements Katina, Voynyagovtsi, Lokorsko, Zhelyava.

Measures: reservation, protection, rehabilitation, conservation, regulation, special statute.

Activities: cognitive and religious tourism, winter entertainment, tourism itineraries, recreation.

“Iskar” Water Park

Scope: *Iskar* Dam, *Passrel* Lake, *Urvich* protected locality, *Pancherevo* Lake, *Iskar* Hydropark, quarry lakes and the River Lesnovska valley till the gorge, *DisneyLand* and *Chepintsi* water entertainment park, part of Plana Mountains and Lozenska Mountains, *Vrana* Park.

Measures: special statute, NATURE 2000, reservation of new plots, protection, preservation, rehabilitation, regulation.

Activities: water sports and entertainment, hunting, angling, horse-riding, cognitive and eco-tourism, recreation in summer house milieu.

While preserving the leading characteristics of every theme park, the establishment of new recreation sites in them enriches and complements the system of specialized centres and environments.

With the proposed additions of new theme sites in the amended Master Plan of Sofia Municipality the full range of centres for recreation is as follows:

- ⇒ National ethnographic architectural museum and rural tourism complex in the “*Poleto*” Entertainment Park (ethnographic village);
- ⇒ National visitors’ centre on nature protection in Bulgaria in the *Sofia Holy Forest* Park in the Balkan Mountain Range;
- ⇒ Monastery complexes and Permanent Festival Folklore Centre in the *Sofia Holy Forest* Park;
- ⇒ Agricultural exhibition in the *Poleto* Entertainment Park;
- ⇒ Water entertainment park in the *Iskar* Park – two sites (AquaLand and Chepintsi) with a different degree of significance;
- ⇒ Attraction – Sofia Fair (on themes of the past century) in the Eastern Park, which with the amendments is transferred into a site for development in long-term perspective;
- ⇒ Intercity geothermal and entertainment centre in the *Poleto* Park in the Northeastern Park;
- ⇒ National environmental centre and national centre for skating and extreme sports in the Northeastern Park;
- ⇒ Dobroslavtsi entertainment park in the place of the former military airfield.
- ⇒ Golf courses – Katina, Bankya

- ⇒ Kubratovo Eco-technology park;
- ⇒ Interpretation visitors’ centre *Sofia Holy Forest*;
- ⇒ *Cherveno Zname* national sports complex;
- ⇒ Cognitive visitors’ centres in the Botanical Garden;
- ⇒ The Zoo and Vrana Park;
- ⇒ Aleko Skiing-centre
- ⇒ Centres for water sports – Pancherevo Lake and *Iskar* Dam;

The thus formed functionally and territorially structure of the theme parks in its complexity creates an environment of enhanced attractiveness of the System “Recreation” for the inhabitants of Sofia and its visitors.

As a component of the theme parks sports have priority in the majority of them with a broad range of types of activities. The situation and construction of big sports centres with multi-functional opportunities (in the Northern and Western Parks, *Cherveno Zname* Complex, *Dobroslavtsi* Complex etc.) comply with the innovative vision concerning sports activities for youth and businessmen. There is interest mainly in certain kinds of sports, namely golf, extreme sports, tennis, bicycle-riding, jogging, carting, paintball etc., while the mass sports and interests of the population are paid adequate attention as well.

Prerequisites are created for hierarchic ranking of the sports centres and individual sites with the purpose to establish the city of Sofia as a regional and European sports centre possessing the capacity to organize international sports events at different levels.

The itineraries for wandering on foot or on horseback in the Balkan part of the *Sofia Holy Forest*, in the *Life-giving Water* climatic and balneology Park (mainly in the area of the city of Bankya) and in the *Iskar* Water Park (to the south of *Iskar* Dam) have been retained and enriched.

Itineraries of the cultural and historical heritage in the *Sofia Holy Forest* Historical Park and from the *Green Memory of Sofia* Park to the *Boyana* Church in the *Vitosha* Nature Park are outlined.

The location of the management and information centres of each of the theme parks, necessary for realization of the interaction among the various institutions (strategic planning, coordination and permit regime), is retained.

In conclusion it may be stated that the amendments in the territorial and functional organization of the System “Recreation” with the proposed additions increase significantly the range of activities and create conditions for realization of the big recreation potential of the city of Sofia and Sofia Municipality, support the trends of development of the “Northern Arch of Recreation” of the city of Sofia and Sofia Municipality. The realization of the System “Recreation” may be achieved only through coordinated efforts and actions at institutional levels of different hierarchic ranking..

4.7.SYSTEM “CULTURAL AND HISTORICAL HERITAGE”

The planning concept concerning the spatial development of the System “Cultural and historical heritage” proposed by the 2003 Master Plan of Sofia Municipality is assumed also in the draft for Amendment to the Master Plan. Reflected in the latter are only the recommendations of the Expert Council of the National Institute on Monuments of Culture with respect to the preliminary draft for Amendment to the Master Plan.

4.7.1. Protection of the system “Cultural and historical heritage”

The proposal for protection of the system “Cultural and historical heritage” comprises priority actions to be implemented in the period till 2012 in five major directions:

• Declaration of a system of territories for monuments of the cultural and historical heritage

These territories represent plots set apart for specific use, which need to be controlled and managed under specific regimes for protection of the cultural and historical resource of the territory. The following systematization of the territories, reflected in the enclosed plans, is proposed.

Protected territories for preservation of the cultural and historical heritage, comprising the following six sub-types of protected territories:

- Territories subject to specific planning protection. These areas feature specific conservation regime – *reserves*. This group comprises the *Serdika-Sredets* Historical and Architectural Reserve, the “*Borisova Gradina*” and the Boyana Church.
- Territories subject to preventive planning protection. These territories possess the statute of protective areas of the respective reserves..
- Territories of groups of sites of immobile cultural and historical heritage and their security zones, not subject to the regime of reserves.
- Territories of monuments of gardening and park layout art, not subject to the regime of reserves..
- Protected territories of isolated archeological sites outside the boundaries of human settlements
- Protected territories around groups of concentrated archeological sites outside the boundaries of human settlements
- Set apart territories within the boundaries of the human settlements containing real estates under regulation containing monuments of culture on the plot.
- Territories featuring characteristic settlement structures. These areas feature cultural and historical identity (architectural, urbanistic, landscape, historical) – for instance the peripheral areas of the compact city and certain settlement structures outside it. .

The above eight territories for monuments of the cultural and historical heritage are regulated by the currently enforced legislation in their capacity of valuable environments, whose cultural value needs legal and planning protection. In addition, the plan lays emphasis on three more types of valuable settlement spaces featuring precious structural qualities, cultural landscapes and cultural itineraries. For that reason it is proposed to incorporate additionally three types of territories:

- Territories of settlement spaces possessing valuable structural characteristics – scale, relationship with the surrounding nature environment, silhouette etc., which should be preserved. The Concept Paper proposes in general compliance with the nature and boundaries of the settlement structures.
- Territories of cultural landscapes without the statute of monuments of gardening and park layout art, identified in the concept papers about the System “Recreation” and the “Green System” as “theme parks”.
- Territories of cultural itineraries – the destination along the radial historical roads, whose vitality has not vanished through the centuries.

• Formation of a system of protected underground and surface public spaces and structures in the compact city

The Concept Paper defines the following integral urban cultural and historical systems and elements (Refer to the plans in scale 1:5 000)::

- Spatial structures possessing high cultural and historical resource.

specific, historically established integrity and comprising emblematic sites of the immobile cultural and historical heritage of strong aesthetic and emotional potential, representing emphases of the “City’s memory” of symbolic value (about 30 sites complying with this requirement have been selected). The indicated spatial cultural and historical structures comprise also specific systems of cultural and historical sites (marked on the respective plans), such as: industrial heritage and memorial artistic synthesis, which enrich the cultural and hisitorial values of the Central City Part.

- A system of outdoor cultural and historical public spaces (streets and squares, historical parks and gardens), whose integrity and parameters should be protected.
- A system of underground cultural and historical public spaces, demonstrating the historical urban stratification. In the Central City Part they are localized above all on the areas of the *Serdika-Sredets* Historical and Archeological Reserve and the Necropolis. .
- Connecting/contact system of elements, ensuring spatial communication between the surface and underground structures, which very often has in its own right a certain cultural and historical potential (for instance the pedestrian subways at the Central Department Store and the Presidential Headquarters).

The above indicated spatial cultural and historical structures have a specific importance for the aesthetic and compositional outline of the Central City Area. They define the basic canvas of the volume and spatial composition of the city centre, the major compositional axes and focal points of strong emotial and aesthetic potential, the panoramic perception of the urban and nature view, the picture of Sofia by night etc. (duly marked on the respective plans).

• **Nomination of the Historical Centre of Sofia for incorporatin in the List of the World Cultural Heritage**

In compliance with the above presented assessment of the cultural and historical resources of the territory as presented above, the historical centre of Sofia possesses “exclusive universal value” in terms of the criteria, listed in the *Operational Guidelines for the Implementation of the World Heritage Convention* and may be nominated for incorporation in the List of the World Cultural Heritage. Its cultural value is “intrinsic”, according to the definition in the siad document, i.e. its incorporation in the List is only a potential opportunity. Political will, backed by consecutive urban strategy for conservation and development of the cultural heritage, are a must for realization of this opportunity.

On these gounds the Concept Paper proposes the nomination of part of the historical centre of Sofia to be one of the primary objectives of the spatial development till 2010. The analysis of the cultural and historial rsources has allowed to define the scope of the territory, which possesses cultural and historical value complying with the “World Heritage” status. This is the area of the two peak cultural and historical modules, linked along axis *Batemberg Square – Tsar Osvoboditel* Blvd. The Concept Paper contains one very first version concerning the boundaries and the buffer zone of this territory in compliance with the requirements of the World Cultural and Nature Heritage Convention.

• **Working out of a system of protective regimes and plans for preservation of the cultural and historical resource of the territory**

The Master Plan of Sofia Municipality proposes a system of planning regimes for preservation of the cultural and historical resource and the appropriate management plans.

The plan defines the structure of the different types of regimes, their typology and their basic territorial parameters. A specific characteristic of the regimes for preservation of the territories for monuments of the cultural and historical heritage is that they may be enforced only under the terms and procdures of the Law on Protection of the Monuments of Culture. From that point of view the herein proposed regimes belong to two categories:

- Regimes, which apply the currently applicable parameters by virtue of the regimes currently in force under the terms and procedures of the Law on Protection of the Monuments of Culture and affecting the regulated territorial scope of the indicated protected areas and the provisions in that respect laid down in the enforced regulations and guidelines.
- The other category comprises a proposal for sanctioning of territories under the terms and procedures of the Law on Protection of the Monuments of Culture, motivated by the real value of the respective areas and the need to protect their parameters.

• **Formulation of a strategy for integrated conservation**

The strategy should comply fully with the requirements for integrated conservation, which means coordinated efforts in the field of archeological investigations, conservation and spatial planning in compliance with the European conventions retified by Bulgaria. To this end the Concept Paper proposes elaboration of a Conservation Master Plan for the System “Cultural and Historical Heritage” for the time horizon by 2010, compiled with the joint efforts of archeologists, conservation experts and experts in urban planning. The Plan should outline the strategic directions for architectural conservation and archeological conservation coordinated with the phases of archeological investigations, exhibition and maintenance of the monuments and emergency measures in the event of averages.

4.7.2. Concept about the utilization and development of the System “Cultural and Historical Heritage”

The spatial planning concept develops the forecast directions for realization of the role of the System “Cultural and Historical Heritage” as a resource-incentive for the attainment of the major objectives of the Master Plan and hence the general spatial development of the city of Sofia and Sofia Municipality.

The concept proposes systematization of sites, spaces, requirements etc. from the functional systems, which in the process of elaboration of detailed urban plans should be taken into account and exhibited.

The manufacturing (engineering) and industrial buildings-monuments of culture, defined as “Industrial heritage”, whose valorization and new commissioning in operation would help enhance the functional and spatial qualities of the system “Work” are as follows:

In the Central City Area:

The fire squad building, situated on *Rakovski* St./the corner with *Iskar* St., box 12, no study available to date, municipal property.

The building of the Sofia Customs House, (year of construction 1936), situated on 84, *Veslets* St., box. 61 (a complex comprising warehouses and other buildings), possesses a passport, state-owned;

Tramway Depot Complex, (year of construction 1901), situated on 84, *Maria Louisa* Blvd ./the corner with *Klokotnitsa* St., boxes 55 and 56, no study available, municipal property;

Complex of three industrial and commercial buildings (former vegetable exchange) (1940), 131, *Hristo Botev* Blvd./the corner with *Slivnitsa* Blvd., box 67, restituted private property.

Makedonia Brewery (the old building, year of construction 1908), 115, *Kozloduy* St. /the corner with *Slivnitsa* Blvd., box 69, possesses a passport, unclear ownership rights.

Tsigarena Fabrika (Cigarette Factory) Complex (1927), 24, *Layosh Koshut* St. /the corner with 20-ti April St., box 310, possesses a passport, property of *Bulgartabak* Holding.

Proshekovo Pivo Brewery, (1906), *San Stefano* St ./the corner with *Sheinovo* St., box 347, no study available, restituted private property.

Avram Chalyovski Sugar Products Factory (1898 and 1914), 41, *Otets Paisii* St., box 41, restituted private property.

The Rag Fair Building, currently Stochna Gara, (1930), *V.Levski* Blvd./ *Slivnitsa* Blvd., box 713, no passport, unclear ownership rights.

In the city of city-districts of Sofia outside the Central City Area:

Zaharna Fabrika (Sugar Factory) architectural building and industrial complex (1897-1898), *Ilinden* Municipality, scientifically motivated proposal for renovation, mixed property rights - the municipality, the Ministry of Agriculture and private. *Zaharna Fabrika* is proposed to be adapted for a Multi-media Centre “Sofia and the European Cultures”.

Sredets Factory (former **military engineering factory**) (1910-1920), *Krasno Selo* Municipality, *Totleben* Blvd. /opposite *Pirogov* Emergency Hospital, no study available, unclear ownership rights.

Buildings of the arms manufacturing workshops in the Pogrebite Park (1904), *Lozenets* Quarter, near the *Loven* Park, no study available, almost in ruins, restituted private property.

Bulgarska Koprina Complex (1900), *Vitosha* Municipality, *Knyazhevo* Quarter, *Knyazhevska* St./the corner with *G.K.Dimitrov* St., no study available, unclear property rights.

On the territory of Sofia Municipality, outside the compact city:

The village of Pancherevo, Hydro-electric Power Plant, (consisting of the main industrial and administrative building and a water tower, 1900), *Pancherevo* Municipality, no study available, municipal property.

The village of Pancherevo, Hydraulic Works (1900), no study available, municipal Property.

Preservation of the folk art handicrafts and traditional economic activities in the human settlements on the territory of Sofia Municipality by ensuring succession through development of specific local manufactures, creating additional employment opportunities.

The renewal of the industrial zones on the area of *Sofiyska Sveta Gora* (Sofia Holy Forest) (*Buhovo*, *Seslavtsi*, *Kremikovtsi*, *Lokorsko*) should become a priority in order to prevent distortion of the future cultural itineraries and the precious cultural heritage of these territories.

- Use of the system “**Cultural and historical heritage**” as a resource for sustainable cultural tourism without violation of its cultural value. To this end integration of the system “Cultural and historical heritage”

- in the proposed system of theme parks for recreation is proposed, enriched by the system of local cultural itineraries, connected with the large European cultural corridors.
- The following main **thematic cultural itineraries** of national and European significance, passing through the areas, have been identified in the specialized studies on the cultural and historical heritage in connection with the Sofia Master Plan:
 - Cultural itinerary *"European routes of the orthodox monachism"* – along the south-north axis Greece-Macedonia-Bulgaria-Romania-Russia, comprising Sofiyska Sveta Gora (The Sofia Holy Forest) and the prominent religious centres on the territory;
 - Cultural itinerary *"European antiquity"* – along the ancient diagonal Istanbul-Edrine-Plovdiv-Sofia-Belgrade, comprising the *Serdika-Sredets* Reserve and archaeological sites on the area of Sofia Municipality;
 - Cultural itinerary *"European fortresses"*, comprising ancient and mediaeval fortress walls on the area of the reserve and sites in the surrounding area (for instance the *Urvich* Fortress);
 - Cultural itinerary *"European traditional architecture"*, relatively underrepresented on the area.
 - An important issue in connection with this is the implementation of the contacts between the European network of cultural itineraries and the identified territorial macro-structure of the local system of cultural heritage.
 - Construction of a Multi-media Centre "Sofia and the European Cultures" in Zaharna Fabrika (the Sugar Factory) is proposed with the aim to establish a multi-media "bridge" between the local cultural and historical system and the European ones along the ancient diagonal Istanbul-Edrine-Plovdiv-Sofia-Belgrade, destination Europe
 - Construction of an Ethnographic Village – "Bulgarian traditional house" Museum in the open is proposed (between the villages Balsha and Katina), which will compensate the insufficient potential of the territory on this theme and will present in a synthesized manner the national wealth of values in traditional architecture
 - A system of local cultural itineraries is proposed, offering a linkage of the territorial system of cultural and historical heritage: radial links (along the indicated historical axes) and circular links (along the Ring Road, following the local cultural and historical agglomeration). Elements of visual communication are proposed at the points of intersection of the system of local itineraries with the European cultural corridors.
 - Territories with regimes of cultural landscapes, adapted to alternative tourism are proposed for recreation in the system of theme parks.
 - A system of urban cultural landscapes, supplementing the system of outdoor public spaces is proposed in the compact city as part of the proposed under the system "Recreation" theme park "The Green Memory of Sofia".
 - The development of the system "Recreation" in the extra-settlement territories will take account of the location of the monuments of culture as sites of cultural tourism.
 - Enrichment and supplementing of the urban system of centres through a series of specialized information centres in connection with the cultural, historical and aesthetic potential of the territory, namely:
 - Main specialized information centres about the cultural and historical heritage of the territory: Southern Centre – in the Guest Building of the Boyana Church, and Northern Centre – in the Ethnographic Village;
 - Secondary specialized information centres about the cultural and historical heritage, situated along the northern arch of Sofiyska Sveta Gora, where the concentration of cultural values is extremely high: in Novi Iskar (motifs: to support the local cultural itinerary, which starts at the town centre in the destination of Svoge, to take up the function

of the future Main Specialized Information Centre in the Ethnographic Village; to promote the development of the centre of the emerging Village) and in Lokorsko – a visitors centre related to the local cultural, historical and nature heritage;

- Information centres about the cultural and historical heritage integrated with the five public information centres, proposed under the system of town centres on the social infrastructure

4.7.3. Directions for management of the System "Cultural and Historical Heritage"

- Upgrading of the system of management of the activities related to protection of the cultural and historical heritage at the local level through optimum deconcentration and decentralization of management.
- Defining and regulation of the system of regimes and plans for protection of the cultural and historical heritage.
- Elaboration of a strategy and approval of a programme for development of cultural tourism on the territory, optimization of the links among the structures related to "Culture" and "Tourism".
- Promotion of new alternative sources of funding for the activities related to protection and development of the cultural heritage.
- Upgrading of the systems for protection of the cultural heritage in their three aspects: *legal protection, contractual protection and traditional protection*;
- Upgrading of the database about the cultural heritage on the area of the city of Sofia and Sofia Municipality – creation of a database in connection with the European programme HEREIN.
- Preparatory work for the nomination of the Historical Centre of Sofia for incorporation in the List of World Cultural Heritage.
- Application of principles and rules for "integrated conservation", especially on the territory of the Central City Area; coordination of the activities on archaeological investigations, conservation and urban planning..

4.7.4. Conservation and development of the cultural and historical heritage

On the basis of a Decision of the Expert Council of the National Institute on Monuments of Culture (Protocol No. 3/29 February 2008) the following recommendations of technical nature have been reflected in the graphical part of the Final Draft-Amendment to the Master Plan:

- Changes of the boundaries of the groups of sites with monuments of culture (ПК) – "Journalists' Quarter" and "Zone Г-14";
- On the drawing in scale 1:10 000 have been entered the existing single (wherever possible) and grouped monuments of architectural and building art on the area of the *Serdika-Sredets* Architectural and Historical Reserve.
- All the green areas identified as monuments of park-and-gardening art on the territory of Sofia Municipality are marked by a contour.

It should be noted that the preservation and development of the green areas identified as monuments of park-and-gardening art is covered in detail under Item 4.5 – "Green System".

Although the proposal made in the 2003 Master Plan to nominate the historical centre of the city of Sofia for incorporation in the List of World Cultural Heritage is viewed with skepticism by some professionals in that domain, this proposal has been retained in the Amendment to the Master Plan.

4.8. TRANSPORT COMMUNICATION INFRASTRUCTURE

4.8.1. Current state of the transport communication system

Republican road network

The transport communication system of the city of Sofia is a consequence of its location as an international crossroads of trans-continental and regional links in east-west and north-south direction.

Three European infrastructure corridors intersect in the Sofia Plain:

European Transport Corridor No. 4 (Dresden – Prague – Bratislava – Budapest – Craiova – Sofia – Plovdiv – Isnabul, with deviation from Sofia to Blagoevgrad – Kulata – Thessaloniki)

European Transport Corridor No. 8 (Durrës – Tirana – Skopje – Gueshevo – Kyustendil _ Pernik _ Sofia – Plovdiv – Burgas _ Varna)

European Transport Corridor No. 10 and Trans-European Highway (Belgrade–Sofia–Istanbul), which are of particular importance for the future development of the infrastructure networks in the city and the municipality.

Currently, the major connections of Sofia Municipality with the country are effected by the following highways and Class A roads:

Highways:

A-1 – *Trakiya* Highway

A-2 – *Hemus* Highway

Class A roads:

I-8 /E 80/

I-1 /E-79/

I-6 /E 770/

Municipal road network

Besides the above mentioned main routes, impact on the transport connections of the region have also the Class II, III, IV and V roads.

The most important among them are as follows:

Ring Road II –18, Sofia – Samokov II 82, Sofia – Iskar Gorge II – 16, Sofia – Petrohan – Lom II – 81, Sofia – Bistritsa III 181 and Sofia – Bankya III 802.

The municipal road network comprises the Class IV and Class V roads, the more important among which are as follows: Sofia – Lozen IV 18079, Sofia - German IV 18091, Sofia – Simeonovo IV 18108, Sofia – Voluyak, Mramor, Mirovyane, Balsha, Podgumer, Voynegovtsi, Lokorsko, Kremikovtsi, Gorni Bogorov, Krivina etc.

As a whole at this stage the road network is developed rather in a quantitative aspect than in qualitative aspect, i.e. it is not adequately maintained.

Street network of the city of Sofia

The total length of the street network is about 3,400 km, while the main street network is 428 km long. The main street network has circular-radial structure.

According to the classification of the existing main street network of the city of Sofia it comprises the following:

- **Class II (city main roads)** of a total length 134 km
- **Class III (city-district arteries)** of a total length 139 km. The account for the major part of the street network, which ensures local transport connections between the individual city-districts and conducts the traffic to the higher classes of roads. Currently they are also the major carrier of the mass public passenger transport.
- **Class IV (main streets)** of a total length 154 km. They services the main city centre and the secondary city centres together with the city-

district arteries. .

Density of the main street network

For Sofia the general density is 2.53 km/km² at 428 km total length and 167 km² total area of the main street network. The density in the Central City Area is 4.63 km/km².

According to the norm requirements (*Norms for Planning and Design of Transport Communication Systems in Human Settlements*, Art. 13, Paragraph 2) the density should be as follows: 3-4 km/km² for the whole urban areas, 4-6 km/km² for the central city area, and minimum 2.5 km/km² for the rest of the territories of the individual zones. This indicates that the total density for the urban area should be increased through further construction of the main street network.

A typical case in the cases of development (incorporation) of new territories to the compact city of Sofia in the recent decade is the lagging behind of the pace of construction of new routes/streets of the main street network. The synchronization between the institutions involved in urban planning, which is a mandatory condition for the functioning of a city, has been undermined. The failure to implement some routes of major importance, having a structure-defining role for the city, hold up the conducting of the traffic flows and obstruct the normal functioning of the urban structure.

In addition it should be emphasized that a large number of the streets of the main street network are not built to the necessary dimensions (the cross section) as per their functional designation. It has been noted the routes of Class I – high-speed city highways – do not exist.

The poor state of the pavements and the sporadic parking in the active lanes of the streets cause additional dramatic diminishing of the throughput capacity of the main street network and hence grave traffic problems. The absence of widening at the funnel part of the crossroads and lay-bys at the stops for the mass public transport also has a negative impact on the throughput capacity. .

It is worth noting that the obsolete system of organization of the urban traffic is inefficient and needs upgrading for the purposes of ensuring higher throughput capacity of the routes and crossroads depending on their load at the different hours of the diurnal cycle. Introduction of an “Intelligent system for traffic control in the city of Sofia” is urgently necessary.

Motorization and car utilization rates and parking arrangements

Automobile traffic creates the main traffic problems in human settlements and especially in the capital, since it accounts for the predominant share in the composition of the traffic flows along the main street network.

The table below illustrates the increase of motorization by years:

Year	Cars	Pick-ups	Trucks	Trucis with trailer	Special freight vehicles	Frieght vehicles total	Busses	Popula-tion	Moto-rization per 1000 inhabi-tants.
1988	249 365	1 559	13 454	1 175	3 643	19 831	2 715	1 217 024	205
1989	265 926	1 846	15 981	1 300	4 149	23 276	2 993	1 208 743	220
1990	288 255	2 097	18 225	1 436	4 651	26 409	3 192	1 202 877	240
1991	300 886	2 175	20 614	1 778	4 861	29 428	3 403	1 198 799	251
1992	326 406	2 175	23 498	2 107	4 958	32 738	3 639	1 189 641	274
1993	357 850	2 177	26 888	2 437	5 143	36 645	3 948	1 188 563	301

1994	384 816	2 177	29 568	2 715	5 308	39 768	4 170	1 191 743	323
1995	405 104	2 177	31 840	3 143	5 442	42 602	4 344	1 192 735	340
1996	422 424	2 177	33 467	3 322	5 557	44 523	4 515	1 189 043	355
1997	432 050	2 177	34 581	3 743	5 660	46 161	4 649	1 190 547	363
1998	439 650	2 177	36 059	3 922	5 838	47 996	4 844	1 192 085	369
2001	509 080	-	-	-	7 064	56 083	7 125	1 176 000	433
2003*	575 874	-	-	-	-	59 980	5 847	1 208 930	476
2005**	615 425	-	-	-	-	77 164	6 866	1 231 622	499,7

Source: Ministry of Interior:: * by 28 February 2003.

** by 31 December 2005

Resultion of the problems of traffic jams may be sought in the following directions:

- Further construction of major routes of the main street network and the city-district street network – increase of the cross sections and development of new sections;
- Construction of a polycentric system of the city of Sofia;
- Construction of stabilized by-pass routes, which re-direct the vehicle flows outside the human settlements;
- Release of active lanes of the main street network from unorganized parking and its orientation towards a system of parking areas and garages;
- Policy for attraction of the passenger flow to the mass public passenger transport;
- Efficient use of the possibilities for organization of traffic.

Because of the steadily increasing motorization and utilization of cars the problem with parking areas, especially in the city of Sofia, becomes ever more topical and difficult to resolve.

The unorganized and chaotic parking creates ever graver traffic problems, increases the hold-ups of the traffic flows and aggravates dramatically the economic efficiency from the traffic organization along the main street network of the city of Sofia. In this context would be appropriate to outline measures for resolution of the problems, however of a type that does not simply involve limitation of transport accessibility. All studies conducted so far reveal that the centre of the city of Sofia because of its saturation with activities and jobs attracts and generates ample traffic and passenger flows.

A basic conclusion, which may be drawn, is that the resolution of the parking problem, especially in the Central City Area, should be sought in many different directions:

- through construction of multi-storey parkings – garages;
- intensive use of the urban plots through introduction of modern parking technologies – lift- and elevator-equipped automated garages;
- through spatial re-organization of the functional potential of the Central City Area and is de-concentration;
- through search for opportunities for utilization of the inner-quarter spaces;
- through ban on the use of the existing garages for other types of activities;
- through construction of buffer parking areas around the Metropolitan stations after the construction of the Metropolitan network, as well as near the big bus terminals;
- construction of parking areas in the zones for recreation and entertainment;

- intensive utilization of the existing parking places through a regime of short-term parking;
- implementation of effective control on parking;
- complying with the norms for construction of the necessary number of parking places in the cases of construction of new public buildings; the investment for these should be ensured from private capital, municipal investments or mixed partnerships;

Entry, exit and transit traffic to and from Sofia

The study of the entry, exit and transit traffic in the city of Sofia has been performed in the form of a survey “Origin-designation” of the five main entry and exit points of the city outside of the Ring Road (Please, refer to Table No. 1 – Entry, exit and transit traffic).

The most loaded routes continue to be the following (which corroborates the findings of the previous study):

Hemus Highway;

Trakiya Highway;

Road I-1 (E 79);

The major transit flows are between the three above mentioned destinations and load the Southern Arch of the Ring Road.

A certain reduction of the freight transit has been observed, which is nevertheless high and varies in the range of 20 per cent to 40 per cent of the freight traffic.

The percentage of TIR transit is very high – 40 per cent to 70 per cent.

The zone of active impact of Sofia is outlined.

Данни за трафика по въходно-изходните магистрали на гр.София за 2005 и 2007 год.															
Год.	Вход	Изход	Всичко	Км. пол.	От км.	До км.	МПС	Лен.	BUS	Г. тов.	Ср. тов.	Г. тов.	Г.пр.	ТОВ	МПС
2005	Път. София-Кюлата (I-1)	Г	53	286.275	285.660	286.847	1338	16522	1047	1335	1131	1093	1549	5119	24015
	Път. София-Драгоман (I-9)	Г	209	25.895	12.692	29.300	509	2004	297	361	454	281	924	2020	4830
	Път. София-Петрохан (II-81)	Г	8	72.822	72.700	76.100	449	2176	66	388	249	127	47	811	3502
	Път. Нови Искър-Мезара (II-19)	Г	7	54.777	51.615	67.680	372	1085	119	131	127	151	86	497	2073
	Път. София-Варна (AM "Хемус")	Г	212	31.3	0.000	38.800	1329	12389	548	1363	1228	345	2670	5606	19972
	Път. София-Горна Малина (I-6)	Г	28	163.45	159.800	179.154	359	1348	160	256	196	147	206	810	2617
	Път. AM "Тракия"	Г	202	14.000	0.000	34.400	1703	11611	532	1159	978	197	2088	4422	18258
2007	Път. София-Кюлата (I-1)	Г	53	286.275	285.660	286.847	1368	16953	977	1356	1142	1042	1579	5119	23407
	Път. София-Драгоман (I-9)	Г	209	25.895	12.692	29.300	427	1852	287	345	383	293	901	1912	4478
	Път. София-Петрохан (II-81)	Г	8	72.822	72.700	76.100	456	2590	72	422	272	133	60	887	4005
	Път. Нови Искър-Мезара (II-19)	Г	7	54.777	51.615	67.680	365	1119	123	119	133	185	134	571	2176
	Път. София-Варна (AM "Хемус")	Г	212	31.3	0.000	38.800	1696	13716	473	1625	1662	610	3172	7269	23154
	Път. София-Горна Малина (I-6)	Г	28	163.45	159.800	179.154	464	1512	96	404	406	345	350	1505	3577
	Път. AM "Тракия"	Г	202	14.000	0.000	34.400	1670	13491	680	1450	1214	391	2506	5361	21182

* Submitted by Sofia Police Directorate – Ministry of Interior, “Traffic Police” Department

- Southwest destination: very strong influence of the city of Pernik - more than 60 per cent of the total entry and exit traffic flow;
- Southeast destination (*Trakiya* Hoghway) – about 50 per cent of the flow goes up to the city of Plovdiv;
- Northeastern destination (*Hemus* Highway) – about 50 per cent of the flow goes up to the cities of Pleven and Lovech plus a small share of correspondences up to Vratsa, Montana and even Vidin.

Mass public passenger traffic. Analysis of the current state and the material and technical base.

Tramway transport

Four tramway depots exist on the area of the capital. They occupy areas of the following sizes:

- *Klokotnitsa* tramway depot: - 17 275 m²;
- *Banishora* tramway depot: - 63 875 m²;
- *Krasna Polyana* tramway depot - 64 000 m²;
- *Iskar* tramway depot: - 86 640 m²;

The tramway network has a total length of 153.6 km. Of these 90 km are double-track lines, including 24 km with track width 1 435 mm and 66 km with 1 009 ; track width. The tramway transport services 17 tramway routes (2005).

A total of 200 street cars run along the tramway routes during the peak hours, and the total fleet of street cars is 402 (the number is changing with the time).

The tramway network is developing in the direction of construction of routes with track width 1 435 mm along all the routes, which will remain in use during the next 20 years.

Trolley bus transport

There are two trolley bus depots and one shed in the city of Sofia. The length of the trolley bus contact network is 97 km. The trolley bus transport services 9 trolley bus routes (2005).

The total number of trolley buses running on the trolley bus network during peak hours is 117. The total inventory number of trolley buses is 216. Their distribution by depots is as follows: =====

Bus transport

In 2005 the total length of the routes serviced by the 45 currently operating city bus lines is 502 km..

Sofia Metropolitan

Currently the Metropolitan is operating up to Station No. 8 of the first Metropolitan line with a total route length in one direction 10 km.

Metropolitan depot Lyulin was built for the needs of the first Metropolitan line and has a total area of 40 470m², including 28 730m² garage area and 11 740m² service area. The capacity of the depot is 200 wagons.

It is envisaged by the end of 2008 to finish the construction of the first Metropolitan line up to Station No. 10 at Interpred.

Shuttle mini-buses

The shuttle mini-buses (48 lines by 2002) are a supplement to the system of regular mass public passenger transport. A total of 368 vehicles operate at intervals of 10-20 minutes. They complement very well the major systems by taking up about 4 per cent of the passenger flow. What is more, they cover also some more distant destinations like Rudartsi, Vladaya, Bankya, Zhiten, Novi Iskar, Mirovyane, Podgumer, Chepintsi, Seslavtsi, Yana, Buhovo, Krivina, German, Lozen, Kokalyane and Bistritsa.

Structure of trips by mass public passenger transport

According to data of the NSI – Sofia Office of Statistics - the share of the

different transport systems of the mass public passenger transport in the transportation process is as follows: :

2005 - transported passengers in thousand people	
buses	- 119 776
tramways	- 57 347
trolley buses	- 232 933
Metropolitan	- 25 181

In perspective it is reckoned to be feasible for the Metropolitan to be the primary carrier and the backbone of the system of mass public passenger transport. As the next hierarchic level it is logical to rely on the tramway system, developed to perform feeder functions to the Metropolitan stations as well as passenger transportation at longer distances.

The trolley bus transport should be used for feeder functions to major points for interchange and being a more environmentally friendly mode it is envisaged to replace some of the bus lines with proven full-day load.

The system of mass public passenger transport should operate as a unified unit, whereat the hierarchy ranking should be as follows: railway, Metropolitan, tramway, trolley bus, bus.

Intercity bus transport

On the area of Sofia Municipality operate eight bus terminals, which service bus lines of the Republican transport system.

Air transport

The key site of the air transport infrastructure, situated in immediate vicinity to the city of Sofia on the strategic intersection of three Pan-European transport corridors, is the Sofia Airport.

The airport traffice in mainly international. Connections by air are provided to different parts of Europe, North America, Africa and Asia as both regular passenger flights and charter passenger and cargo flights.

The take-off and landing runway is 2 000 m long and 45 m wide, covered with asphalt-concrete. The ruling pathways are 7, each 14-22 m wide, covered with asphalt-concrete or concrete. In its present location the main connections to the airport are currently effected via Bussels Blvd. The public transport service is provided bus line No. 84.

At the beginning of 2007 the building of the new passenger terminal with the aircraft platforms and the new runway with the pathways for rolling of the planes was inaugurated.

The new runway is 3 600 m long. The frontline saction and end safety pathways as required by ICAO (Annex 14.3.1.9) are envisaged, as well as 45.00 m ПИК width. The current capacity of the airport is estimated at 4 million passengers.

Passenger chair-lifts and roads orividing access to Vitosha Mountains

The roads used by visitors for rapid access to the mountain by car or public transport are two:

- Boyana-Zlatni Mostove (9.5 km long asphalt road); and-
- Dragalevtsi-Aleko Chalet (14 km long).

Passenger lifts:

The cable lifts for quick and easy access to Vitosha Mountains are as follows:

- Knyazhevo-Kopitoto cabin lift.
- *Dragalevtsi-Bay Krastyo-Goli Vrah* twin-seat and two-stage chair-

- lift
- Simeonovo-*Aleko* Chalet cabin lift

There are two skilifts in the area of *Aleko* Chalet:

- *Romanski-Malak Rozen Vrah* twin-seat skilift for skiers and tourists mounting to Cherni Vrah
- *Akademika* three-seat skilift

4.8.2. Objectives of the development of the transport communication system (2003 Master Plan)

The major orbjective of the development of the transport communication system is to:

to create conditions for linkage of the city of Sofia and its area with the European highway infrastructure and transformation of the city into a regional crossroads centre, as well as development of the urban transport system and transformation of Sofia into a modern European metropolis.

The operative achievement of this objective imposes the necessity of preliminary structuring of the *specific objectives of the development* of the transport system and their implementation in two conventional groups:

The first group is oriented directly to the selection of the routes of the European transport corridors and comprises the requirement to create conditions for:

Determination of the location of the corridors taking into consideration the network of national, regional and local road links, railway network and the infrastructure networks and their linkage into a unified system through ensuring maximum saturation of the routes of the corridors with their inherent transportation functions – road and railway transport, power transmission lines, product transmission pipelines;

Localization of economic and service structures along the routes of the corridors, related to:

- maintenance, traffic control and management;
- performance of the inter-modal transport functions of the corridors;
- development of specific activities related to servicing of the transport flows;
- development of specific activities related to maintenance and repair of the transport vehicles;
- development of export-oriented manufactures and services;
- creation of high-tech parks;

Localization along the routes of the corridors of economic and service structures related to:

- maintenance, traffic control and management;
- performance of the inter-modal transport functions of the corridors;
- development of specific activities related to servicing of the transport flows;
- development of specific activities related to maintenance and repair of the transport vehicles;
- development of export-oriented manufactures and services;
- creation and development of high-tech parks.

Linkage of the network of the corridors to the transport network of

the city and the region through:

development of new destinations of the urban transport and feeder infrastructure networks and their linkage to the elements of the corridors; development of the routes of the mass public transport and their linkage to elements of the corridors; construction of multi-storey garages and parking areas connecting the corridors with the main elements of the urban transport system; reconstruction of the existing and creation of new transport connections with the territories of Sofia Region and their linkage with elements of the corridors.

The implementation of these *specific planning objectives* of this phase helps achieve:

maximum urban planning effect for the city;
re-orientation of the transit traffic flows and alleviation of the southern arch of the Ring Road with respect to its role as a main high-speed tangential urban route;
preservation of the major entry and exit routes of the city and development of additional opportunities for entry to the city from the north and via Lyulin Highway from the southwest;
opportunities for localization of inter-modal, logistic and service structures along the routes of the European transport corridors.

The second group of *specific planning objectives* is oriented towards creation of conditions for:

- reconstruction and development of the urban transport network with due account of the fundamental importance of the priority development of the transport function of the Metropolitan;
- construction and linkage of the urban transport infrastructure with the transport elements of the Trans-European corridors and the transport network of the region in a unified transport infrastructure as a condition for incorporation of the city in the local, regional, national and European space;
- promotion of a transition from a monocentric structure of the city towards spatial forms with polycentric character and with radial-tangential configuration of the main street network;
- construction of buffer garages and parking areas near the routes of the Metropolitan, linked into a common system with buffer garages and parking areas near the routes of the transport corridors;
- radical planning solution of the problems of shortage of parking spaces and garages in the compact city;
- development of the railway transport for servicing of the surrounding area and the zone of active influence;

The implementation of these objectives should be achieved through:

Trans-European Transport Corridors:

Situation of the routes of the Trans-European transport corridors as follows:

- Trans-European transport corridor No.10 and Trans-European Highway (Salzburg-Ljubljana-Belgrade-Sofia-Istanbul / Thessaloniki) makes a connection at Slivnitsa with Road I-8 (E 80), runs to the north of Voluyak, to the south of the village of Mramor and joins the northern arch of the Ring Road. Farther, the route of the corridor runs along the northern arch of the Ring Road, whereby to the north of Chepintsi it is diverted and continues in southeastern direction, running to the southwest of Botunets and Yana, and joins *Hemus* Highway. To the east of Sofia the corridor makes a connection between the two highways – *Hemus* and *Trakiya*. The junction into *Trakiya* Highway takes place to the southwest of *Gara Elin Pelin* (Elin Pelin Railway Station).

- The route of corridor No. 4 (Dresden-Prague-Bratislava-Budapest-Kraiova-Sofia-Thessaloniki/Istanbul) is designed with opportunities for phased construction. Phase One is developed under condition that the tunnel transition under Petrohan has not been implemented and the main traffic flows using the bridge at Vidin are oriented in southern direction along *Hemus* Highway. Under this provision the route of Corridor No. 4 to the north of Sofia overlaps with the route of Corridor No. 10. The two routes run together till the deviation of Corridor No. 10. The route of Corridor No. 4 continues till the western arch of the Ring Road, uses the route of *Lyulin* Highway and at the *Tsarkva* junction enters Road I-1 (E 79). During Phase Two (a long-term horizon) the route of the corridor is deviated in southwestern direction from the route of Road II 81 at Beledie Khan. Near Slivnitsa, to the west of Petarch, it makes a connection with Corridor No. 10 and via Road I 8 - a connection with Sofia. After that the route follows the route of the railway Pernik-Voluyak and joins Road I-1 (E 79).
- The route of Corridor No. 8 (Durrës-Tirana-Skopije-Sofia-Bourgas-Varna) follows to one or another extent the routes of corridors No. 10 and No. 4.

The proposed new solutions, situating the Trans-European Transport Corridors in northern, eastern and western direction, are aimed at taking the transit traffic flows out of the framework of the city.

The main entries and exists to and from Sofia are preserved with the only difference that additional opportunities are created for entry to the city from the north and that the entry from southwest is proposed to be effected via *Lyulin* Highway.

Main street network

The structure of the future main street network is strictly hierarchic. The classification of the network and its parameters have been worked out in compliance with the document *Norms for Planning and Design of Transport Communication Systems in Human Settlements* of 11 October 1994. The proposed structure and configuration of the network features the following characteristics;

- it encourages the transition from a monocentric spatial structure of the city to polycentric spatial structure with tangential-radial configuration of the main street network;
- the major entry and exit points are developed further as follows: *Tsarigradsko Shosse* Blvd. from the east and *Botevgradsko Shosse* Blvd. and *Vladimir Vazov* Blvd. from the west and southwest - *Slivnitsa* Blvd. - and *Lyulin* Highway via a by-pass of *Lyulin* Housing Estate;
- development of systems of tangents; this provides an opportunity for high-speed transition of the traffic flows, coupled with their evacuation from the city centre;
- the proposed network features a density of 3.7 km/km² for conducting the traffic..

The functional classification of the forecast main street network comprises the following categories of streets:

- **Class I (high-speed city highways).** They ensure high-speed road connections between the zones of residence and the zones for work, whereby they also provide connections with the roads of the regional road network. The high-speed city highways feature uninterrupted traffic regime, whereby the access of pedestrians to the traffic lanes is banned. Intersection opportunities for vehicles are provided at junction points (at different levels), and for pedestrians – through subways.

The total length is 61.8 km. Class I streets are the northern high-speed tangent and the southern, eastern and western arches of the Ring Road. The adjacent areas are serviced via local lanes.

- **Class II (city highways).** Classified under this category are the entry-exit routes: *Tsar Boris III* Blvd., *Botevgradsko Shosse* Blvd., *Slivnitsa* Blvd., *Lomsko Shosse* Blvd., *Rozhen* Blvd. and several tangential routes – *T.Kableshkov* Blvd., the eastern tangent, the western tangent, etc.

The main city roads ensure transport link among the zones for work and between them and the city centre, with the high-speed city highways and the roads of the regional road network. The intersections are at one level, however, if necessary, junctions are proposed. The city **highways** service a group of city districts and connect the newly proposed 2nd-level centres; crossing major urban spatial units is not allowed. Total length 116.3 km.

- **Class III (district arteries).** They are the basic part of the street network, which ensures local transport connections between the individual districts and takes the traffic to the higher classes of streets.

In the project design they are the major carrier of the mass public transport of the city. The total length of Class III^a streets is 93.4 km and that of Class III^b streets – 210.8 km..

- **Class IV (main streets).** They service the main city centre and the 2nd-level centres together with the district arteries. Total length of Class IV streets: 371.1 km.

The total length of the main street network is 853.6 km.

In the final project design dimensioning of the main street network is made with proposal concerning the class and size of the streets. This has been done after simulation of the traffic and calculation of the forecast loads on both the street network and the mass public passenger transport. The simulation has been performed by means of the German software technology “VISEVA-VISUM” with the laid down forecast parameters for motorization, car use and distribution of trips by types of transport (modal split). Forecast data for development of the systems “Work” and “Residence”, “Tertiary Sector”, “Recreation” etc. by structural units (transport districts) have been used.

Mass public passenger transport

The Master plan proposes priority development of the public transport:

- The *Metropolitan* is proposed to be the main backbone and carrier of the system of public transport. It is becoming the basis of the transport planning organization of the urban territories, taking into account also the structuring role of the Metropolitan stations with respect to the public activity. The plan proposes construction of two major diameters (Metropolitan lines):
- Metropolitan diameter No. 1: Obelya – Centre – Mladost IV (with deviation to Sofia Airport)
- Metropolitan diameter No. 2: Nadezhda – Centre – Manastirski Livadi

The main connection points of the Metropolitan system with the railway network are at Obelya Railway Station, the Sofia Central Railway Station and the newly proposed Druzhba Railway Station. In this way conditions are established for integrated operation of the systems of the Metropolitan and the railways.

The role of the Metropolitan as a main system of the public transport is considerable. It takes up 24.4 per cent of all trips during the peak hours. The maximum load per section per hour is 30 000 passengers for Diameter One and 23 000 passengers for Diameter Two.

- *The tramway system* is further developed and restructured. It performs feeder functions to the Metropolitan and other

modes of long-distance public transport. New routes of a total length of 24 km should be constructed and routes, whose functions will be taken up by the Metropolitan shall be decommissioned. The overall structure of the tramway network will be reconciled with the development of the Metropolitan.

On the basis of the results from the study of the passenger load of the public transport certain corrections have been made along the new tramway routes as compared to the original draft.

- *The bus transport* is developed as a priority for the services of the surrounding area;
- *The trolley bus* is further developed with another 53 km new trolley bus lines. Its main functions are defined as feeder functions. Being an environmentally-friendly transport it is proposed to replace some bus lines with proven daily loading, mainly along the rings.

In the phased plan for development of the transport communication system it is proposed to work out programmes for optimization of the road transport with a focus on its feeder functions to the Metropolitan.

Development of the system of bus terminals

In the final draft a scheme for general restructuring of the bus terminals is proposed, involving closure of some of the existing ones and their shift to new locations. The objective of these changes is related to the attempt to set up a general transport scheme, in which a mutual complementarity and synchronized operational module is sought. The idea is to dismantle some of the existing bus terminals, which are located in the inner parts of the city, and to release this space for other, more attractive activities for the specific area. At the same time, these bus terminals shall be moved to the periphery of the city, close to Metropolitan stations, railway stations and tramway stops. In this way a better linkage will be achieved with the public transport system, the railway network and the Metropolitan. The new location of the bus terminals should contribute to the achievement of the above mentioned synchronization and complementarity between the different modes of transport, while the excessive overloading of the street network by intercity buses will be avoided without any inconvenience for the passengers.

The newly proposed bus terminal locations are as follows: next to the Metropolitan station in Mladost IV, Obelya Railway Station and the Metropolitan Station at the Central Railway Station, on *Botevgrad Shosse* Blvd. next to the last tram stop, and a specialized bus terminal for international trips on the territory of the Sofia Central Railway Station.

It is necessary to develop project design about the location and capacity of the bus terminals on the area of the city of Sofia depending on the destination of the bus lines from the Republican Transport Scheme and their volume.

Development of the urban system of parking spaces

- It is proposed to set up buffer parking areas in the vicinity of Metropolitan stations, bus terminals, railway stations and the airport in order to create opportunities for shift of the passenger flow to the public transport;
- It is proposed also to set up block parking areas on the periphery of the Central City Area. This will create opportunities for mixed trip correspondence (motor car – public transport), which will be particularly needed in the event of orientation towards dispersed development of the city.

The proposals for location of such parking areas comprise:

In northwestern direction:

- at Obelya II Metropolitan station
- at the 3rd Metropolitan station of Metropolitan Diameter One at the intersection with *Lyulin* Highway

In northeastern direction:

- the newly proposed bus terminal at the tramway roundabout
- at Sofia Airport

In southeastern direction:

- at the last Metrololitan station in Mladost IV Housing Estate, jointly with the newly proposed bus terminal

In southern direction:

- at the last Metropolitan station of Metropolitan Diameter II

The envisaged dispersed development of the city presumes increase of the percentage of inhabitants, who would prefer to use their private cars. The setting up of “buffer” parking areas will allow an opportunity for convenient travel through mixed correspondences (motor car – public transport), which will, as already mentioned above, alleviate additionally the urban street network.

Because of the increasing parking problems in the Central City Area, the project proposes meeting the demand of parking areas through setting up parking places for the residents in the areas between the apartment blocks and inner neighbourhood areas, introduction of paid parking along the streets of the Class II streets network for employees and visitors without hindering the traffic. All this will be incorporated as an element of the Specialized Programme for Parking in the Central City Area, proposed for elaboration in the framework of the Urgent Action Plan Stage. A ban on the use of garages for activities other than parking and freeing of the sidewalks from parked vehicles are some of the provisions proposed to be enforced with the Law on the Master Plan..

Concerning the development of the system of bicycle lanes the following is proposed:

- construction of bicycle lanes along all newly designed routes of the street network;;
- construction of bicycle networks in all large residential districts in Sofia;
- construction of bicycle networks in all parks in the capital;
- setting up bicycle lanes along the main street network, linking the bicycle lanes in the parks with those in the residential districts;
- equipment of bicycle parking areas at the Metropolitan stations, public centres and transport nodes.

Air transport

The air transport services the civil air-borne navigation via Sofia Airport, certified as civil airport for public use for international and domestic flights, the Lesnovo airfield, certified to service flights for aviation assignments with air-borne crafts with up to 5 700 kg maximum mass, and the Lozen helicopter field.

On the basis of many years of scrutiny the Council of Ministers has made a decision for reconstruction and modernization of Sofia Airport. It is situated at a distance of 5 km to the north of the centre of the capital and ensures the main access to Bulgaria by air for passengers from the rest of the world - Europe, North America, Asia and Africa. In the period 1995 –1999 a number of studies have been conducted by foreign companies, among which Sir Alexander Gibb and Partners and William Halcrow and Partners. The latest project for development of the airport was developed by the end of 1998 by the NACO Company.

The general development plan, worked by NACO, proposes construction of a new passenger terminal with annual capacity 2.6 million passengers by 2018. After the first stage of implementation of the 1999-2003 Master Plan the terminal will have a capacity of servicing 1000 passengers

during peak hours and 1 million passengers per year. Its modular structure will allow gradual additional expansion depending on the market demand. The plot required for full development of the passenger terminal (time horizon 2018) is 40,180 m² at service capacity 2000 passengers during peak hours. The cargo zone has been dimensioned for 26,000 tonnes of cargo by 2018 and requires an area of 17,555 m². The parameters of the new Sofia airport correspond to the world standards for servicing of Class C passengers and Category III under the ICAO provisions (Document 9184 – AN/902).

The length of the new runway is 3 600 m. The front airport square is linked with *Brussels* Blvd., with a new road link and a multi-storey parking area for 820 motor cars. The shift at some 540 m to the east of the operative section of the runway and its prolongation to 3 600 m provides a more favourable solution to the issue of the aircraft noise impact as compared to the current situation

A new railway connection to the cargo zone of the airport is proposed.

Servicing of the passengers by public transport shall be performed by the Metropolitan and by bus. The project takes into account these plans and is reflected on the principle drawing of the Master Plan of Sofia Municipality. The other airfields – Mussachevo, Bozhurishte and Dobroslavtsi – are proposed to be used for sports purposes (air tourism, parachutism, etc..

4.8.3. Amendment to the Master Plan – final draft in the scope of the transport communication system

Graphic changes of the routes of the main street network, related to the need of improvement of the transport communication system, coordinated with the Working Group, as well as changes included in the programme for construction of sites of the transport and engineering infrastructure till 2010.

- ⇒ Change in the route of the Trans-European Highway within the scope of Sofia Municipality is proposed. After comparison of the two alternative routes – the Northern high-speed tangent and the Sofia Ring Road – with the amendments of the Master Plan it is proposed that the Northern high-speed tangent shall become part of the Republican road network along Trans-European Transport Corridors No. 8 and No. 10. The Sofia Ring Road –the Northern arch – is planned to remain a city highway.
- ⇒ Change of the route of the Western tangent is proposed, since in this way it will service better the territory without entering into conflict with the Western Park.
- ⇒ After detailed transport-communication studies some of the routes of the Ring Road are changed, namely Southern Arch, *Rozhen* Blvd., *Chepinsko Shosse* Blvd. .
- ⇒ New link is proposed from *N. Vaptsarov* Blvd. along the route of the railway and *Srebarna* St., instead of crossing of the Southern Park at the *Vaptsarov* break-through.
- ⇒ Extension of *Tsaritsa Yoanna* Blvd. is proposed, which should run under the Ring Road and be connected to the road destination Dragoman.
- ⇒ The northern by-pass at Knyazhevo is relected.
- ⇒ The transport services provision for the Northern territories is improved.
- ⇒ We propose a Class III artery from *Samokovsko Shosse* Road to the Eastern tangent along the route of the eliminated railway track at *Pioner* Railway Station up to *Hristo Botev* Quarter.
- ⇒ The locations for establishment of additional underground and multi-storey parking areas-garages in the Central City Area and along the main street network are graphically marked on the plan and reflected on the attached to the Amendment of the Master Plan plan-schemes concerning the organization of car parking

and utilization of underground spaces.

- ⇒ Miscellaneous graphic changes and additions related to the further development of the mass public transport, including track-based transport.
- ⇒ The network of the public track-based transport is upgraded further.

Metropolitan

- The approved route of Metropolitan Diameter I in the direction Sofia Airport via *Mladost I-A* Housing Estate and *Druzhba* Housing Estate is outlined;
- Extention of the Metropolitan route from Sofia Airport towards Kremikovtsi;

A high-speed tramway along part of the route of the Metropolitan Diameter III in a long-term perspective is proposed, namely:

- From *Botevgradsko Shosse* Blvd. and the deviation towards Kremikovtsi, making connection with the Metropolitan Route Sofia Airport – Kremikovtsi – *Poduene* Square, continuing underground along *Madrid* Blvd. – *Yanko Sakazov* Blvd. – *Moskovska* St. (via *Pametnik Levski* Square);
- At the intersection of *Tsar Osvooboditel* Blvd. a Metropolitan Station shall be constructed for connection with Metropolitan Diameter I. continuing along *Alabin* St., *Makedonia* Blvd. and *Tsar Boris III* Blvd. destination Knyazhevo.

Development of the Metropolitan network in southern direction is proposed as follows:

- Extention of the Metropolitan route from *Al. Marinov* Blvd. towards *Simeonovo* cable-lift station, then along *Kliment Ohridski* Blvd. via *Malinova Dolina* Housing Estate, *Vitosha* Quarter and along *Cherni Vrah* Blvd. to connection with Metropolitan Diameter II. In this way a “loop” is made between Diameter I and Diameter II, similar to the one in northern direction at *Obelya* Housing Estate.

Tramway transport

New tramway routes are proposed for the purposes of improvement of the transport services on the territory of the city of Sofia, as follows:

- Lyulin Housing Estate. From *Dobrinova Skala* Blvd. via *Pancho Vladigerov* Blvd. – *Cherni Drin* St. – *Vrah Mancho* St. – *3019* St. – *Kukush* St. – *Shtrossmayer* St. up to *Skopije* Blvd.
- In connection with the implementation of the Metropolitan route from *Obelya* Housing Estate along *Lomsko Shosse* Blvd. to the Central Railway Station the following tramway route is proposed: *Obelya Housing Estate* – *Lyutiche* St. – *Beli Dunav* St. – *General Nikola Zhekov* St.- *Parva Bulgarska Armiya* St. – *Rezbarska* St. towards *Vladimir Vazov* Blvd. – *Vrazhdebna* Housing Estate – *Botevgradsko Shosse* Blvd.;
- *Orlandovtsi* Quarter. Extension of the route from *Kamenodelska* St. - *Mara Buneva* St. – *Lazar Mihaylov* St.
- With the construction of the Metropolitan along *Kliment Ohridski* Blvd. it is proposed to entend the tramway route from the crossing of *Simeonovsko Shosse* Blvd. with *Yavorov* Blvd. along *Simeonovsko Shosse* Blvd. towards *Pioner* Railway Station and from there along *Nikola Gabrovski* Blvd. – *G.M.Dimitrov* Blvd. – *Kliment Ohridski* Blvd. – *8th Dekemvri* St. – *Akad. Boris Stefanov* St. – *Prof. Ivan Strenski* Blvd. – *Arch. Stefan Mladenov* St. This route would service part of *Izgrev* Quarter and *Studentski Grad* and make connection with Metropolitan Diameter I.
- It is proposed that the tramway route from *Sitnyakovo* Blvd. via *Poduene* Square should run along *Danail Nikolaev* Blvd. and at

the *Chavdar* Brisge continue along *Dondukov* Blvd.

- It is proposed that the tramway route should continue along *Iskarsko Shosse* Blvd. towards *D. Milenkov* Quarter to the proposed *Vrana* Cemetery Park. .

Bicycle transport

In the programme of specialized studies various project drafts were developed on the theme “Bicycle traffic”, which are based on the following fundamental principles for selection of routes:

- Building of a complete, relatively undisturbed network of bicycle lanes in urban environment;
- Laying of bicycle routes in park environment;
- Utilization of the existing lanes and wide sidewalks for the purposes of rapid implementation of part of the designed routes;
- Possibilities for conflict-free conductance of a network of bicycle lanes with crossing facilities;
- Linkage of the network of bicycle lanes with the exits from the Metropolitan stations;
- Opportunities for construction of changing rooms for bicycle-riders and bicycle-parking areas near the transport services nodes, Metropolitan entrance halls etc.
- Building of independent bicycle lane networks in the housing estates.
- Building of theme bicycle-riding itineraries as linkage routes to the recreation areas in the surrounding area.

In the framework of the 10-year period from 1998 till 2008 schemes and investment projects concerning the bicycle lane network of Sofia at different stages of detailization and completeness have been worked out and unified in an overall scheme of the network.

The objectives of these studies are as follows:

- Promotion of the use of the environmentally-friendly bicycle-riding to the benefit of environmental protection;
- Restoration of the traditions in moving around by bicycle;
- Creation of conditions for recreation and sports for people of all the age groups.

The total length of the bicycle lane network within the construction boundaries of the city of Sofia is about 300 km, including 8.26 km already *in situ* and 36 km for which investment is available wherever necessary.

4.8.4. Railway transport

Analysis of the current state

The railway infrastructure of Sofia represents a complex of spatially localized and functionally interconnected sites of the railway transport system. Its present state is the result of the historical development of the railway system and its facilities for servicing the transit and local traffic of the capital as important transport node and socio-economic centre.

The junction location of Sofia, geographically predetermined by the crossroads location of the Sofia Plain, comprises two railway tracks of international and national significance:

- Pirot-Sofia-Plovdiv-Edirne;
- Thessaloniki-Sofia-Rousse / Vidin / Varna;

and the destination Sofia-Karlovo-Bourgas / Varna of considerable national significance.

As a system of interconnected functional elements, the railway infrastructure of Sofia comprises the following:

- inter-station track sections – current tracks, safety equipment, contact network, communication lines, intercrossings, stops;
- railway stations: tracks, arrows, railway stations platforms, safety

equipment, approaches, intersections, buildings, freight platforms, materials handling mechanization;

- auxiliary railway facilities (depots, factories, yards, etc.);
- industrial railway branches and unloading stations.

The linear railway infrastructure comprises 39 inter-station track sections. Thee total length of the railway tracks (including the Kremikovtsi ring) is 249 km.

There are 27 railway stations belonging to the Sofia railway node.

The industrial railway branches are an important part of the system. They serve as the starting and discharge points of more than 60 per cent of the freight flows to and from Sofia. The industrial railway infrastructure is property of and managed by the respective enterprises and companies. The main finding is that from the point of view of national-level standards the railway infrastructure of Sofia is relatively well developed, however compared to that of other European cities this conclusion is more valid in quantitative rather than in qualitative terms.

The freights transit that passes via Sofia is three times more than that the city itself receives and dispatches (consumes and produces). The relative share of freight transit is steadily growing.

From the point of view of the national-level railway traffic it is possible to make the conclusion that while Sofia “provides” about 3-4 per cent of the railway traffic, it hosts 20 per cent of the transit railway freight traffic of the country (loaded locally and/or abroad).

These conclusions define Sofia as a railway transit centre and one more formal corroboration of the strategic location of the city.

The passenger traffic is defined as urban, suburban, long-distance and international trips.

The urban trips at the current organization of traffic account for some 10 000 passengers per day. This indicates an insignificant use of the railways for this types of trips.

The suburban trips to/from Sofia are those lasting for about two hours in the destination respectively of Kalotina/Stalyantsi, Eliseyna*Mezdra,, Koprivshtitsa, Kostenets and Radomir. .

With a view to the perspectives for construction of high-speed railway lines an assessment of the sub-segment “international railway trips to/from Sofia” is necessary.

Under the current organization they are considered “long-distance trips” and comprise the destinations Nish/Skopije – Belgrade – Budapest; Viena/Munich/Berlin/Warsaw; Thessaloniki – Athens; Edrine – Istanbul; Bucharest – Russia.

Below are presented Table 1, illustrating the amount of passenger traffic for the period 1995-2001 for the indicated railway stations and stops and Table 2, illustrating the freight traffic for the period 1990-2001 for some of the bigger railway stations. .

Table 2.

	FREIGHT RAILWAY TRAFFIC OF SOFIA FOR THE PERIOD 1990 - 2001																	
	Loaded tons						Unloaded tons						Обработени тонове					
Railway station/Year	1990	1992	1997	1998	2000	2001	1990	1992	1997	1998	2000	2001	1990	1992	1997	1998	2000	2001
Voluyak	16 380	2 066	2 845	1 577	3 785	4 511	233 325	92 478	85 065	71 269	29 181	35 238	249 705	94 544	87 910	72 846	32 966	39 749
Sofia	136 676	66 095	37 586	18 336	22 427	14 330	291 485	174 927	173 254	141 786	122 608	109 352	428 161	241 022	210 840	160 122	145 035	123 682
Poduene /Distribution/	127 768	109 661	35 414	36 019	17 626	9 672	416 297	372 923	262 160	100 512	124 314	107 746	544 065	482 584	297 574	136 531	141 940	117 418
Iskar	105 804	47 139	12 255	1 868	42 449	51 350	568 067	313 727	253 276	218 908	147 199	136 831	673 871	360 866	265 531	220 776	189 648	188 181
Sofia North	11 757	14 420	4 848	8 216	11 966	34 581	112 359	45 674	26 480	26 295	15 137	16 128	124 116	60 094	31 328	34 511	27 103	50 709
Iliyantsi	419 936	102 981	15 983	1 570	69 724	38 223	508 149	359 141	164 924	171 280	181 764	155 013	928 085	462 122	180 907	172 850	251 488	193 236
Zaharna Fabrika	111 518	14 542	3 034	1 210	17 054	13 730	411 767	136 584	91 324	61 891	48 518	37 436	523 285	151 126	94 358	63 101	65 572	51 166
Gorna Banya	4 039	2 210	3 244	11 040	1 154	538	78 320	35 551	32 157	28 491	21 301	23 168	82 359	37 761	35 401	39 531	22 455	23 706
Birimirtsi	10 1664	9 123	25 857	400	4 489	27 816	214 761	85 785	90 617	100 069	81 155	109 050	316 425	94 908	116 474	100 469	85 644	136 866
Pioner	21 522	4 763	1 133	400	90	390	167 622	58 172	24 356	57 476	31 945	43 973	189144	62 935	25 489	57 876	32 035	44 363
Bankya	16 834	1 134	320	0	0	0	6 107	5 170	0	3 583	107	0	22 941	6 304	320	3 583	107	0
Sum total	1 073 898	374 134	142 519	80 636	190 764	195 141	300 8259	1 680 132	1 203 613	981 560	803 229	773 935	4 082 157	2 054 266	1 346 132	1 062 196	993 993	969 076
Chain index		35%	38%	57%	237%	102%		56%	72%	82%	82%	96%		50%	66%	79%	94%	97%

Table 1.

PASSENGER TRAFFIC TO/FROM SOFIA						
1995 - 2001						
Railway station/stop	1995	1996	1997	1998	2000	2001
Voluyak Railway station	58 043	61885	33 012	19 958	29 524	12 360
Obelya Railway stop	63 471	58 297	60 300	40 043	19 570	10 900
Vrabnitsa Railway stop	210 802	170 886	141 824	107 447	77 915	31 963
Nadezhda Railway stop	12 428	21 390	23 441	11 592	29 473	16 235
Sofia Railway station	8 002 977	8 136 423	8 809 246	7 043 030	6 175 222	5 384 226
Poduene Railway station	337 314	380 262	387 891	361 646	294 441	280 819
Hristo Smirnenski Railway stop	35 294	34 444	14 925	18 656	56 632	46 210
Iskar Railway station	422 422	446 992	492 751	437 415	273 975	186 791
Sofia North Railway station	183 150	194 482	177 443	175 613	163 911	103 011
Iliyantsi Railway station	21 095	28 808	29 057	27 448	23 374	10 605
Zaharna Fabrika Railway station	341 449	387 783	460 641	398 561	330 021	13 102
Bozhurishte	216 616	202 664	251 813	211 660	214 663	257 892
Bozhurishte	39 390	42 233	24 010	11 154	13 639	8 929
Ivanyane Railway stop	36 534	23 611	17 122	8 068	10 786	4 483
Bankya Railway station	221761	263 950	243 876	78 040	183 124	104 122
Sum total	10 202 746	10 454 110	11 167 352	8 950 331	7 896 270	6 471 648
Bulgarian State Railways total	58 900 000	66 100 000	82 700 000	64 259 542	50 028 511	41 817 462
Relative share of Sofia	17.3%	15.8%	13.5%	13.9%	15.8%	15.5%
Note: Railway station Hristo Smirnenski including also railway stop Poduene Distribution						

Forecast for the development of the railway infrastructure

The study is based on the Final Draft of the Master Plan of Sofia Municipality, completed in April 2003.

The major objectives and concepts of the Master Plan of Sofia Municipality are reviewed in a long-term timeframe.

The subject of the study under this section is the development of the railway infrastructure, which will service and generate traffic, which may be differentiated as follows:

1. Freight traffic:
 - conventional
 - combined transport
2. Passenger traffic
 - urban
 - suburban
 - intercity
 - high-speed

FREIGHT TRAFFIC

The expected amount of freight traffic under the optimistic version is as follows:

Year 2015:	
A) Freight (non-containerized)	1 900 000 t/year
B) Combined	1 600 000 t/year
TOTAL: 3 500 000 t/year	
Year 2030	
A) Freight (non-containerized)	2 700 000 t/year
B) Combined	3 000 000 t/year
TOTAL: 5 700 000 t/year	

The total picture of the freight railway traffic in perspective may be summarized as follows:

– active “planned – market-based” re-orientation of the incoming and outgoing freight flows, which outline a qualitatively new picture by the end of the period – concentration of the freight flows from and to:

- *Ilientsi* Railway Station and *Iskar* Railway Station with their well-developed network of industrial railway branches;
- The railway stations Sofia-Cargo, Voluyak, Gorna Banya, *Zaharna Fabrika* and Kremikovtsi as support railway stations on the territory of the capital;
- Universal terminal for combined freight transport in the area of *Poduyane* Distribution Railway Station (Eastern Area), planned to grow into a centre for reloading activities;
- reservation of land for another terminal for combined freight transport.

PASSENGER TRAFFIC

Unlike the freight railway traffic, for which it has been found that there is no market niche for inner city freight traffic, the situation with the passenger traffic in this segment of the transport market is radically different. There is a great potential for increase of the inner city railway traffic.

Rail transport might become the backbone of public transport because it combines a number of cost-efficiency characteristics:

- high transportation capacity;
- its specific infrastructure (in the majority of cases) ignores traffic jams;
- low relative energy consumption;
- high environment-friendly characteristics and safety.

The following options have been considered:

Option 1: It envisages implementation of inner city trips under the existing organization at the Bulgarian State Railways: through the suburban trains and shuttle schedule from Bankya and Gorna Banya (Pernik). The Sofia Central Railway Station is the starting point and end stop.

Option 2: The Sofia Central Railway Station is the starting point and end stop under introduction of a shuttle schedule for all destinations

Option 3: Introduction of a diametrical scheme, in which Sofia is no more an end (starting) point

Option 4: Introduction of new routes through utilization of the routes of the freight traffic.

The estimated inner city passenger flow is 20,000 passengers per day.

This figure might be somewhat higher in case of better interaction between the different modes of rail transport (railway-Metropolitan-tramway of 1 435 track width).

The technical conditions for such interaction are minimum radius R=190 mm and rolling stock of twin-drive system. This in fact is the so-called “light railway” – a modern and relatively cheap form of perfect interaction in the supply of public transport services..

With respect to the suburban and intercity trips improvement of the quality of the service will be sought in terms of trip duration and comfort. Opportunities will be sought also for deconcentration of passenger flows. To this end it is proposed to construct new passenger end stations *Obelya* and *Druzhba*, situated respectively in the western and eastern ends of Sofia. The Central Railway Station will act as an intermediate station for many of the trains. The implementation of this new technology will require the reservation of a plot for a new technical station, to be situated to the east of *Iskar* Railway Station. The forecast is by the year 2020 to service about 27 000 passengers per day from suburban and intercity trips.

The international passenger trips will be realized along high-speed routes.

traffic in 2005 is expected to be 5,000 passengers per day. After 2015 it is possible to expect active demand for the high-speed transport service in the destinations Belgrade-Sofia-Istanbul and Thessaloniki-Sofia-Vidin (Rousse)-Bucharest. The estimated passenger volume is 18 900 per day.

In the Master Plan of Sofia Municipality a high-speed route is reserved for a twin-track railway line. It is planned to be to the south of the existing main railway line in the section Voluyak – Obelya – Sofia – Poduyane – Druzhba – Iskar – Kazichene – Plovdiv. After Kazichene the route is transferred above the railway line for Plovdiv in the direction Mussachevo and Stolnik. Along the entire length the parameters of the route will allow maximum speed of 160 km/h for the conventional trains with the exception of the sections before and after the Sofia Central Station (100 km/h), where all the trains will stop. Linkage of the high-speed route with Sofia Airport will be realized by a new railway station Druzhba via the envisaged to that purpose section of the Sofia Metropolitan.

Such a link with a Metropolitan station will be realized also at the future *Obelya* Railway Station. The railway from Iliyanatsi via Kremikovtsi to Stolnik is envisaged to be reconstructed for operation at 160 km/h.

Some more significant measures with respect to the future development of the railway infrastructure in a long-term aspect are as follows:

- Construction of a new *Vardar* Railway Station at km 3+495 between the railway stations *Zaharna Fabrika* and *Gorna Banya* (pedestrian connection to *Vardar* Metropolitan station);
- Construction of *Obelya* Metropolitan station with a convenient connection to *Obelya-M* Railway Station;
- Upgrading of the container terminal on the area of Railway Station *Sofia-Freight Transport*;
- Restoration of the operation of the existing railway line from *Chavdar* Bridge to *Birimirtsi* Railway Station;
- Vehicle subway under the tracks of Sofia Central Railway Station for establishment of a connection for automobile traffic from *Maria Luisa* Blvd. (Hristo Botev) to 202nd St.
- Reconstruction of the square before the Central Railway Station and the main building of the station.
- Construction of an inter-modal terminal (on the area of Poduyane Distribution Railway Station – eastern region).

In a more distant horizon (phased and in compliance with the real need of and demand for railway services) is planned implementation of the following activities:

- Construction of a new passenger railway station *Obelya*;
- Construction of a new passenger railway station *Druzhba*;
- Construction of a new engineering railway station *Iskar*;
- Introduction of city railway passenger transport along a diametric scheme;
- Opening of new railway stops at *Obelya-M*, *Ovcha Kupel*, *Stochna Gara*, *Druzhba-M* etc.;
- Reconstruction and upgrading of the railway stations *Iliyantsi* and *Iskar*;
- Opening of upgraded support freight railway stations at Voluyak, Gorna Banya, *Zaharna Fabrika* and Kremikovtsi;
- Construction of second inter-modal terminal on the area of Sofia. The exact location will be determined after specialized study on one of the following platforms: Voluyak, Iliyantsi or Kazichene;
- Construction of additional tracks between the following railway stations: *Zaharna Fabrika* – *Gorna Banya (Pernik)*, *Voluyak* – *Bankya*, *Sofia* – *Iliyantsi*,

- Envisaged construction of a new specific twin-track for high-speed railway destination Voluyak – Sofia – Kazichene – Stolnik/Elin Pelin;
- Change to twin-track and reconstruction for 160 km/h of the Kremikovtsi railway ring (Iliyantsi – Yana/Stolnik);
- Replacement of the existing railway level along the main railway tracks by facilities for two-level crossing with the street network.

Draft for change of the railway infrastructure laid down in the Amendment to the Master Plan of Sofia Municipality

The changes introduced in the railway-transport-related part of the 2003 Master Plan ensue from the real change in the paces of economic development, the launching of different projects under specialized development programmes, new concepts concerning the phased realization and concrete remarks and recommendations submitted by the Ministry of Transport in 2008.

The following more substantial changes have found their place in the plan for development of the railway infrastructure:

- In a short-term horizon a new inter-modal terminal shall have to be constructed in the eastern end of the *Poduyane-Distribution* Railway Station. The design of that site has started as early as in 2007. An advantages of the site is that Phase One will be implemented entirely on plots owned by the Railway Infrastructure National Complex (HK). The project revokes the decision for urgent construction of such a terminal to the east of *Kazichene* Railway Station.
- The existing railway line Birimirts – Poduyane (Eastern Region) along *Rilska Obitel* St. is retained and its shifting to a different location is cancelled. This is a request in the position paper dated 26 March 2008 of the Ministry of Transport.
- The existing routes of the ring railay line of Sofia in the sections *Zaharna Fabrika* – Stan and *Poduyane-Slatina-Pioner* are eliminated. The area of these sections is property of the Railway Infrastructure National Complex, which shall have to decide jointly with Sofia Municipality what shall be the future functional use of these plots.
- Marking on the scheme a new road artery, connecting *Maria Luisa* Blvd. (Hristo Botev) with 202nd St., crossing the tracks of the Sofia Central Railway Station via a traffic subway (tunnel). A feasibility study for that engineering solution nas been worked out (in 2008) and approved.
- Marking on the scheme of the latest design solutions to and from railway junction Sofia for the destination Botevgrad-Mezdra-Vratsa-Vidin at travel speed of 160 kn/h.

4.9. SYSTEM “ENGINEERING-TECHNICAL INFRASTRUCTURE”

4.9.1. Water supply

Principles of construction of the system

The modern water supply of the city of Sofia dates back to 1884, when by virtue of Protocol No. 36/17 July 1884 the Minister of Interior, Petko Rachov Slaveykov, approved the first project for water supply system of the capital. .

Following the approval of Eng. Salbah’s project in 1902 construction of the water supply network in the Central City Area and the Old City. The main water source was water from Vitosha Mountains. Cast iron pipes “Manesman”-type were laid down.

In 1923 a project design under the leadership of Eng. Ivan Ivanov for water supply of the city of Sofia with water from Rila Mountains was worked out. From that point begins the construction of a modern water supply system, ensuring reliable water supply for the city till present.

The system was designed as a closed-loop one. For overcoming of the geodetic level difference of the territory, on which the city is constructed and continues to be built, seven water supply zones have been established.

For each of the zones are built reservoirs, whose operative capacity is designed to provide the necessary water quantities at maximum consumption rate per hour.

Potable water sources

The water sources of the city of Sofia are as follows: *Iskar* Dam, *Beli Iskar* Dam, Vitosha water catchments, etc.

Iskar Dam is a multi-annual leveler with a total storage capacity of 655.3 million m³ (according to data of the Ministry of Environment and Waters). It maintains active storage capacity of 570 -630 million m³. It provides water to approximately 78 per cent of the population. The daily average consumption per capita is 605 (according to data of the Ministry of Environment and Waters). According to the schedules for use of the water of the complex and significant dams in the Republic of Bulgaria it is possible to ensure monthly water supply of the city of Sofia in the range of 13 to 15.3 million m³. The dam is public-state property and is managed by the Dams and Cascades Enterprise with the National Electric Company SP plc.

Along the Passarel derivation the water is conducted to the Pancherevo Water Treatment Plant.

Along the Iskar derivation the water is conducted to the Bistritsa Water Treatment Plant.

Both derivations take their source from the Passarel AK. In the recent years landslides were observed in this area.

Emergency connections have been constructed between the following:

- the Iskar derivation and the Pancherevo Water Treatment Plant;
- the water tower of Kokalyane HPP and the Pancherevo Water Treatment Plant;

Beli Iskar Dam has a useful storage capacity of 15.3 million m³. It was constructed in 1949. The dam is a seasonal equalizer and compensates all river water catchments situated after it. It supplies water along the Rila water pipeline, which has throughput capacity of 2100 l/sec, but it cannot be reached since the designed second pipeline at two of the dykes has not been installed. To date the average discharge rate varies from 1300 to 1500 l/sec. According to the schedules for use of complex and significant dams in the Republic of Bulgaria it is possible to ensure water supply for the city of Sofia at the rate between 1430 l/sec and 1670 l/sec. It provides water for approximately 20 per cent of the population of the city. In 2002 the water-facing side of the dam was repaired. The dam is public municipal property and is operated by *Sofiyska Voda* (Sofia Water) plc. Some local water sources are used for the settlements of the surrounding area as well: the village of Balsha, the village of Dobroslavtsi, the village of Zhelyava, the village of Lokorsko, Vladaya Quarter, the village of Marchaevo, the village of Katina etc.

Local reservoirs exist above Boyana (discharge rate about 50 l/sec.), water catchment on the River Boyanska at the Stone Building in Vitosha

Mountains (discharge rate 150 l/sec.). In reality currently only about 20 l/sec. are used because of the relatively poor water quality.

With the construction of the *Belmeken-Sestrimo* Cascade in dry years additional water quantities may be transferred from the Maritsa Basin via the collection canals *Granchar* and *Manastirski*. By virtue of Disposition of the Council of Ministers of 1983 the larger portion of the water tapped by the water catchments (3.4–3.6 m³) shall be transferred to *Iskar* Dam. According to the design data it may be relied on 85 million m³ transferred water.

The *Skakavitsa-Djerman* Derivation has been designed as part of the Rila Water Supply Complex. The derivation is operating under a specific duty cycle. For the time being water is supplied along it only during spring high water periods. According to design data up to 17.4 million m³ may be transferred along it. Bearing in mind that the facilities are not completed yet and that some of them are in poor state-of-repair, in reality only 12-14 million m³ can be transferred.

For the purpose of procuring spare (alternative) potable water sources in dry years and in the event of shortage of water in *Iskar* Dam it is necessary to maintain the facilities for water transfer from the *Belmeken* Cascade to *Iskar* Dam in proper operating condition.

The *Belmeken-Sestrimo* Cascade in its portion *Granchar* Canal and *Manastirski* Canal and the facilities connected to them are controlled and operated by the *Dams and Cascades* Enterprise with the National Electric Company SP plc. For that reason the maintenance of the above facilities is not included as part of the Concession Contract signed between Sofia Municipality and *Sofiyska Voda* plc.

13 smaller surface water sources are connected with the water supply system of *Beli Iskar* Dam. Three of them are emergency and spare units. The water catchments along the length of the Rila water pipeline should also be maintained in good conditions and be connected to it only in emergency cases or in the event of shortage of water in the *Beli Iskar* Dam.

The emergency water supply source for the city of Sofia is *Kokalyane* Weir. It has active storage capacity of 2.7 million m³, including 900 000 m³ merging capacity. The weir acts as a lower-end equalizer for *Passarel* HPP and is charged by *Iskar* Dam. The equalizing capacity is sufficient to meet several-days-demand.

The surface water catchments are maintained in a relatively good state. The procedure for establishment of sanitary protection zones for all the sources has not been concluded yet.

Sources for conventionally clean water

Water supply for industrial applications

It is provided from potable water sources, ground water from the terraces of the River Iskar and its tributaries and from dams.

The main source of conventionally clean water is the Pancherevo Lake:

- built-up capacity - 6,465 million m³
- available capacity - 6,165 million m³.

Pancherevo Weir has been designed and implemented as a lower-end equalizer of Kokalyane HPP. After 1964 it has been declared as a recreation site and is actively used as such; it performs minimum regulation of the runoff of the rivers Egulya, Planshtits and Vitoshka Bistritsa; It creates favorable conditions for water abstraction for irrigation of the Eastern Sofia Plain.

In addition for these purposes are used waters from *Ognyanovo* Dam, the ballast quarries along the River Iskar valley, draw wells, shafts and quarry lakes.

Ognyanovo Dam was designed by the end of the 1970's. Its total built storage capacity is 44.2 million m³. The maximum charged capacity has been designed up to elevation 626 m - 35.4 million m³. By 31 July 1997 the spillway was charged to elevation 624.50 m., whereat the charged capacity was 31.65 million m³ and the idle capacity is 2.50 million m³. Currently it is privately operated. Its charging started on 11 November 1991. The dam was designed as a complex water reservoir by virtue of Decision dated February 1994 of the Council of Ministers and had been assigned for management by the *Kremikovtsi* Combined Metallurgical Works under complex use of its waters. The necessary feeder pipelines from the dam to the consumers are as yet not fully in place.

According to the schedules for use of the water from the complex and significant dams in the Republic of Bulgaria there exists a possibility for water supply to *Kremikovtsi* Combined Metallurgical Works for industrial applications – monthly supply of nearly 2 million m³ from *Pancharevo* Weir. In summer up to 1.4 million m³ may be delivered to *Kremikovtsi* Combined Metallurgical Works from *Ognyanovo* Dam.

The following major irrigation systems are in place:

- Eastern Sofia Plain irrigation system : 95 260 dca
- Western Sofia Plain irrigation system: 21 720 dca

Sources for potable and conventionally clean water – development opportunities:

Meeting the water consumption demand may be ensured from the existing water sources and some unproblematic new ones (Water economy conditions and water balance of the city of Sofia and Sofia Municipality – April 2003).

Taking into account that *Iskar* Dam is the main water supply source for Sofia Municipality it is necessary to seek alternative water sources in the event of emergency (repair) situation and also in a more distant perspective. For additional and alternative water supply of the city of Sofia, Sofia Municipality and the so-called “Sofia agglomeration” the following water sources have been investigated:

- The river Batuliyska: construction of *Eleshnitsa* Dam and drinking water treatment plant in the area of the village of Lokorsko. Estimated additional water quantities 45-60 million m³/year.
- Ground waters from the Eastern Sofia Plain.
- River Struma waters: transfer of water from the River Rilska valley and River Iskar tributaries. Estimated additional water quantities 250 m³ in an average year.
- Construction of a new independent dam – *Lakatitsa* Dam – to be filled by transferred waters from the River Struma basin. When the dam is fully charged during the seasons of ample water availability it is estimated that water mass of up to 150 m³ may be ensured.
- Use of surface waters through their equalization in the local dams
- Use for the needs of industry. Irrigation and artificial refill of ground waters of treated waste water from *Kubratovo* Waste Water Treatment Plant.
- Utilization of the running water of the rivers Matitsa, Lesnovska, Blato etc. for water supply for industrial applications, in which open-type water abstraction is possible through pumping water transfer.

The indicated water sources differ considerably in terms of feasibility and engineering indicators.

It is necessary to resume the investigations of alternative water sources and working out of an up-to-date unified concept for complex water supply of the city of Sofia and Sofia Municipality in a long-term perspective (time

horizon after 2030). The investigations should be linked with “General schemes for utilization of waters in the basin management regions” of the year 2000 and the Plan for Management of the Waters of the Danube River Basin, whose publication is expected at the beginning of 2009.

Feeder water pipelines

The feeder water pipelines from the water sources to the water treatment plants and from the water treatment plants to the reservoirs are fully in place:

- Rila water pipeline – design throughput capacity 2.1 m³/sec. In actual fact about 1.3 –1.8 m³/sec are supplied to Sofia. The full throughput capacity may be achieved after further construction of the so-called Siphons 11 and 13.
- Passarel-Pancharevo Derivation – throughput capacity 4.50 m³/sec. Because of certain narrower sections in the area of *Zlatnata Ribka* Restaurant and after the outlet of Svinechki Dol Siphon the actual throughput capacity of the pipeline is 3.6 m³/sec (according to data of *Sofiyska Voda* plc).
- Iskar water pipeline - throughput capacity 13.50 m³/sec. Since the second water pipeline from Zli Kamak AK to *Bistritsa* Drinking Water Treatment Plant is not constructed yet the actual water quantities that can be delivered along this section amount to 6.75 m³/sec at normal duty cycle of the plant. In the case of forced dirty cycle 8.5 m³/sec (according – data of *Sofiyska Voda* plc)..

To date the total capacity of the feeder water pipelines is 13.9 m³/sec. Under normal circumstances some 7.5 m³/sec. Provided the design solutions were implemented it might be possible to achieve throughput capacity of up to 20.1 m³/sec..The restoration of the design throughput capacity of the *Passarel-Pancharevo* Derivation of the Rila water pipeline in a more distant future will ensure water supply to the network in the event of averages in the *Bistritsa* Drinking Water Treatment plant. .

Water treatment plants

Two drinking water treatment plants are in operation:

- *Pancharevo* drinking water treatment plant, delivery rate 4.5 m³/sec
- *Bistritsa* drinking water treatment plant, delivery rate 6.73 m³/sec

The properties of the drinking water are controlled at the outlet of the two treatment plants in compliance with the norm requirements for supervision and control.

The water quantities from *Beli Iskar* Dam and the Vitosha catchments do not pass through drinking water treatment plant.

On the territory of Sofia Municipality operate 36 chloration plants.

For the purposes of complying with the norm requirements concerning the drinking water properties, as part of the site “Water sector of the city of Sofia”, financed under the ISPA Programme (Measure No. 2003/BG/16/P/PA/004), are included the following actions:

- Construction of drinking water treatment plants along the Rila water pipeline;
- Main water supply pipeline from *Dragalevtsi* reservoir along *Dragalevsko Shosse* Blvd. (*Cherni Vrah* Blvd.);
- Rehabilitation of the Rila water pipeline and its facilities.

Pumping stations

Three main pumping stations are *in situ* for the water supply network of the city of Sofia:

Below Simeonovo pumping station is connected to the gravity water pipeline and *Below Simeonovo* reservoir. It has not been commissioned.

Buxton pumping station, situated below the Ring Road, supplies water to the main water pumpline feeding the *Lozishte* and *Moderno Predgradie* reservoirs. After the commissioning of *Bistritsa* drinking water treatment plant remains as a spare facility in the event of emergency duty cycle.

Konyovitsa pumping station, constructed before the shutter chamber of *Konyovitsa* reservoir. It has been decommissioned after the construction of the dia. 900 mm water pipline for *Moderno Predgradie* reservoir.

The Sofia water supply system comprises 22 more pumping stations, which ensure supply of the required water quantities for the neighborhoods and settlements around Sofia.

Reservoirs. Water supply zones.

The water supply system of the capital comprises 15 reservoirs with capacity “as built” of 331 000 m³. The *Below Simeonovo*, *Krasno Selo* and *Below Boyana* reservoirs (capacity “as built” 70 500 m³) have not been commissioned. It is necessary to work out a specialized programme “Connection of the *Below Simeonovo*, *Krasno Selo* and *Below Boyana* reservoirs to the Sofia water supply system”. .

In respect of level parameters the capital is situated between horizontals 520.00 and 800.00. Because of the big level differential and depending on the elevations of the feeder external pipelines several water supply zones have been formed. The zones have been identified according to the manner of feeding of the constructed pipelines - each water supply zone is proposed to be fed by one or several reservoirs.

Depending of their location in terms of altitude the reservoirs have been assigned to the respective water supply zones as follows:

Water supply zones	Reservoirs	Capacity, m³
First water supply zone	Kolezha	60 000
	Lozenets	17 000
	Konyivitisa	26 000
	total	103 000
Second water supply zone	Iztok	28 500
	Dragalevtsi	15 000
	Moderno	57 000
	Predgradie	21 000
	Total	121 500
Third water supply zone	Below Simeonovo	38 000
	Lozishte	16 000
	Krasno Selo	16 500
	total	70 500
Forth water supply zone	Below Boyana	16 000
	Total	16 000
Fifth water supply zone	Knyazhevo	3 000
	Boyana	2 500
	total	5 500

The *Malo Buchino* reservoir of capacity “as built” 13 000 m³ is fed by the

Rila water pipepline and supplies water to the water supply network of Bankya city-district.

A certain disproportion has been incurred between the built capacity of reservoirs and the serviced population. As an outcome of the forecast calculations it was found out that the city of Sofia does not need construction of new main reservoirs. It is necessary to work out a new zoning of the water supply system of the city, the aim being to ensure equitable equivalent “reservoir capacity per inhabitant”. It is possible to transfer some water quantities towards First water supply zone from excessive volumes in the zones situated at a higher altitude.

For the neighborhoods and villages in the suburban area are constructed reservoirs of about 23 960 m³ capacity “as built”. According to data from the *Sofiyska Voda* plc the actually commissioned and operating reservoirs feature a total capacity of 16 500 m³. With this Amendment to the Master Plan are identified locations for new reservoirs in compliance with the localization of the consumers from the point of view of altitude in order to prevent building of static pressure of more than 0.6 MPa in the water supply system.

For the settlements situated to the south of the Ring Road it is necessary to construct reservoirs for the purpose of building 24-hour equalizers – Gorna Banya, Bistritsa – Kokalyane, Dragalevtsi and other - and alleviating the high pressure impact.

It is necessary to construct the water pipeline for the Third water supply zone (dia. 600 – 700 mm and length 8.5 km), designed to connect the *Below Simeonovo* reservoir with the *Krasno Selo* reservoir. .

Main water supply pipelines (from the reservoirs towards the city)

Drinking water for districts from the First water supply zone, the districts situated farthest from the contre and the suburban districts is delivered by four main water supply pipeline rings.

Between the individual rings are constructed water pipelines for redistribution of the water quantities within the zone.

Energy dampers

They are designated for pressure dampening and energy generation. To date two energy dampers have been commissioned and are in regular operation.

In 2008 Sofia Municipality compiled “Technical analysis of the possibilities for building a mini-HPP based on the water supply system of the city of Sofia”. Construction of 8 mini-HPPs operating at a duty cycle subordinated to the duty cycle of the water supply is envisaged. They are proposed to be situated at locations by-passing the existing feeder water pipelines of the city of Sofia. Plots have been allocated for all the enegy dampers.

In addition to the purely energy-related benefits from the implementation of this project it is estimated to achieve significant improvement of the hydraulic operation at the proposed points of the water supply system of the city of Sofia. The project proposes power generation based on a renewable energy source and in this way contributes to saving of energy produced from conventional energy sources and hence avoiding GHG emissions.

Water supply network

COMPACT CITY

The beginning of the construction of the water supply system of the city of Sofia goes back to the end of the 19th c.

The total length of the water supply network is 4 075 km, including 12 per

cent built in the period 1998 – 2004. 36 per cent of the total length of the network features pipelines of small diameter, which have not been passed over to *Sofiyska Voda* for regular operation. The network services extend over almost 100 per cent of the population of Sofia Municipality. The trend that has set in in recent years is towards further expansion and rehabilitation of the water supply network for drinking water end-use through involvement of private investors on the basis of contracts signed with Sofia Municipality for construction of infrastructure sites. The recorded water losses demonstrate a steady increase because of depreciation of the existing water supply network, which was constructed mainly during the 1950-1980's.

Year of construction	Water losses in %
1952	39
1962	27.6
1967	20.83
1972	17.8
1992	40
1995	40
2002	63.62
2003	65

The total length of the network for conventionally clean water is about 40 km. Along it is delivered water for industrial applications to Kremikovtsi SP plc and the industrial zones of Sofia.

SURROUNDING AREA

The settlements of the suburban area, which are connected to the Sofia water supply system, are clustered in several water supply groups:

The Iskar Railway Station water supply group comprises the settlements Kazichene, Krivina, Busmantsi and Dolni Bogorov.

The Kremikovtsi water supply group comprises the settlements Kremokovtsi, Seslavtsi, Botunets, Chelopechene, Gorni Bogrov, Buhovo and Yana.

The Northern villages – centre water supply group comprises the villages of Negovan, Svetovrachane, Chepintsi, Katina and part of the city of Novi Iskar (Kurilo, Izgrev and Gnilyane).

The Lozen water supply group comprises the villages German, Lozen and Gorublyane Quarter.

The Banlya water supply group comprises Bankya, Ivanyane, Malo Buchino, Verdikal, Mihaylovo and Gradoman.

The Northwestern territory water supply group comprises the villages of Mramor, Voluyak, Dobroslavtsi, Zhiten and Balsha.

The Novi Iskar water supply group comprises the villages of Trebich, Mirovyane and the city of Novi Iskar Mirovyane.

The Pancharevo water supply group comprises the villages of Pancharevo and Kokalyane.

The Vladaya water supply group comprises the villages of Vladaya and Marchaevo. The system is not fed by the water supply network of Sofia. The local water sources are in a poor state-of-repair.

Principles of construction of the system

The construction of the water supply system of the city of Sofia started more than 120 years ago. The high altitude location of the water sources (Iskar Dam, Beli Iskar Dam, the Vitosha water catchments) predetermines the gravity delivery of water to the capital. The scheme of localization of the reservoirs and the water supply network takes maximum advantage of the relief of the city of Sofia and the surrounding area.

The water supply zones have been designed for a maximum static pressure 80 m and maximum dynamic pressure 30 m. For the settlements of the Vitosha foothill collar, Gorna Banya, Kremikovtsi, Seslavtsi, Novi Iskar etc. additional local zoning is required because of the steep terrain. Each water supply zone is envisaged to be fed by one or several reservoirs. The water supply network is designed as a closed-loop one. For several years now a dispatch system (SCADA) is in operation for supervision and control of the strategic part of the water supply system. It extends over 37 reservoirs (all the main reservoirs and a smaller portion of the local ones), control switches of pumping stations, chloration plants etc. Expansion of the scope of the system and improvement of its efficiency are envisaged. The dispatch system is operated by *Sofiyska Voda* plc.

Organizational structure of management

The water supply system on the area of Sofia Municipality has been granted under concession for a period of 25 years and is managed by *Sofiyska Voda* (Sofia Water) plc. The concession agreement entered into force on 6 October 2000. Its period of validity overlaps with the period for which the Amendment of the Sofia Master Plan is prepared.

It is necessary for Sofia Municipality and *Sofiyska Voda* plc to work out a programme-agreement for joint actions in the domain of forecasting, design and construction of the water supply system of the city.

Principles of setting the system parameters

The parameters of the capacity of the feeder water pipelines, the treatment plants and main reservoirs should be determined on the basis of the water supply norm of 310 l/inhabitant/day (set by the Ministry of Regional Development and Public Works in 1987 for the city of Sofia), valid for all the types of water consumption.

In the process of development of concept design for human settlements, quarters, localities and planning zones the definition of the parameters of the water transportation network and the facilities for it shall be worked out on the basis of water consumption according to the functional designation of the territory under review and should comply with the requirements concerning the programmes for approval by and involvement of the European Union with respect to the use of funding from the EU Pre-accession Funds.

Project solution for provision to Sofia Municipality of the necessary water quantities with the appropriate “drinking water” properties according to the Amendment of the Master Plan for the timeframe till 2030

Number of inhabitants according to the maximum capacity by structural units N=1 747 000 people.

$$Q_{\text{average/day}} = 1\,747\,000 \text{ inhabitants} \times 310 \text{ l/inhabitant/day} = 541\,570\,000 \text{ l/day}$$

$$Q_{\text{average/day}} = 6,268 \text{ m}^3/\text{sec}$$

$$Q_{\text{max/day}} = 6,268 \times 1,25 = 7,835 \text{ m}^3/\text{sec}$$

Physical losses in the system – 20 per cent of $Q_{\text{average/day}}$

$$Q_{\text{physical losses}} = 6,268 \times 0,20 = 1,254 \text{ m}^3/\text{sec}$$

Water quantity entering the system after the water treatment plants

$$Q_{\text{op}} = Q_{\text{max/day}} + Q_{\text{physical losses}} = 7,835 + 1,254 = 9,089 \text{ m}^3/\text{sec}$$

Water quantity supplied by the water sources

$$Q_{\text{sources}} = Q_{\text{op}} \times 1,10 = 9,089 \times 1,10 = 9,998 \text{ m}^3/\text{sec} \approx 10,00 \text{ m}^3/\text{sec}$$

Water quantities, which may be delivered by the sources towards the city at the moment:

Rila water pipeline 1,80 m³/sec

Pancharevo drinking water treatment plant: 2,25 m³/сек

Bistritsa drinking water treatment plant 6,75 m³/sec

Total: 10,80 m³/sec

The constructed drinking water treatment plants and feeder water pipelines ensure the necessary water quantities as laid down in the Amendment to the Master Plan for the timeframe by 2030.

Alternative water sources

Several dry years on a row

- Supply of water masses from the Maritsa Basin along the *Granchar* tunnel and the *Manastirski* canal
- Supply of water masses from the River Struma Basin – western derivations
- Transfer of water from the River Batuliyska (*Eleshnitsa* Dam) and construction of drinking water treatment plant in the land of the village of Voynyagovtsi or the village of Logorsko

Break in water supply along the Iskar water pipeline in the area of lanadslide processes (Passarel AK)

- Bistritsa drinking water treatment plant is out of operation
- Pancharevo* drinking water treatment plant receives water along an emergency connection (dia 1800 mm) after *Kokalyane* AK

In order to ensure adequate water supply to the city the drinking water treatment plant for the water of *Eleshnitsa* Dam it should have a capacity of 3,30 m³/sec (according to the design project it is planned for 1,50 m³/sec).

It is necessary to study the possibility for building a parallel (spare) water pipeline along a route, which avoids the landslide area near Passarel AK in order to guarantee the normal operation of Bistritsa drinking water treatment plant.

Plots for new reservoirs, pumping plants and servitude bands

It is indispensable to preserve the sanctioned routes and servitudes for construction and further construction of main water pipelines and inherent facilities.

The area and location of the new reservoir, pumping plants and energy dampers, as well as their sanitary protection zones have been determined through expert assessment depending on the concrete territory, parameters, relief and nature factors, whereat the ownership on the land has been taken due account of.

Specialized programmes

It is necessary to work out specialized programmes dealing with:

- A methodology for hydraulic dimensioning of the system in the cases of elaboration of design concepts for the individual planning zones, locations, quarters and settlements on the basis of water consumption projections depending on the functional designation of the area under review.
- Final selection of the manner of water supply to the eastern territories adjacent to the Ring Road, the *Tsarigradsko Shosse* Road and *Botevgradsko Shosse* Road.

4.9.2.Sewerage

Principles of building of the system

The sewerage system of the city of Sofia has been constructed and operating as a mixed one for more than 100 years now, whereat is has preserved its basic principles of layout during all that time.

The system features gravity evacuation of waste water to the urban waste water treatment plant. The existing sewerage pumping stations are situated to the north of *Orlandovtsi* Quarter and *Voenna Rampa* locality towards Novi Iskar and Botunets.

The gravity evacuation of the waste water limits the possible routes of the discharge pipelines and sewers to the flat areas of the city and the surrounding area.

The territory of the city is traversed by a multitude of rivers and gullies, which provides an opportunity for dispersal of the waste water quantities among 11 main sewers. As a rule, their routes are localized along the river banks.

With the expansion of the drainage territories and for improvement of the sewerage services provision the existing sewers have been duplicated.

The reconstruction of the sewerage network in the central parts of the city is realized by retaining the sewerage pipelines with dia. above 600 mm, construction of spillway-distribution shafts and other engineering activities for the purpose of optimum use and maximum preservation of the existing sewerage network.

Urban waste water treatment plant

The urban waste water treatment plant was constructed to the north of *Benkovski* Quarter. It operates as follows: in terms of water treatment at full load 80 per cent and water treatment at limited load 50 per cent (2002 figures).

Main characteristics:

- Incoming waste waters – 5.7 m3/sec.
- Maximum hydraulic load – 10.5 m3/sec.
- БПК₅ of incoming wastewater - 100 t/day

The waste water treatment plant operation is aligned to the quality of the waste water discharged in the River Iskar.

The capacity of the plant permits treatment of the waste waters generated by the city of Sofia and the suburban quarters, the city of Bankya, Malo Buchino, Phillipovtsi, Suhodol, the city of Novi Iskar, Busmantsi, Pancharevo, Chepintsi, Negovan, Svetovrachane, Kubratovo, Gorni Lozen, Dolni Lozen, German and Voluyak.

The incomplete construction of part of the discharge collectors creates grave prblems for the operation of the urban waste water treatment plant.

On the area of Sofia Municipality is situated also the existing waste water treatment plant, which has been designed and implemented in the period 1975-1980. Its parameters are as follows:

$$Q_{\text{ср.ч.}} = 1080 \text{ m}^3/\text{h} = 300 \text{ l/sec}$$

$$Q_{\text{макс.ч.}} = 2880 \text{ m}^3/\text{h} = 800 \text{ l/sec}$$

$$\text{БПК}_{5, \text{вход}} = 220 \text{ mg/l}$$

$$N_{\text{inhabitants equivalent}} = 25 \text{ 000 inhabitants equivalent}$$

It is constructed as a classical treatment plant for biological treatment. It is situated on a common site of 50 000 m², property of the *Kremikovtsi* Combined Metallurgical Works.

Sewerage network

COMPACT CITY

The sewerage network of the city of Sofia has been designed as a MIXED one with fivefold dilution of the waste waters.

Its construction started in 1897 under a design project of the Viena expert Rella. The right-hand *Vladaya* sewer from *Stochna Gara* to *Hristo Botev* Blvd. and the left-hand *Perlovski* sewer from *Stochna Gara* to *Graf Ignatiev* Blvd. were constructed..

The length of the sewerage network, which is maintained by the operator company, is 1 450 km. It services about 70 per cent of the population.

The length of the main sewers on the area of the city of Sofia is 426 km. Eleven main sewers have been established. Their routes run along the banks of the rivers traversing Sofia. Gravity evacuation of the waste waters from the compact city and the surrounding area to the *Kubratovo* urban waste water treatment plant is ensured.

With the development and expansion of the city and the tangent areas the existing street sewerage network in the old city turned out to be of inadequate throughput capacity and in need of reconstruction. In the rest of the residential areas it is fully *in situ* or is envisaged for further construction. In the Southern territories, the Vitosha Foothills Collar, *Moderno Predgradie* Neighborhood, *Benkovski* Quarter, *Iliyantsi* Quarter and the *Faculteta* Neighborhood there is no network *in situ*.

The technical state-of-repair of the existing sewerage network is relatively good.

SURROUNDING AREA

Novi Iskar and Bankya have a partially constructed sewerage network. Their external sewers are not fully constructed.

The external sewer for Gorni Lozen and Dolni Lozen and German is more or less constructed.

Buhovo and Botunets have partially constructed mixed sewerage network. Their external sewers are not in place.

The rest of the settlements in the surrounding territories have neither sewerage networks nor external sewers.

Organizational management structure

The sewerage network on the territory of Sofia Municipality has been

leased under concession till 2025 and is managed by *Sofiyska Voda* plc.

Sofiyska Voda plc prepares periodically a programme for further construction of the sewerage network of the city of Sofia and Sofia Municipality.

Sofia Municipality and *Sofiyska Voda* plc have to negotiate an agreement for joint actions in forecasting and design of the sewerage system.

Principles for defining the parameters of the system

A differentiated approach to and methodology for dimensioning of the system should be applied in the process of development of concept designs for individual planning zones, localities and quarters. :

Design solution concerning waste water treatment – water quantities and spatial development of the sewerage network

COMPACT CITY

The sewerage system of the city of Sofia will continue to develop and operate mainly as a mixed one.

The large-scale construction during the recent years has forced investors to construct local waste water treatment facilities or drain pits. On the other hand, some concrete concept designs for the territories in the southern part of the city proved the efficiency of the separate collection systems and combined systems. It is envisaged that the type of the sewerage system for each territory should be determined depending on the concrete conditions on the basis of cost-effectiveness and feasibility.

The feasibility studies for the main sewers of the city of Sofia by the 2020 horizon, worked out in the period 1990-1992 are still topical as regards the routes for further construction and duplication of the main sewers, sub-sewers and escape canals. Because of certain shortcomings in the currently enforced regulatory framework and the poor coordination among the different municipal units, no plots have been allocated as yet for some of the design routes and alternatives could be sought – the righthand *Vladaya* sewer duplicate, the sewer along *Todorini Kukli* St., the lefthand *Slatina* sewer duplicate, the escape canals to the righthand *Kakachki* sewer and ILeading sewer 2 etc.

Updating of the water quantities used for dimensioning is necessary, above all for:

- Amendment of the regulatory documents defining the discharge norms;
- Adjustments of the water catchment areas to reflect the incurred functional changes of territories in the compact city and the surrounding areas;
- Change of the runoff coefficients;

There is a narrow connection between the construction of the main sewers and sub-sewers and the main street network.

The construction of the main sewers and sub-sewers helps achieve autonomy for further construction of the system of all the territories in the water catchment. Depending on the pace of their development an opportunity is created for application of different schemes for financing of the investment process.

As part of the project “Water sector of the city of Sofia”, financed under the

ISPA Programme (Measure No. 2003/BG/16/P/PA/004), are included the following:

- *Bankya* external sewer;
- Left-hand *Vladaya* sewer in the *Ovcha Kupel* locality and *Karpuzitsa* Locality;
- Sewer along *Buxton* Blvd. up to the left-hand *Vladaya* sewer;
- Right-hand *Perlovski* sewer from *Byala Cherkva* St. up to *Todor Kableshkov* Blvd. and *Bulgaria* Blvd.;
- Right-hand *Slatinski* sewer along *Srebarna* St., *Cherni Vrah* Blvd. and *T. Kableshkov* Blvd.;
- Duplicate of the left-hand *Vladaya* sewer from *Benkovski* Quarter up to *G. S. Rakovski* St.;
- Pumping station for sewerage waters the city of *Novi Iskar* and rehabilitation of the pusher to *Kubratovo* waste water treatment plant.

In the period 2006-2009 Sofia Municipality developed investment projects for the sewerage networks of *Suhodol*, *Dragalevtsi*, *Manastirski Livadi* – East, *Krastova Voda* – East, *Vitosha* – *Simeonovo HPP*, *Boyana*, the *Cinema Centre* etc. and undertook concrete actions for procurement of financing under Operational Programme “Environment 2007-2013” and the *Enerprise for Management of Environmental Protction Activities*.

SURROUNDING AREA

In the surrounding area a decentralized sewerage scheme will be applied, under which waste waters will be treated in immediate vicinity to their source, which will lead to considerable reduction of the construction costs and to facilitation of services. The decentralized treatment of waste waters from the surrounding area will prevent hydraulic overloading of the existing waste water treatment plant.

In the period 2006-2009 Sofia Municipality developed investment projects for construction of sewerage networks and waste water treatment for the following settlements:

- Concept design for water supply and sewerage networks in the village of *Busmantsi*;
- Concept design for water supply and sewerage networks in the village of *Kubratovo*, the village of *Chepintsi*, the village of *Negovan* and the village of *Svetovrachane* and a collection sewer for three pumping stations for pumping of these waters and a pusher from the pumping station of the village of *Svetovrachane* towards the *Kubratovo* waste water treatment plant.
- Concept design for water supply and sewerage networks a regional waste water treatment plant (at *Dolni Bogrov* near the *River Lesnovska*) for *Kremikovtsi*, *Seslavtsi*, *Buhovo*, *Botunets*, *Yana*, *Chelopechene*, *Kazichene*, *Krivina* and *Dolni Bogrov*;
- Concept design for water supply and sewerage networks and a local waste water treatment plant - the village of *Trebich*;
- Concept design for water supply and sewerage networks and a local waste water treatment plant - the village of *Katina*;
- Concept design for water supply and sewerage networks and a local waste water treatment plant - the village of *Zhiten*;
- Concept design for water supply and sewerage networks and a local waste water treatment plant - the village of *Dobroslavtsi*;
- Concept design for water supply and sewerage networks and a local waste water treatment plant - the village of *Balsha*;
- Concept design for water supply and sewerage networks and a local waste water treatment plant - the village of *Zhelyava*;
- Concept design for water supply and sewerage networks and a regional waste water treatment plant, connected by gravity supply sewers from the village of *Mramor* and the village of *Mirovyane*;
- Concept design for water supply and sewerage networks and a

- local waste water treatment plant - the village of *Vladaya*;
- Concept design for water supply and sewerage networks and a local waste water treatment plant - the village of *Kokalyane*;
- Concept design for water supply and sewerage networks and a local waste water treatment plant - the village of *Voynegovtsi*;
- Concept design for water supply and sewerage networks and a local waste water treatment plant - the village of *Podgumer*;
- Concept design for water supply and sewerage networks and a local waste water treatment plant - the village of *Lokorsko*;

The expansion of the urbanized territories to the west (between *Bozhurishte* and *Voluyak*, along the road towards the village of *Mramor*) and to the east (between *Gorni Lozen* and *Dolni Lozen* and *Kazichene*) raises the issue concerning evacuation of the surface runoff and the treated waste waters. The relief is flat and there are no natural receivers (rivers). The only possibility is restoration and efficient use of the system of protective, drainage and irrigation canals, which are currently public state property.

It is necessary for Sofia Municipality to undertake actions for construction of drainage sewers or canals, which discharge in the nearest water receivers (corrected rivers), using the routes of liquidated irrigation canals and facilities.

Plots for new pumping stations, treatment plants and servitude strips

It is urgently necessary to preserve the sanctioned routes and servitudes for further construction of sections of the main sewers, their duplicates and sub-sewers, as well as the inherent facilities.

A concrete approach is necessary in the determination of the servitudes of the existing sewers, whose cross section is bigger than 1.8 m².

It is proposed to reserve a 10m-wide servitude on one side of the axis, and on the other side the width shall be the half of the outer diameter of the sewer plus 1.0 m.

For the new sewers we recommend to reserve servitude at a distance of 10 m on both sides of the sewer axis (i.e. a total of 20 m).

The area and location of the new waste water treatment plants have been defined as follows:

- In compliance with the cincept designs for the sewerage networks of the village of *Kubratovo*, the village of *Chepintsi*, the village of *Negovan*, the village of *Svetovrachane*, *Kremikovtsi*, *Seslavtsi*, *Buhovo*, *Butonets*, *Yana*, *Chelopechene*, *Kazichene*, *Krivina*, *Dolni Bogorov*, *Trebich*, *Katina*, *Benkovski*, *Busmantsi*, *Kokalyane* and *Zhiten*.
- According to expert assessment for the rest of the human settlements, depending on the concrete territory, nature factors and the envisagements of the Master Plan.
-

Specialized programmes

Elaboration of specialized programmes is necessary for:

- Forecasting and design of the “Sewerage” System;
- Updating of the dimensioning of the water quantities for the main sewers of the city of *Sofia*;
- Engineering solutions for evacuation of waste rainwater and treated waste water from the eastern and westerns parts of the surrounding area.

4.9.3. Open water courses

Characreristics and peculiarities of the River Iskar water catchment area

All rivers traversing the area of Sofia Municipality are tributaries of the

river *Iskar*, which cuts the *Sofia Plain* into two almost equal halves. From southeast to northwest the area of the capital is traversed by the rivers *Shindra*, *Slatinska*, *Vartopo*, *Perlovska*, *Boyanska*, *Vladayska*, *Suhodolska* and *Kakach*, and in the lowest end of *Sofia* - flow the rivers *Blato* and *Lesnovska* (*Stari Iskar*).

The *River Iskar* and respectively the water currents on the area of *Sofia Municipality* fall under the scope of action of the *Plan for the River Danube Basin Management*.

Table 1

List of the rivers traversing the area of *Sofia Municipality*

River	Source	Discharges into:	Bigger tributaries
Iskar	River Prav Iskar (Rila)	The river Danube	Stari Iskar, Kalna, Perlovska, Vladayska, Kakach, Blato
Stari Iskar (Lesnovska)	River Lopushna (Belitsa)	The river Iskar, Svetovrachane Quarter	Makotsevska, Matitsa, Buhovska, Botunetska, Kremikovska, Lokorska, Voynyagovska, Podgumerska
Kalna	The land of the village of Bistritsa (Vitosha)	The river Iskar, Gorublene Quarter	River Banska Reka
Perlovska	Gorno Blato (Vitosha)	The river Iskar, and after the correction it is discharged in the river Vladayska	Darvenitsa, Slatinska, Novachnitsa
Vladayska	Gorno Blato (Vitosha)	The river Iskar, joint mouth with theriver Perlovskarловска	Gornobanksa and Suhodolska
Kakach (Bankenska)	Bankenska (Lyulin, below Raylovsko Gradishte Peak)	The river Iskar, after Kubratovo	Shevovitsa, Golayan Reka
Blato	The land of the village of Opitsvet (Tri Ushi Mountains)	The river Iskar, at the city of Novi Iskar	Slivnishka, Belitsa, Tsarna Bara, Kriva Reka
Shindra	The fore-mountain hills of Vitosha Mountains, 1050 m a.s.l.	After Gorublyane	Dalboka Reka, Kalna, Banishka.

According to the *Plan for River Danube Basin Management* in terms of river typology category the river *Iskar* is classified for the larger part of its course as BGTR7. A small section at its mouth has been defined as BGTR9 and its mountainous portion after the spings – as BGTR12. Its tributaries on the area of the *Sofia Plain* are defined for the predominant part of them as river typology category BGTR13 (the river *Blato* and its tributaries the river *Slivnishka Reka* and the river *Kostinbrodska*, the river *Kakach/Banska*, the river *Suhodolska*, the river *Vladayska*, the river *Perlovska*, the river *Slatinska*, the river *Stari Iskar/Lesnovska* with its tributary the river *Eleshnitsa*). The upper stretches of the rivers *Vladayska* and *Perlovska* belong to the river typology category BGTR9.

The rivers on the territory of *Sofia Municipality* (Order No. RD – 272/03 May 2001 of the Ministry of Environment and Water concerning categorization of the surface water in the water sites or parts of them on the grounds of Ordinance No. 7 about the municipalities and norms for determination of

the quality of the surface running waters) are defined as Category II (water designated for watering of animals, water sports, cultural needs etc.). Excluded are only the river Vladayska after the bridge in Knazhevo up to its discharge in the river Iskar, the river Perlovska after the correction up to its discharge in the river Iskar and the river Lesnovska after the tailing reservoir of the Kremokovtsi waste water plant up to the discharge in the river Iskar, which are defined as Category III water (waters to be used for irrigation, industrial applications, water sports etc.).

Current state of the surface waters

The surface runoff of the river Iskar is characterized by high irregularity, which is in discord with the needs of water consumption. This has imposed the necessity of building seasonal and multi-annual equalizers (dams) – *Beli Iskar, Iskar, Passarel, Pancharevo, Kremikovtsi* and *Ognyanovo*. At the metering point of the Novi Iskar hydrometric station minimum discharge rate of 2.915 m³/sec and the maximum 220.00 m³ /sec. have been read till now.

As a consequence of many years of ===== the river beds of the river Iskar and the rive Lasnovska and other tributaries have led to disruption of a multitude of sewerage systems, irrigation facilities and drainage pipelines and canals. In the area of Novi Iskar Municipality a major portion of the rainwaters pour into the main irrigation canals. The latter have been designed only for their function as irrigation canals and not for taking up the water from the rainwater evacuation canals. As a result large areas around Kurilo, Benkovski, Kubratovo, Chepintsi, Chelopechene and other quarters often remain under water. 56 km corrections of riverbeds have been implemented. Almost all the rivers in the Central City Area have been corrected, but because of poor operation their throughput capacity and sanitary-hygiene regime have been undermined. Many of the facilities needed to ensure problem-free transportation of water are not yet constructed. In this way conditions are created for flooding of some adjacent areas in the event of high water. Because of not sufficient construction of the sewerage network at certan places direct discharge of urban waster waters in the rivers has been observed.

At the monitoring points along the river Iskar valley on the area of Sofia Municipality different degree of pollution of surface waters has been observed. The indicators, which characterize the quantity of organic and unorganic reducers in the river Iskar water (oxidation, ХПК и БПК₅), indicate for considerable presence of polluters – reducers of organic and unorganic origin. The biogene elements exceed many times the permissible values for the respective category of water source. The pollution is due mainly to the lack of sewerage facilities in the territories traversed by the rivers and the irresponsible attitude of the population, which uses the riverbeds as dumpsites.

Part of the earth corrections in individual sections have been dimensioned and constructed for lower percentage of influx and are not capable of letting through the designed water quantity in the event of water quantities of 1 per cent and 0.1 per cent. There are no facilities for reduction of pitting from the solid matter runoff along the storm gullies in the surrounding area

State-owned hydro-meliorative facilities on the area of Sofia Municipality

State-owned hydro-meliorative facilities on the non-regulated territories of Sofia Municipality consist of two groups:

- Facilities for protection against damages caused by rivers;
- Irrigation facilities;

Corrections of rivers and gullies on the territory of Sofia Municipality – public state property

Name	Land area	Municipality	Servitudes	In opera-tion since
			Yes/No	
Gully No. 4	The village of German	Pancharevo	Yes	-
Gully No. 5	The village of German	Pancharevo	Yes	-
Gully No. 6	The village of German	Pancharevo	Yes	-
Gully No. 7	The village of German	Pancharevo	Yes	-
Gully No. 9a	The village of Gorni Lozen	Pancharevo	Yes	-
Gully No. 11	The village of Gorni Lozen	Pancharevo	Yes	-
Gully No. 12	The village of Gorni Lozen	Pancharevo	Yes	-
Gully No. 13	The village of Gorni Lozen	Pancharevo	Yes	-
Gully No. 14	The village of Gorni Lozen	Pancharevo	Yes	-
Gully No. 15	The village of Dolni Lozen	Pancharevo	Yes	-
Gully No. 17	The village of Dolni Lozen	Pancharevo	Yes	-
Gully No. 20	The village of Dolni Lozen	Pancharevo	Yes	-
The river Iskar	-	Novi Iskar	Yes	1956
The river Gnilyanska	The village of Gnilyane	Novi Iskar	Yes	-
The river Blato	The city of Novi Iskar, the village of Petarch	Novi Iskar	Yes	1950-1983
The river Tsarna Bara	The village of Mramor	Vrabnitsa	Yes	1982
The river Dobroslavska	The village of Mramor	Vrabnitsa	Yes	1940
The river Kriva	The village of Zhiten	Novi Iskar	Yes	1960
The river Belichka	The village of Belitsa	Kostinbrod	Yes	1962
The river Bara Metilyavets	The village of Metilyavets	Kostinbrod	Yes	1960
The river Slana Bara	The village of Metilyavets	Kostinbrod	Yes	1950
The river Chervena	The village of Slavovtsi	Novi Iskar	Yes	-
The river Kakach	-	Novi Iskar	Yes	1994
The river Lesnovska	-	Novi Iskar	Yes	-
The river Podgumer	-	Novi Iskar	Yes	-
The river Lokorska	-	Novi Iskar	Yes	-
The river Voznyagovska	-	Novi Iskar	Yes	-
Novi Iskър	The village of Chepintsi	Novi Iskar	Yes	-
Gully Dukata	The village of Chepintsi	Novi Iskar	Yes	-
The river Vladayska	The village of Benkovski	Serdika	Yes	-
The river Darvenishka	The village of Benkovski	Serdika	Yes	-
The river Yaneshtitsa	The village of Ravno Pole, the village of Musachevo, the village of Gorni Bogorov, the village of Yana	Elin Pelin, Kremokovtsi	Yes	1956

Drainage sewers public-state property on the territory of Sofia Municipality

Description	Land area	Municipality	Year of
			Yes/No
Drainage sewer	-	Pancharevo, Kremikovtsi	Yes
C-5	-	Kremikovtsi	Yes
C-1	-	Kremikovtsi	Yes
C-3	-	Kremikovtsi	Yes

C-2	-	Pancharevo,	Yes	-
35-Г-10	-	Pancharevo,	Yes	
O-6(P1)	-	Pancharevo, Kremikovtsi	Yes	-
O-6	-	Kremikovtsi, Novi Iskar	Yes	1965-69
Drainage Pumping Station	Gnilyane	Novi Iskar Искър	Yes	1974
Drainage pumping station 2	Kubatovo	Novi Iskar	-	1992
Main drainage canal with drainage pumping station 2	-	Novi Iskar	Yes	1987
Drainage canal from Kubratovo drainage pumping station	-	Novi Iskar	Yes	1965
Kubatovo drainage pumping station	Novi Iskar	Novi Iskar	-	1963

Irrigation canals, dams and other facilities state property on the area of Sofia Municipality.

Description	Land area	Year of Commis-sioning	Total length of the canal (km)
Pancharevo weir, main water source		1957	
Equalizing main canal from km 0+000 to km 11+059	German	1953/1957	10.666
Irrigation canal R-1	German	-	18.255
Irrigation canal R-1-0	German	-	2.269
Irrigation canal 35-G-5	Gorni Lozen	-	1.222
Irrigation canal 2-C-1	Busmantsi	-	0.925
Irrigation canal R-1-1	Kazichane	-	5.543
Irrigation canal R-1-1-1 - transportation	Kazichane	-	2.000
Irrigation canal 15-C-1	Krivina	-	1.200
Irrigation canal 11-R	Krivina	-	5.004
Irrigation canal 1-G-6	Krivina	-	1.600
Irrigation canal 37-G-2 - Angling	Chelopechene	-	3.414
Irrigation canal 37-G-4	Chelopechene	-	0.938
Irrigation canal 37-G-12a	Chelopechene	-	0.149
Irrigation canal 37-G-12	Chelopechene	-	1.096
Chisti Vodi irrigation canal	Vrazhdebna	-	2.095
- transportation			
Chepintsi Pumping station – additional water source.	Chepintsi	1985	-
Selimitsa Equalizer	Vrazhdebna	1987	-
Selimitsa pumping station – additional water source.	Vrazhdebna	1988	-
Irrigation canal RKD	Chepintsi	1970	2.332
Irrigation canal RKD'	Chepintsi	1970	7.915
Irrigation canal 32-C-2	Chepintsi	-	0.926
Negovan equalizer	Benkovski	1970	-
Negovan Stara pumping station – additional water source.	Benkovski	1960	
Negovan Nova pumping station – additional water source.	Negovan	1985	
Irrigation canal K 32-C-1	Chepintsi		2.320
Irrigation canal 32-G-6	Negovan		0.770
Irrigation canal 23-C-1	Gorni Bogorov		3.585

Irrigation canal R-11	Gorni Bogrov		2.208
Irrigation canal 15-C-2	Gorni Bogrov		0.500
Irrigation canal R-13	Yana		8.751
Kremikovtsi equalizer	Kremikovtsi	1966	
Irrigation canal 33-G-4	Lokorsko		1.130
Lokorsko pumpin station	Lokorsko	1952	
River Iskar water catchment (for Irrigation canal R-0)	German	1966	
Irrigation canal P-0	Gorublyane		2.,980
Irrigation canal P-8 (Житен)	Zhiten	1949	1.075
Water feeding canal to Kurilo pumping station	Kurilo	1963	2.934
Kurilo pumping station	Novi Iskar	1963	
Irrigation transport of Kurilo pumping station	Kurilo	1963	
Equalizer of Irrigation canal P-7 – Kurilo	Kurilo	1965	
Irrigation canal P-7	Kurilo	1963	8.440
Irrigation canal P-1 from Irrigation canal P-7	Dobroslavtsi	1961	2.234
Prospecting wells of Mekizha irrigation pumping	Slavovtsi	1992	
Mekizha pumping station	Slavovtsi	1992	
Phillipovtsi Dam	Suhodol Quarter		

The state-of-repair of the facilities is poor and they are in grave need of repair and rehabilitation. At present reassessment of the adjacent areas and review of the dimensioned water quantities of the IMK.has been assigned and is in the process of implementation. The objective is to clarify which of the canals and facilities will continue to be used in the future as irrigation facilities and which will be liquidated as a result of having lost their primary designation.

There is a possibility after liquidation of the respective canals to use their routes for construction of drainage sewers or canals tailed in the nearest water receivers (corrected rivers).

As early as now it may be presumed that canal R-0 will be fully liquidated since the majority of it is scapped and deprived of areas subject to irrigation. It is also possible that as a result of the reassessment the designation of canals 0-6 and R-1 will be changed after their crossing *Hemus* Highway up to their tailing in *Chisti Vodi* canal, which originates from the river Iskar water catchment in *Vrazhdebna* Quarter and supplies water for irrigation purposes to *Chepintsi* Quarter.

After 1990 and especially after completion of the construction of the deviation towards *Chelopechene*, of the second lane of the Ring Road and the road node at *Hemus* Highway construction of a number of industrial enterprises and commercial estates was launched. The rainwater from these sites, as well as the water from the ditches along the road in the area, when the area of the site is above 140-150 dca, shall be discharged in drainage canals 0-6 and R-1 without treatment.

According to this Amendment to the Master Plan the designation of a significant portion of the agricultural land in the territory between the Ring Road, *Hemus* Highway and the road towards *Chelopechene* Quarter is changed. In this way in that part of the system the main facilities – canal R-1 and the drainage canal 0-6 - do not any more supply water for irrigation of agricultural land and serve only for collection of water, which is currently discharged in the *Chisti Vodi* irrigation canal.

The operation of the rest of the canals and facilities should be assessed in a similar manner, especially the corrections of rivers, and the ownership rights of all those subject to regulation shall be transferred to Sofia Municipality for maintenance and care. All these corrected rivers should be dimensioned for 1 per cent safety provisions and checked for 0.1 per cent safety provisions in the event of “high” water, since currently the dimensioned water quantities are specified at 5 per cent or 10 per cent safety provisions.

Another major hydro-engineering facility, which was originally conceived for complex designation for water transport, attractions and water supply for irrigation at the western end, was the navigation canal, beginning at the *Pancharevo* Weir. This project has lost its significance and has no prospects to be implemented (since many sections of the canal have been restituted to their former owners and currently are being built up). It is necessary to reassess the possibility to use the non-restituted parts for construction of collection sewers for evacuation of rainwater and their tailing in the nearest water receiver.

The *Phillipovtsi* Dam is also state-owned. There are no areas subject to irrigation attached to it and it performs only retention functions. The dam bears potential risk. In that connection it is necessary to perform risk assessment of that facility and lay down measures for improving its safety.

Since the dam is situated in fully resulated area it is necessary to consider the possibility for transfer the ownership right on that facility and the responsibility for its operation on Sofia Municipality.

Endorsed projects, evaluation for topicality

There are developed but not implemented project designs for the rivers *Kakach*, *Vladayska*, *Drenovichka*, *Suhodolska*, *Adjubaritsa*, *Suha Reka* and others.

Because of the erosion activity of high water the design projects not implemented within 5 years of their completion should be updated after a comprehensive analysis of the objective conditions during the period of time that has elapsed after their completion.

It is necessary to update the initial hydro-engineering data about the rivers and their tributaries taking due account of the changes that have occurred during the years in the orographic characteristics of their water catchment basins, the new data from the hydro-metric, meteorological and rainfall metering stations, etc. .

The water economy studies should take account also of the changes in the demographic, economic and other relevant circumstances, which may affect the calculations for development of the system.

The elaboration of detailed spatial plans for areas traversed by rivers should mandatory be bound with a reassessment of the state of the open water currents and if necessary arrangements should be made for ensuring design and allocation of financing for the correction activities.

Development trends

The natural open water currents are a nature factor, which has a substantial impact on the city’s development. Despite their apparent autonomy, they may not be considered in isolation. The development of this system is inherently bound to the development forecasts for the city of Sofia and Sofia Municipality.

The peculiarities of the system, provoked by its very nature, raise specific requirements concerning its development, which frequently depend on specific rules and laws, which are beyond the impact of the manmade ones.

The general direction of development are formulated in a manner, which in addition to the specific rules take into consideration also the norms and requirements for development of the other systems covered by the Master Plan. The open water currents act as a natural stop for the development of certain systems of the Master Plan, such as urban planning, transport and communications, engineering infrastructure, etc. On the other hand, the multiple rivers traversing the city and its surroundings create favorable conditions for the development of other systems, such as “Recreation”,

“Tourism” and “Green system” etc.

A serious problem for the open water currents is their irresponsible pollution with solid urban waste and waste water.

In its role of water receiver of all the rivers traversing the city of Sofia and Sofia Municipality the river *Iskar* is the victim of all the negative consequences of the poor state of its tributaries. The river is polluted additionally directly by the residential and industrial zones situated in close vicinity to it.

Determination of norm indicators for the system parameters

Corrections of rivers and gullies for protection from flooding of human settlements, industrial zones etc. are dimensioned in a way to provide the normal water quantity of 1 per cent, whereby checks are made for availability of maximum water quantity of 0,1 per cent.

Corrections of rivers and facilities for protection from flooding of agricultural areas are dimensioned in a way to provide the normal water quantity of 5 per cent, whereby checks are made of the reserves for availability of maximum water quantity of 1 per cent.

Measured precipitation quantities in l/m² at the stations of the National Institute of Meteorology and Hydrology

Station	Date		
	5 August 2005	6 August 2005	7 August.2005
Sofia District			
Sofia – City	53	64	8
Office of Hydrology and Meteorology			
Kokalyane	39	53	23
Orlandovtsi	48	65	4
Ivan Vazov	67	69	15
Boyana	65	66	11
Bozhurishte	74	58	4
Bankya	95	49	2
Kurilo	52	82	5

The review of the available data for the rainfall during 2005 on the territory of the city of Sofia reveals that the measured rainfall does not exceed the registered historical maximums for each of the stations on the territory of Sofia Municipality and no re-calculation of the emerging “high” water under availability as prescribed in the norm is necessary.

In view of the construction works underway in the southern areas of the city, however, reassessment is necessary of the runoff conditions and and the impact of the newly constructed roads and buildings on the general runoff module of the area and the time of arrival. To this end it is necessary to conduct a more precise study only of these areas. .

The ridges of the protective facilities (embankments and back walls) should be designed at the elevation of a forced water level, corresponding to the maximum water quantity, whereat the reserve elevation above the normal water level should be from 0.4 m to 0.8 m for small and medium-size rivers and from 0.6 to 1 m for big rivers. For human settlements, industrial zones etc. these values should be respectively from 0.5 m to 1 m for small ad medium-size rivers and from 0.8 m to 1.2 m for big rivers.

The necessary servitudes for the open water courses shall be determined in compliance with Item 42 of the Annex to Art. 3, Paragraph 2 of the Law on Regulation and Build-up of Sofia Municipality.

The overall dimensions of the corrected rivers in human settlements, industrial zones, etc. should comply with the requirements of the planning regimes, set up by the detailed urban plans. The detailed urban plans and the projects for the “Green system” should define also locations for ponds and other manmade water reservoirs and approaches to them for water abstraction for fire-fighting in the event of emergency situations in accordance with the norm requirements of Civil Defence..

Development of the system and limitation of pollution of open water courses

The majority of the rivers traversing the area of the city of Sofia have been corrected. Because of the mutual restrictions in the spatial development of the systems of urban planning and infrastructure nature, the applicable measures within the framework of the existing servitudes are reduced to better operation, maintenance and further construction of the required facilities.

A matter of extreme importance for the correct development and functioning of the system is to put a halt on pollution of river waters and river beds, uncontrolled abstraction of inert materials from the river beds and other human activities of negative impact.

Measures for improvement of the state of surface waters on the territory of Sofia Municipality:

- Compilation and approval of a Unified programme about the major priorities in the field of riverbed corrections and construction of sewerage systems in order to prevent discharging of waste waters in the gullies and rivers on the territory of Sofia Municipality.
- Improvement of the conditions for maintenance of riverbeds and prevention of pollution and slime building. Construction of gravel catchers and engineering platforms.
- Construction of the necessary facilities for handling and prevention of the harmful impact of water.
- Efficient coordination between the institutions responsible for care taking of rivers (municipalities, the Ministry of Regional Development and Public Works, the Ministry of Agriculture, the Ministry of Emergency Situations, the Ministry of Environment Water) on the issue of ownership.
- Monitoring of surface waters and of the point of their exit from Sofia, as well as of the quality of water at the entry to and exit from the city area.

For avoidance and reduction of the unfavorable consequences from flooding it is necessary:

- To increase the density of the network for meteorological and hydrological monitoring and its upgrading for the purposes of obtaining of more and more reliable data,survey and maintenance of the riverbeds, mapping of flooded areas;
- Working out of a plan for management of the flooding risk and a programme for urgent restoration of the drainage system.

In order to achieve the objectives of the draft concerning development of the system it is necessary to work out programmes with updated input data for the design of river corrections. :

- updating of the engineering and hydrological studies;
- hydrological and water economy studies of the southern end of the surrounding area;
- clarification of the opportunities for irrigation of agricultural land;
- specialized water economy and planning studies about the need for and the economic effect from the construction of drainage and irrigation

canals for evacuation of the surface waters from the surrounding area.

Development of the system of water sites. category “Lakes”

On the area of the Sofia Plain the water sites of the category “Lakes” are represented by dams and several ponds. The dams are Seslavtsi, Bistritsa, Kremikovtsi, Mramor (Tsarna Bara), Marchaevo and Suhodol-2.

Their main designation is to accumulate water for irrigation of the agricultural areas in the region. The height of their walls is up to 15 m. They are constructed as earth-fill type walls with a main outlet and a lateral spillway. According to “Norms for design of hydro-engineering facilities. General provisions – Classification of the hydro-engineering facilities” the micro-dams belong to Classes III and IV, whose spillway should be capable of conducting safely high water featuring recurrence rate once in 100 years (safety provision 1 per cent).

For the purpose of finding out their current state The Centre for Research and Design with the University of Architecture, Civil Engineering and Geodesy conducted in 2008 inspection of these water sites, involving assessment of their safety and analysis of their technical conditions.

The waters of some of the water sites are polluted by the discharge in them of untreated waste water. The water of the river Tsarna Bara, for instance, is polluted by waters and solid urban waste from the village of Voluyak and the adjacent territories. Additional pollution is observed as a result of rotting of the abundant water plants plantations in the dam pond.

The riverbed and the adjacent plots of the majority of water sites need periodical cleaning. In compliance with the Water Act and Odrinance No. 13/29 January 2004 concerning the terms and conditions for implementation of technical operation of dam walls and related facilities Sofia Municipality has been assigned the responsibility for maintaining the throughput capacity of the riverbed in a section extending to 500 m after the dam wall.

For the purposes of ensuring the safety of dam walls and related facilities the inspection (audit) has proposed measures, which should be implemented by Sofia Municipality.

Action plans for emergency (extreme and average) situations exist for these sites.

It is necessary also to work out Technical Passports of the water sites and their relevant facilities in accordance with the provisions of Ordinance No. 5 concerning the technical passports of construction sites.

Management, maintenance and operation

The quality of surface waters is controlled by the National System for Environmental Monitoring with the Ministry of Environment and Water. The points subject to this monitoring on the territory of the city of Sofia and Sofia Municipality to date are as follows: the river Iskar after *Iskar* Dam, the river Iskar at Kurilo Quarter (Hydro-meteorological station) – the city of Novi Iskar and the river Lesnovska at the village of Dolni Bogrov. In the “Programme for Environmental Management in Sofia Municipality”

setting up of new points for monitoring of the quality of the surface waters is envisaged for the rivers Boyanska, Dragalevska, Stara Reka etc.

The maintenance and exploitation of the rivers in the city of Sofia is performed by companies, which have gained that assignment on the basis of tenders conducted by Sofia Municipality under the terms and conditions of the Law on Protection of Nature. The repairs are implemented after relevant ranking in terms of urgency defined at the discretion of Sofia Municipality and the Civil Defense authority.

The regulatory framework concerning the control and sanctions in the event of damages caused or incurred as a result of corrections of the rivers and relevant facilities or in the event of intentional pollution of rivers still wants addendum and strict application.

It is urgently necessary to create a specialized body, whose responsibilities and competences would ensure proper management and protection of the open water courses on the territory of the city of Sofia and Sofia Municipality.

Requirements of the system “Open water courses” in relation to the development of other, specific and general programmes covered by the Master Plan.

For ensuring the linkage of the system with the other systems of the Master Plan it is necessary:

- to envisage in the systems “Sewerage”, “Recreation”, “Tourism” and “Green System” complex use of parts of the servitudes of rivers;
- to envisage in the programme for administrative management the setting up of an Office for Management, Monitoring and Control, in order to guarantee the development and protection against pollution of the open water courses.

4.9.4. Power supply

Analysis of the existing state of construction by 2008

The power supply system of Sofia is part of the national power supply system. It comprises the 400 and 220 kV transmission network, 110 kV network, together with the 110kV/MV distribution power substations, the medium and low voltage distribution networks on the area of the city, as well as the power generation plants in the city – Sofia TPP, Sofia-Iztok TPP and several small hydro-power plants. The 400(200)/110 kV supply substations and certain individual power transmission lines link system to the rest of the national power grid (220)/110 kV.

In the recent years certain changes have occurred, which will in the future have a decisive impact on the development and operation of the power supply system of Sofia. These were the realized restructuring of the energy sector and the privatization of the electricity distribution companies that followed. As a result of that currently the below listed energy companies are directly involved in the energy supply of Sofia:

- “CEZ Distribution Bulgaria” plc, whose field of activity is operation and management of the electricity distribution in the city;
- the “National Electric Company (NEC) SP plc”, owner of the transmission network, which is operated and managed by its daughter company “Power System Operator” SP plc through its network operational districts (NOD) – NOD Sofia-city and NOD Sofia-District;
- “Toplofikatsiya (District Heating) Sofia” plc – owner and operator of *Sofia* TPP and *Sofia-Iztok* TPP for combined heat and power generation;

According to the Energy Act the construction of infrastructure energy sites is obligation of the respective energy companies.

During the past period electricity consumption in the city of Sofia was characterized by certain fluctuations resulting from the instable and dynamic socio-economic circumstances during the period of transition from central planning to market-oriented economic development. After the introduction of the Currency Board in 1997 the economic situation has stabilized. As a result electricity consumption has also regained its stability and after 2001 has been manifesting steady increase. By types of consumers in the recent years it is characterized by:

- considerable drop in industrial consumption followed by a certain revival as a consequence of privatization and restructuring;
- considerable increase of consumption by the services sector after a certain drop in the years before;
- the consumption by the residential sector is the steadiest and even demonstrates some increase irrespective of the price changes.

By 2008 the final electricity consumption in Sofia reached the level of 4243 GWh, which accounts for about 14 per cent of the total consumption nationwide.

The recorded maximum loads follow in general terms the fluctuations in the changes of electricity consumption. In recent years these changes were in the range of 1100-1250 MW and the hours of consumption varied from 3600 to 3800 hours. On 1 January 2009 was registered maximum load of 1309 MW.

The analysis of the results from the power capacity balance of Sofia shows that the maximum load of the city is covered by:

- a) the generation capacities of the sources situated in the vicinity from a spatial point of view: about 15 per cent of the load;
- b) the national transmission network: about 85 per cent, whereat in terms of voltage levels the distribution is as follows:
 - 220 kV – about 45 per cent via the automatic transformers 220/110 kV in Sofia-South substation, Kazichene substation and Sofia TPP;
 - 400 kV – about 25 per cent via the automatic transformers 400/110 kV in Sofia-West substation and Stolnik substation;
 - 110 kV – about 15 per cent via the 110 kV air-borne lines, which provide connections to the other parts of the electricity system of the country.

The power supply system of Sofia features considerably higher capacity than the electricity consumption and maximum loads registered in recent years. Nevertheless, there exist certain “bottlenecks” in the 110 kV network on the area of the city, which have to be repaired urgently in order to ensure the appropriate security of electricity supply at the background of the manifested trend of steady increase of the electricity load in the city of Sofia. In addition, in order to allow for comprehensive utilization of the existing power supply system in perspective as well it is necessary to rehabilitate timely the elements in need of rehabilitation.

Forecast for electricity consumption and maximum load till 2030

Forecast for development of final electricity consumption in Sofia for the 2030 horizon has been developed. It is based on the envisaged rates of growth of electricity consumption (2.1 per cent average annual increase) in the forecast worked out in 2003 for the period till 2020 in connection with the

elaboration of the Master Plan. It coincides with the average annual growth rate laid down in the forecast concerning the total electricity consumption for the entire country by 2020, developed by the NEC SP plc. The recorded final electricity consumption in the city during the recent years indicates a good match of the forecast figures. In addition, account was taken of the impact of the global economic crisis and hence a smaller annual increase was laid down – 1.5 per cent.

The changes in electricity consumption of Sofia in perspective are within the limits of the real consumption during 2008 - 4243 GWh to 6450 GWh at the end of the period, which makes an increase of 52 per cent.

The estimated maximum load at annual use during 3600-3800 hours is in the range of 1700-1800 MW.

Development of the sources

With a view to improving the energy efficiency in the plants of “Toplofikatsiya (District Heating) Sofia” plc it is envisaged to increase the share of co-generation within the limits of the estimated maximum heating load and annual heat consumption in the period till 2030. It may be expected the part of the existing generation capacities (231 MW), which are in good technical state, will continue to operate during the forecast period till 2030 as well. It is envisaged to implement rehabilitation of a total of 115 MW currently operating capacities. Construction of new capacities for co-generation (a total of about 200 MW) is also expected. The distribution of these capacities among the different generation plants is as follows:

- Sofia TPP: Installation of three gas-fired turbines of 30 MW each, three utilizer boilers for steam production through heat recovery from the flue gases of the gas-fired turbines and one steam recuperating steam turbine of 20 MW is envisaged. In this way the total installed electricity generation capacity of the plant will reach 185 MW.
- Zemlyane TPP: construction of new 43 MW generation capacities from a gas turbine module comprising a gas-fired turbine and a utilizer boiler.
- Lyulin TPP: construction of new 43 MW generation capacity from a gas turbine module comprising only a gas-fired turbine and utilizer boiler.
- Ovcha Kupel 1 TPP: construction of new 3.1MW generation capacity.
- Ovcha Kupel 2 TPP: construction of new 3.1MW) generation capacity.

In the process of preparation is construction and commissioning of 8 mini-hydro-power plants (mini-HPPs) with a total installed (design) capacity of about 6 MW on the water supply system of the city.

In perspective broader penetration of local power sources in the residential sector and the public sector is possible in the form of small co-generation plants at the premises of consumers of heat and power: photovoltaic systems, hydrogen fuel cells, wind turbines. Because of their small capacity and the need of their being taken into account by the power supply system they will not have a substantial impact on its development.

Development of the network

Supply substations. The forecast development of the generation sources in the area shows that the new generation capacities envisaged to be constructed and the electricity produced by them will not be able to cover the expected increase in the maximum load and the electricity consumption of the area for the coming period till 2030. For this reason as different from the 2003 Master Plan, which envisaged construction of bigger generation capacities, currently it is indispensable to ensure increase of the share of

the power generation system through more efficient use of the existing supply substations and construction of new ones.

- It is envisaged that the existing 400/110 kV *Metallurgichna* substation, which till present was used only for supply of the separated 110 kV network of the *Kremikovtsi* Combined Metallurgical Works, shall be connected also to the 110 kV supply network of the city;
- Construction of a new 400/110 kV substation in the western part of the city (conventionally called “Suhodol”) is envisaged. The absence of a supply substation in that part of the city creates a problem with the reliability of power supply there even at present. As regards the 440 kV aspect, it will get connected to the system via a break-through of the air-borne 400 kV line between *Sofia-West* substation and *Chervena Moguila* substation.
- In the event of realization of the envisaged more intensive development of the “Northern city” and increase of the loads in that part of the city it may become necessary to introduce tension of 440 kV and transformation 400/110 kV in *Kurilo* substation. Connection of the substation to the 400 kV network is possible through breaking through the near-by running power transmission line from the *Metallurgichna* substation to *Sofia-West* substation.

Distribution substation 110 kV / medium voltage

On the basis of the performed analysis of the:

- loading of the existing 110 kV/medium voltage substations;
- technical and operating difficulties related to the operation of the 10 kV and 20 kV distribution networks;
- difficulties related to the connection of new consumers because of the lack of free plugs in the 10 kV and 20 kV systems of the existing substations;
- data about the urban planning development of the individual districts;
- development of the electricity loads and electricity consumption of individual districts and parts of the city

Construction of the following new 110 kV/medium voltage substations is envisaged:

- ⇒ as a priority: *Banishora* substation – in the Zone B-17 region;
- ⇒ *Kambanite* substation for power supply of the intensively advancing build-up in the southeastern part of the city;
- ⇒ Substation at the European Trade Centre;
- ⇒ Substation in the area of the former *Serdika* Railway Station for power supply of the envisaged high-rise build-up along *Todor Alexandrov Blvd.* (western direction), where the boundaries of the regions supplied by the *Sofia-Centre*, *Serdika* and *Borimechkata* substations;
- ⇒ Substation in the region before the Airport, where construction of logistics facilities is advancing at an accelerated pace;
- ⇒ Substation at the Factory for Solid Waste Treatment near the village of Yana;
- ⇒ Substation in the region to the north of the Central Railway Station, where construction of residential and commercial estates at an accelerated pace is envisaged.

It is necessary to reserve in the Master Plan plots for the sites of these new distribution power substations.

It is envisaged to build 20 kV distribution boards and to install 110 / 20 kV transformer capacity at the substations *Sofia-South*, *Kazichene* and at the *Sofia-East* TPP. These boards will feed the 20 kV network in their adjacent

regions and in the case of Sofia-East TPP – the industrial consumers, which are currently supplied at 6 kV, will change to power supply at 20 kV voltage. In this way will be avoided the occupation of new plots in the city for new substations and routes of new electric transmission lines.

In terms of priority, shift of the *Nikola Kolev* substation, which is the only one still left with supply of 35 kV, to supply from the 110 kV network is envisaged.

Construction of a 20 kV board and installation of 3-winding transformers 110/20/10 kV at *Mladost* substation (which currently features only 110/10 kV transformation) is also envisaged. In this way the mutual reservation of the substations in this region via the distribution network, one part of which is rated for 10 kV voltage and the rest for 20 kV voltage, will be resolved to a certain extent. For taking up the loads in the southwestern part of the city it is feasible also to install a 20 kV distribution board at *Boyana* substation and to install three 3-winding transformers 110/20/10 kV. As an alternative power supply for this region it is possible to construct a new substation in the area of Pavlovo, for which it will be difficult to find a free plot.

It is envisaged that in the event of increase of the loads in the northeastern surrounding area *Rudnichna* substation may be used for their supply. Currently it feeds 6 kV voltage only for the Kremikovtsi pit. A 20 kV distribution board will be built in its, as well as two 3-winding transformers 110/20/6 kV.

It is envisaged also that in the event of increase of the loads the already constructed 110/20 kV, which currently is used only as a note 20 kV station, will be commissioned in regular operation. Since, however, it is located in a region, where the majority of the distribution network features 10 kV tension, it will be feasible to built in it a 10 kV distribution board and respectively to install 3-winding transformers 110/20/10 kV.

In the event of increase of the loads in the southeastern part at a later stage the *Gorublyane* substation (110/20 kV), whose construction was suspended several year ago, may be completed and commissioned.

It is possible that during the forecast period might emerge a necessity to build substations 110 kV/medium voltage for independent supply of certain big industrial or other consumers. These substations will be located on the sites of the consumers themselves, therefore there is no need of reserving plots for them in the Master Plan.

Development of the 110 kV network

The development of the 110 kV network during the forecast period comprises construction of new air-borne and cable lines for connection of the 110 kV boards of the new supply and distribution substations, of *Zemlyane* TPP and *Lyulin* TPP. The connection of every new element to the 110 kV network is an independent task by itself and hence needs detailed study. For the purposes of the Master Plan are proposed possible solutions for construction of new air-borne and cable transmission lines with a view to reserve plots for the routes of these lines. The proposed solutions follow the general principles of power supply to big cities.

In the periphery these lines are constructed as air-borne and in the densely built-up central areas – as cable lines.

In the forecast period till 2030 replacement of the existing 110 kV cables will be necessary because of exhaustion of their service life resource. It would be feasible for the new cables to have a higher transmission capacity. In the cases of replacement of cables it is possible that the routes of some of them shall have to be changed.

For urban planning reasons it is possible that certain air-borne lines or

certain parts of them would be implemented as cable lines.

Because of the insufficient transmission capacity of some of the existing air-borne lines, implemented with conductor section 185 mm² replacement of these conductors with units with section 400 mm² is envisaged, and in some cases also their reconstruction from single to double lines using the same routes.

Because of the limited possibilities for allocation of plots for routes of high- and medium tension air-borne lines it is feasible to envisage corridors for construction of the elements of the engineering infrastructure along the Rinf Road, northern and western tangents etc., scheduled for construction within the Master Plan timeframe.

4.9.5. District heating

The district heating of the city of Sofia is effected by *Toplofikatsiya Sofia (District Heating Sofia) Sole-Proprietor Public Liability Company (SP plc)*. The company is 100 per cent state property as of 13 January 2009. It has been the operator of the district heating system of the city since its very creation 50 years ago. By its capacity and coverage it is one of the largest district heating companies in Europe.

Toplofikatsiya Sofia SP plc possesses the following licenses issued by the State Energy and Water Regulatory Commission:

- License No. L-032-02/15 November 2000: For production of electricity and heat energy in TPP;
- License No. L-031-02/15 November 2000: For production of heat energy in DHP and TDHP;
- License No. L-033-05/15 November 2000 for transportation of heat energy; amended by virtue of Decision No. 11-L-033-05/23 April 2007.

The validity term of all the licenses is 20 years, i.e. till 2020.

The boundaries of the territory, covered by the rights for transportation and sales (according to the above mentioned License No. L-033-05/15 November 2000) r) is as follows:

Ring Road southward lane, Nikola Petkov Blvd., Buket St., Georgui Stranski St. (renamed to 693 St.), *Boryana St., Montevideo St., Boycho Boychev St., Ring Road, Voluyak-Birimiritsi* railway line, northern and eastern boundary of *Levski G (4)* Housing Estate, eastern boundary of *Levski C (3)* Housing Estate, eastern tangent, *Polkovnik Vassil Zlatarev St., 5008 St.*, eastern boundary of *Iskar* Railway station locality and *Industrial Zone* locality, eastern boundary of *Druzhiba-2* Housing Estate, eastern boundary of *Gorublyane* Locality and *Ring Road shouthward lane*.

The boundaries of the licensed region in fact comprise the entire urban area with the exception of the quarters and localities *Orlandovtsi, Malachevtsi, Manastirski Livadi, Mircho Draganov, Vitosha, Malinova Dolina, Sredorek* and *Gerena*. Within the boundaries of this territory fall also the industrial zones of Sofia TPP and Iskar Railway Station.

In addition to satisfying the district heating demand *Toplofikatsiya* Sofia SP plc sells also limited quantities of industrial steam to the industrial zone of the city.

The information provided below is structured according to the specifics of the technology process of production and consumption of heat energy, which comprise the following:

- Production of heat energy;
- Transportation of heat energy;
- Sales (realization) of heat energy.

The territory of the city of Sofia is divided into 4 district heating regions.

The heat sources of the company are concentrated in 4 main plants, which are also the major suppliers for the respective district heating regions:

- Two thermal-power plants:
 - *Sofia* TPP;
 - *Sofia-Iztok* TPP;
- Two district heating plants:
 - *Zemlyane* DHP;
 - *Lyulin* DHP;

and temporary district heating plants: *Hadji Dimitar* TDHP, *Suha Reka* TDHP, *Levski G (4)* TDHP, *Ovcha Kupel I* TDHP, *Ovcha Kupel II* TDHP and *Inzhstroy* TDHP.

Boundaries of the district heating regions:

Sofia District Heating Region

It covers the territory of the housing estates *Nadezhda 1* and *Nadezhda 2*, *Tolstoy, Triagalnika, Fondovi Zhilishta, Sveta Troytsa, Gen. VI. Zaimov, Hadji Dimitar, Stefan Karadja, Suhata Reka, Levski – Zona G*, the Central City area comprising the following quarters and localities: *Zone B-2-3, Zone B-3, Zone B-4, Zone B-5, Zone B-18, Zone B-19, Zone B-15, Zone B-16, Zone B-17 Zone G-14, Banishora, Bukata, Centre, Doktorski Pametnik*, the industrial zone comprising the *Stara Planina* НПЗ and *Voenna Rampa*.

The housing estates *Hadji Dimitar, Stefan Karadja, Suhata Reka, Levski – Zone C (3)* and *Levski – Zone G (4)* ara supplied with district heating by temporary district heating plants (TDHPs).

Sofia-Iztok District Heating Plant

This district heating region comprises the area of the folloing residential areas: *Yavorov* Housing Estate, *Poduene-Centre* Housing Estate, 3rd Outer City Part, *Hristo Smirnenski* Housing Estate, *Geo Milev* Housing Estate, *Iztok* Housing Estate, *Izgrev* Housing Estate, *Lozenets* Housing Estate, *Dianabad* Housing Estate, *Mussagenitsa* Housing Estate, *Darvenitsa* Housing Estate, *Polygona* Quarter, *Studentski Grad* Housing Estate, *Mladost* Housing Estate and *Druzhiba* Housing Estate.

The territory of the industrial zone supplied with steam for technological applications as heat carrier has the following boundaries: *Dimitar Peshev St.*, the fence of *Sofia-Iztok* TPP, *DK-3*, the river *Iskar*, *5-008 St.*, *Podporuchik Yordan Todorov St.*, *5-009 St.*, *Iliya Beshkov St.* and *Bezimenna St.*

The boundaries of the industrial zone supplied with steam as heat carrier and domestic hot water are as follows: *Prof. Tsvetan Lazarov Blvd.*, the river *Iskar*, *5008 St.*, *Podporuchik Yordan Todorov St.*, *Bulgranit*, railway line *Sofia Central* Railway Station, *Iskar* Railway Station, *Druzhiba* Car Service Station, XXVIII Complex Diagnostic Centre, *Daru* Car Building, *Iliya Beshkov St.*, *Bezimenna St.*, *Dimitar Peshev St.*, including *Vrana* Zone.

Zemlyane District heating plant

The district heating region covers the territory of the following residential areas: *Ivan Vazov* Housing Estate, *Kriva Reka* Housing Estate, *Hypodruma* Housing Estate, *Lagera* Housing Estate, *Zdrave* Housing Estate, *Dobrudjanski* Housing Estate, *Krasno Selo – Strelbishte* Housing Estate, *Buxton* Housing Estate, *Krasno Selo – Borovo* Housing Estate, *Motopista* Housing Estate, *G. Delchev* Housing Estate, *Strelbishte* Housing Estate, *Serdika* Housing Estate, *Krasna Polyana* Housing Estate, *Razsadnika-Bezantsite* Housing Estate, *Razsadnika-Konyovitsa* Quarter, *Zona B-19* locality, *Zapaden Park* Housing Estate, *Gevgeli* Housing Estate, *Ovcha Kupel 1* Housing Estate and *Ovcha Kupel 2* Housing Estate.

Lyulin District heating plant

The district heating region covers the area of the following residential areas: *Lyulin* Housing Estate, *Obelya* Housing Estate, *Hadezhda* Housing Estate Parts 3, 4, 5 and 6, *Svoboda* Housing Estate, *Vrabnitsa* Housing Estate and *Zaharna Fabrika* Housing Estate.

Structure of heat production and distribution

The heat sources are grouped by district heating regions as follows:

DISTRICT HEATING REGION	Sofia	Sofia-Iztok	Zemlyane	Lyulin
Major plants	Sofia TPP	Sofia-Iztok TPP	Zemlyane DHP	Lyulin DHP
DH main distribution lines	7 off.	5 off.	4 off.	4 off.
Temporary DH plants	Hadji Dimitar Suha Reka Levski G "		Ovcha Kupel I Ovcha Kupel II	Inzhstroy

The total installed capacity of the heat sources is:

- 3 970.7 MW_{th} (available 2 892.0 MW_{th}) - for heat energy
- 261.0 MW_e (available 220.0 MW_e) – for electricity

The boiler stock of the company total is composed of:

12 electric boilers PK 220 t/h of unit capacity 157 MW_{th},
15 water heating boilers, an obsolete Russian design, PTVM-100 - 116 MW_{th},
9 water heating boilers, Bulgarian design, VK-100 - 116 MW_{th},
31 flame-tubular water heating boilers VKGM-7.5 – 8.7 MW_{th}.

The turbogenerators of the company feature the following capacities:

50 MW – 1 off – *Sofia* TPP
25 MW – 1 off – *Sofia* TPP
30 MW – 4 off – *Sofia-Iztok* TPP (1 has been decommissioned)
66 MW – 1 off – *Sofia-Iztok* TPP

The installed capacities in the individual plants are as follows:

Sofia District heating region

Sofia TPP

Co-generation is realized by means of energy boilers EK 220 t/h, steam connected to turbogenerators TG 6 - 50 MW_e and TG 8- 25 MW_e. The total coefficient of efficiency of the unit is 72 - 75 per cent.

Generation of heat energy only is realized in:

2 reconstructed boilers PTVM (R) – 100, coefficient of efficiency 91- 93 per cent; and
3 boilers of Russian make PTVM-100, coefficient of efficiency 86 – 88 per cent.

The temporary district heating plants *Hadji Dimitar*, *Suha Reka*, and *Levski G* are equipped with boilers VKGM-7.5.

Sofia-Iztok District heating region

Sofia-Iztok TPP

The combined heat and power generation is realized in two energy producing parts of the plant:

- Old part, equipped with 4 energy boilers EK 220 t/h, steam connected to turbogenerators TG1, TG 2 and TG 4 - unit capacity 30 MW_e, coefficient of efficiency total 72 - 75 per cent.
- Energy expansion equipped with 3 energy boilers EK 220 t/h, connected to turbogenerator TG5 – 66 MW_e, coefficient of efficiency total 82 - 85 per cent.

The generation of heat energy only is realized in:

8 boilers VK-100, coefficient of efficiency 90- 92 per cent.

Zemlyane District heating plant

Zemplyane District heating plant

Heat energy generation is realized by:

2 water heating reconstructed boilers PTVM (R)-100, coefficient of efficiency 91- 93 per cent; and
3 boilers of Russian make PTVM-100, coefficient of efficiency 86 – 88 per cent.

Temporary district heating plants *Ovcha Kupel I* and *Ovcha Kupel II*

The generation capacities of the plants are flame-tubular water heating boilers type VKGM-7.5, coefficient of efficiency 90- 91 per cent.

Lyulin District heating region

Lyulin District heating plant

The generation of heat energy is realized in water heating boilers:

1 reconstructed water heating boiler PTVM (R)-100, coefficient of efficiency 91- 93 per cent
1 boiler VK-100, coefficient of efficiency 91- 93 per cent
2 boilers of Russian make PTVM-100, coefficient of efficiency 86 – 88 per cent.

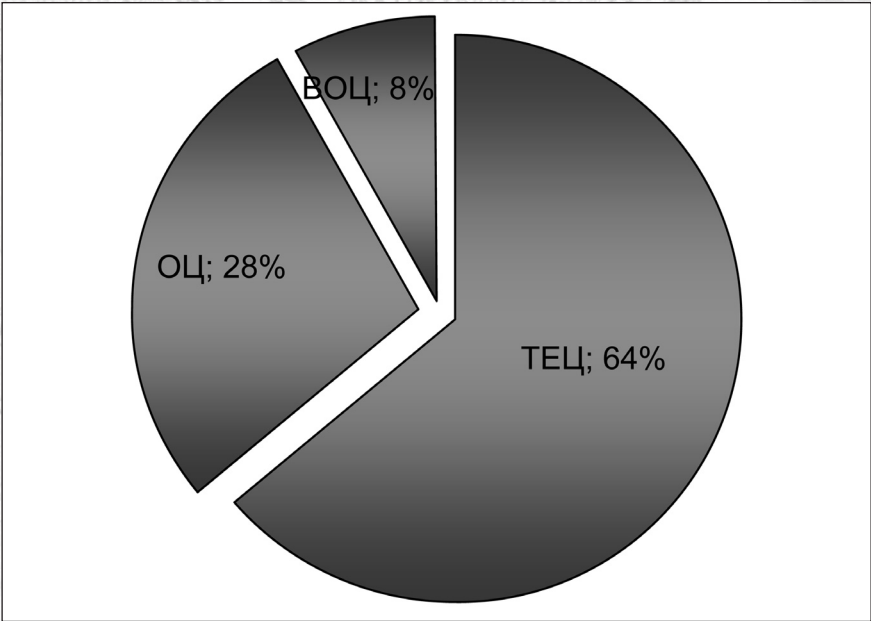
Inzhstroy Temporary district heating plant

In the plant are installed as follows:

2 boilers VK 7.5 Gcal/h and 1 boiler KTM-2 Gcal/h, coefficient of efficiency 88 - 90 per cent.

Annual production

Distribution of heat energy production by types of plants:



Heat energy output in MWth

	2006	2007	Estimated
TOTAL	5 591 731	5 135 279	
<i>Sofia</i> TPP	1 444 030	1 490 796	1 500 000
<i>Sofia-Iztok</i> TPP	2 087 021	1 965 748	1 950 000
DHP and TDHP	2 060 680	1 678 735	1 700 000

The drop in the heat energy output in 2007 as compared to 2006 is due not so much on the change of the number of subscribers as on the reduction of the losses in heat energy transmission and the improved regulation of heat energy consumption by the subscribers, as well as to reasons related to climate.

In the column “Estimated” is quoted the load, which is expected to be taken up in medium-term perspective.

Toplofikatsiya Sofia SP plc meets nearly 95 per cent of the needs of heat energy of the capital in the regions, for which it is licensed.

Electricity output of Toplofikatsiya Sofia SP plc in MW_eh

	2006	2007
TOTAL	798 636	1 024 846
<i>Sofia</i> TPP	130 585	343 466
<i>Sofia-Iztok</i> TPP	668 051	681 380

In recent year preferential prices were introduced for the purchasing out of electricity produced through co-generation, which resulted in increase of the electricity output.

The electricity produced by *Toplofikatsiya Sofia* SP plc covers about one quarter (1/4) of the electricity consumption of the city of Sofia.

The plants of *Toplofikatsiya Sofia* SP plc consume annually about 750 - 800 million nm³ natural gas.

In 2008 a shift from heavy oil to natural gas was implemented for the temporary district heating plants, which had not been gasified by that time. This action produced, apart from the achieved improvement of the economic indicators, also a notable environmental and social effect (including provision of DHW). During the 2009-2009 heating season was put a stop to the planned consumption of about 20 000 t of heavy oil.

Heat transportation network

The heat transportation network in the city of Sofia is a twin-pipe system and is governed through the change in the temperature of the heat carrier depending on the climatic conditions during the heating season.

The total length of the heat transportation network is 968 km, including 920 km hot water pipelines, 32.8 km steam pipelines and 25.6 condensate pipelines. The pipeline diameter is 1 200 mm. About 75.5 per cent of the heat transportation network is laid in impassable grooves not allowing opportunities for effective preventive maintenance through visual control nor for a technology systems for monitoring the state-of-repair of the heat pipelines. An exception in this respect are the heat pipelines of pre-insulated pipe (15.5 per cent), those laid down in installation collectors (5.1 per cent) and those laid in the open along a route at some height above the ground (2.9 per cent). Still in operation are sections of minimum size laid in aerated concrete without grooves, which are the utmost depreciated ones.

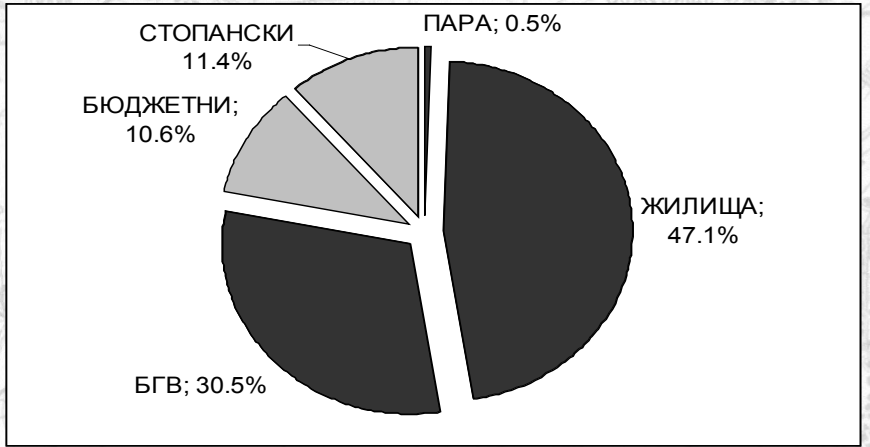
The main part of the heat transportation network was built till the 1990's under outdated and since long time denounced technologies at low level of workmanship. As a result of that fact the averages rate and the energy

losses in transportation are relatively high as compared to the situation in the rest of the European states.

In 2002 *Toplofikatsiya Sofia* SP plc started a project for rehabilitation of the district heating system in the city of Sofia. To date 105 km pipelines of the heat transportation network have been replaced. The replacement involves almost entirely preinsulated pipelines laid down without grooves. This represents 45 km above the originally planned 60 km. The project implementation has led to considerable reduction of the transportation losses but is not sufficient to bring the network to the desirable good condition, since there are still pipelines, which have been in operation for more than 40 years. More than 30 km of pipelines should be replaced annually, especially in the first several years, in order to compensate for the lagging behind in the previous years.

Heat energy consumption

The structure of heat energy consumption as supplied by Toplofikatsiya Sofia SP plc is as follows:



The subscribers of Toplofikatsiya Sofia SP plc comprise:

381 000 flats
25 000 non-residential premises
Number of DH substations: 16 000

From the total number of DH substations only 23 are direct ones. In implementation of the project for rehabilitation of the district heating system of the city of Sofia since 2002 till now some 9 650 DH substations have been replaced. After the scheduled replacement of another 703 DH substations in the period 2008/2009 the total number of the new substations will increase to 10 353.

Following the introduction of automatic control of a large number of DH substations the hydraulic regime of the individual district heating networks became very dynamic, which can be identified by the instantaneous heat consumption and the local regulatory systems of these networks.

The basic connected heat load in MW, is as follows:

Plant	Calculated load	Available	Actually necessary
Sofia TPP	1490	540	450
Sofia-Iztok TPP	2024	1045	620
Zemlyane DHP	1120	536	350
Lyulin DHP	665	512	240

ANALYSIS OF THE CURRENT STATE AND DEVELOPMENT PLANS

In all the Eastern European countries a large-scale rehabilitation and upgrading of the existing histrict heating systems is underway seeking for the options at least costs for society and the subscribers.

The existing district heating infrastructure will, after adequate rehabilitation and upgrading, be able to guarantee reliable heat supply at least costs for society.

The available heat generation capacity by heat sources is some 1/3 higher than the instantaneous peak capacity of the connected heat loads, i.e. the heat sources possess the necessary capacity to service the district heated sites in the city. The same applies for the heat loads of steam consumers. The district heating system has been constructed in the course of 50 years, huge amounts of capital have been invested in it and its rehabilitation and upgrading has already begun. This fact, as well as the complexity of the constructed underground communications, makes unfeasible any consideration of an option involving replacement of the district heating system by a new gas supply system. Such a shift would involve very big investments, long periods for reconstruction and construction works, discarding of already constructed facilities and generation capacities, which define it as economically unprofitable. This conclusion is corroborated also by the practice in other European countries. With a view to the stated considerations it was decided to regard as potential consumers of the gas-supplied regions only regions, which are not district heated. The existing district heating system should be upgraded within the boundaries of the licensed regions.

Production capacities

Sofia TPP is the oldest plant in the framework of the company. It is equipped with depreciated and technologically obsolete equipment, which should be subjected to measures for renewal and upgrading of the capacities, as well as improvement of the efficiency and reliability of the operated facilities.

Sofia-Iztok TPP is a plant in good technology state. In this connection it would be reasonable to implement only measures related to reconstruction and upgrading of the existing facilities.

In the *Zemlyane* and *Lyulin* district heating plants it is necessary to construct capacities for combined heat and power generation and implement measures for improvement of the efficiency and operational reliability.

The gas supply pipelines to the plants and the storage yards in these possess capacity for much higher output of heat energy and electricity as compared to the current rates.

Transmission networks

Currently there are high losses in the heat transportation networks. The networks feature minimum automation, distance control and operative management. The majority of it offers no possibility for effective preventive maintenance.

In recent years a regime allowing regulation in terms of quantity and quality of district heating supply is being introduced successfully. To date this has been realized for the district heating regions *Sofia*, *Zemlyane* and *Lyulin* and partially for *Sofia-Iztok* district heating region.

Forthcoming (scheduled for next? year) is introduction of the necessary thermo-hydraulic regime in *Sofia-Iztok* district heating region, which will take place after installation of automatic controls of the networking pumps equipped with frequency transformers in *Sofia-Iztok* TPP.

The subscribers

The conducted analysis of heat energy production in recent years revealed a trend of reduction of consumption. The main reasons for this drop are as follows:

- Partial or full renouncement of the services of the DH system because of the raising prices of district heating, which cannot be compensated by the connected new subscribers;
- The ever broader introduction of devices for individual control and metering of heat consumption;
- Improvement of the thermal characteristics of the repaired buildings and especially of the new buildings;
- Grave drop in industrial consumption as a result of suspended, privatized and modernized industrial enterprises and as a whole of the significant reduction of their production programmes.

Concerning the district heating system in general

The general shortcomings of the system are as follows:

- The share of effective co-generation is low for the expense of the significant share of water heating boilers. The available power generation capacity is below 10 per cent as regards the total heat generation capacity.
- For more than 10 years (until 2002) no rehabilitation or upgrading activities have been realized in the district heating system.
- No account was taken of the trends towards changes in the prices of energy carriers nor were any measures undertaken for improvement of the coefficient of efficiency of the technological process as a whole. If that had been done the increase in the price of district heating would not have been so dramatic and the number of subscribers, who had renounced the services of the company, would have been lesser and hence the incurred losses would have been lower.
- Although substantially improved, the regulatory framework still needs further adjustments in order to match the European models and to be aligned to the psychology traits of Bulgarians.

The conducted studies of the energy market in the next 20 years provide grounds to expect the following changes in the district heating system of the city of Sofia;

- Increase in the share of co-generation including twofold of power generation only. Besides the considerable improvement of the financial indicators of the company this development would contribute to make the price of heat energy supplied by *Toplofikatsiya Sofia* SP plc the lowest one as compared to the other space heating alternatives.
- Introduction of alternative primary energy carriers for heat and power generation, belonging to the group of renewable energy sources (RES). Such alternatives are, for instance, fuels produced on the basis of solid urban waste etc. Their use is extremely favorable for the following reasons: that is local fuel and hence it reduces the dependence on external suppliers; it is linked to financial preferences related to the use of RES; the price of heat energy would not be so strongly influenced by changes in the prices of natural gas; *Toplofikatsiya Sofia* SP plc would be able to gain additional revenue from the combustion of this type of fuel. That is the practice in many developed countries.
- Reduction of transmission losses. That means less heat losses as a consequence of the replacement of the heat transportation pipelines by more modern ones and less losses of electricity for ensuring the transportation of heat through improvement of the hydraulic regimes.
- Optimization of the thermo-hydraulic regime of energy transportation.
- Gaining back some of the subscribers from the residential sector, who have renounced the services of the system, after introduction of the devices for individual accounting and regulation of heat consumption,

- but above all because of the cheaper price of the heat carrier. In addition, district heated dwellings offer a higher living comfort.
- The new modern housing construction and other types of construction, which will lead to higher density of the district heating regions within the boundaries of the licensed zones.
 - The increase in the number of commercial and business buildings and offices, which are definitely interested in connection to the district heating system.
 - An increase in the consumption of steam for industrial applications is not expected and hence the use of this heat carrier may be discarded.

As a result of the conducted studies of the forecast heat loads to be covered by *Toplofikatsiya Sofia* SP plc, identified on the basis of the declared required heat loads (by 2013) and calculated heat loads by aggregate indicators based on the build-up rates (by 2030), the following figures have been obtained for the individual district heating regions:

District heating region	Load pending connection (finished buildings)	Forecast heat load ¹ (not cumulative)
Sofia	120 MW _{th}	185 MW _{th}
Sofia-Iztok	200 MW _{th}	250 MW _{th}
Zemplyane	100 MW _{th}	300 MW _{th}
Lyulin	50 MW _{th}	150 MW _{th}

¹ The forecast heat load is based on increase of the density of build-up of the quarter spaces and reconstruction of the building stock, as well as the future build-up.

Some of the bigger heat loads are as follows:

Sofia district heating region

For the territory of the *Botevgradsko Shosse* Road locality: 80 MW_t

For the territory of *Orlandovtsi* locality and the adjacent zone: 25 MW_t

Sofia-Iztok district heating region

For the territory of *Krastova Voda* locality – Southern Park Part IV: 70 MW_t

For the territory of *Vitosha* locality – *Simeonovo* HPP: 100 MW_t

For the territory of *Malinova Dolina* localcity – *Gorublyane* locality: 65 MW_t

Zemlyane district heating region

For the territory of *Manastirski Livadi-West* locality: 90 MW_t

For the territory of *Manastirski Livadi-East* locality: 75 MW_t

The development of the heat transportation network in the city of Sofia is directly dependent on the connection of new consumers. It is envisaged to construct new heat transportation pipelines or to expand the existing network as follows:

Location	Route along	Dia. (mm)	Length (m)
Zone B-2-3	<i>Tsar Someon</i> St. from <i>G. Washington</i> St. to <i>Bratya Miladinovi</i> St.	200	450
	<i>Tsar Simeon</i> St. from <i>Otets Paisii</i> St. to <i>Inzh. Iv. Ivanov</i> St.	150	200
	<i>Ossogovo</i> St. up to the collector in Zone B-5 (finishing works)	500	600
Zone B - 3, Zone B - 4	<i>Sofronii Vrachanski</i> St. between <i>Tsar Simeon</i> St. and <i>T. Alexandrov</i> Blvd.	150	600
	<i>Antim I</i> St.	150	150
	<i>Sredna Gora</i> St. between <i>Tsar Simeon</i> St. and <i>T. Alexandrov</i> Blvd.	150	150
	<i>Tsar Simeon</i> St. in the direction of <i>Hristo Botev</i> Blvd.	200	200
	<i>Strandga</i> St.	150	300
	<i>Ossogovo</i> St. in the direction of <i>Slivnitsa</i> Blvd.	150	120
	<i>Bregalnitsa</i> St.	150	350
	<i>Balgarska Morava</i> St.	150	350
	<i>Ovche Pole</i> St.	200	100
Zone B – 17	<i>Odrin</i> St.	150	300
	<i>Kozloduy</i> St.	150	200
	<i>Gen. Chernyaev</i> St. and <i>Svishtov</i> St.	100	150
Zone B – 19	<i>Zaychar</i> St.	150	200
	<i>Pozitano</i> St. for boxes 232, 233, 224 and 272	150	150
Triagalnika Houseing Estate	Deviation for urban main line V	200	200
		150	120
<i>Botevgradsko Shosse</i> Blvd.	<i>Botevgradsko Shosse</i> Blvd. – further construction and commissioning of installation collector	500	2570
Poduyane Reduta	<i>At. Uzunov</i> St.	500	300
	<i>At. Uzunov</i> up to <i>V. Atanasov</i> St.	400	600
	From chamber No. I IIXC - 33 on <i>Iv. Shterev</i> St. and <i>At. Uzunov</i> St. along <i>Kalimantsi</i> St., <i>Stoil Voyvoda</i> St., <i>Decho Stafanov</i> St., along <i>V. Atanasov</i> St. up to chanmer No. ПЦ -7-4	400	960
<i>Dragalevska Spirka</i> Locality	Construction of outlets from the district heating main pipeline from the tunnel (chamber No. 42) along <i>Cherni Vrah</i> Blvd. up to its crossing.	300	100
	2-way laying in the local lane.	200	400
Lyulin-West Housing Estate	Deviation from chamber No. 100 for blocks Nos. 261-262, 263-264 and 361-365	300	150
		250	200
		200	150
	Deviation from Chamber No. 304 For blocks Nos. 368-371 For blocks Nos. 561-565 and 545-547	250	300
		250	650
V. Mancho Housing Estate	<i>Bratya Stanoslavovi</i> St.	200	700

Envisaged also is the following:

- Extension of the *Lozen* district heating main pipeline at *Kastova Vada* Locality and part of the *Vitosha* Locality – *Simeonovo* HPP
- Further construction of the route of *Iskar* district heating main pipeline IV in the area of *Gorublyane* НПЗ in *Malinova Dolina* Locality and *Gorublyane* Locality.

Repair of the indicated shortcomings and guaranteeing of safe and effective meeing of the district heating demand of Sofia in the period till 2030 and beyond may be achieved only provided the elaborated long-term programme for rehabilitation of the district heating sources, district heating transportation network and substations is duly implemented. Without radical investment aimed at performing the necessary rehabilitation and

construction of new capacities and facilities it would not be possible to achieve reliability and high energy efficiency of heat energy production, transportation and distribution.

In general the following should be implemented:

- Increase of electricity production through co-generation as a result of the increased heat load;
- Construction of steam-gas energy modules for combined heat and power generation at *Sofia* TPP (127 MW_e), *Zemlyane* DHP (86 MW_e), *Lyulin* DHP (43 MW_e) and *Ovcha KupeI* DHP (6.2 MW_e);
- Construction of power generation capacity based on alternative fuel (produced from solid urban waste);
- Rehabilitation of three steam boilers at *Sofia* TPP;
- Rehabilitation of six water heating boilers of 116 MW_m each in the four main heat sources;
- Reconstruction of turbine No. 3 at *Sofia-Iztok* TPP;
- Replacement of turbo-generator No. 6 at *Sofia* TPP by a new one of 55-60 MW capacity;
- Modernization of turbo-generators No. 3 at *Sofia-Iztok* TPP;
- Reconstruction of boiler plants Nos. 1 and 2 and commissioning of boiler plant No. 3 at *Sofia-Iztok* TPP;
- Rehabilitation of boiler plants;
- Rehabilitation of pumping stations;
- Structural changes in the heat transportation network of *Sofia* TPP with a view to liquation of inefficient temporary DH plants;
- Replacement of all the heat transportation pipelines laid in aerated concrete;
- Reconstruction of some main heat transportation pipelines on the area of the city;
- Finishing works on some main heat transportation pipelines on the area of the city;
- Concerning the DH substations: replacement of the direct ones and equipment by automatic controls;
- Setting in place of a dispatch system..

1.1.6. Telecommunications

Analysis and major development needs

The major directions of the analysis and conclusions concerning the future demand take account of the action of three main factors:

- **Liberalization** of the telecommunications market;
- **The EU Directives**, as well as the commitments under Chapter 19 “Telecommunication and Information Technologies” in connection with the negotiations for Bulgaria’s accession to the EU;
- **The programmes** for development of the information and communication infrastructure.

Telephone network

The territory of the city of Sofia and the surrounding area is linked in a unified inter-settlement telephone network of the digital type. In 2006 the last phase of the process of replacement of the analogue exchanges by digital ones was completed. In the recent 5 years priority was given to the dislocated digital capacities closer to the consumers, whose number currently is above 40 MSAN and OUTDOOR stations with approximately 30 000 subscribers. This has significantly improved the quality and reliability of the offered telephone services.

The total number of subscribers is about 745 000, which corresponds to a telephone density of approx. 53 per cent. On the territory of the city of Sofia the duplex telephone lines have been fully abolished. About 350 duplex

telephone lines are still in operation on the territory of the surrounding area.

In operation are about 4 000 public telephone booths, which are entirely of the type with prepaid cards.

The current subscriber waiting list comprises some 9 000 entries, whereby those from the surrounding area account for the larger relative share

The already attained degree of digitalization is a complex figure, which may be expressed by the following indicators:

- Digitalization in the settlements exchanges 95%
- Digitalization of the settlements connection network: 95%
- Digitalization of the connections between the national and international networks 100%

Telephone exchanges

Number of telephone exchanges	
City of Sofia	67/incl. OUTDOOR /
Surrounding area	<u>21</u>
Total:	88

CONNECTION NETWORK

It is developed by means of two types of cables – copper and optical. The connection network between exchanges has been implemented as a transmission medium based entirely on optical cables. Copper cables are used solely for certain parts of the surrounding area. The existing optical network uses cables with capacity from 12 to 96 optic fibres. The connection topology may be described by means of optical rings at two levels. Level One (the mainline level) features four rings – eastern, western and two in the central part of the city. Level Two comprises local rings. Optical connection to a number of human settlements in the surrounding area is ensured by means of deviations (‘tails’). Within the scope of its topology the optical network is a very good base for future development as fundamentals for the dynamically changing information and communication technologies.

SUBSCRIBER ACCESS NETWORK

It is constructed mainly on the basis of copper cables with configuration at three levels – primary, secondary and tertiary. The structure is of the “star”-type, which does not allow organization of by-pass connections in case of cable breakdowns. In the past 5 years a significant advance was achieved in the offer of sevices via the MAH network, so that currently 95 per cent of the transmission medium is based on OK.

Cable TV systems. There are about 30 cable TV systems currently in operation. The total number of consumers is approximately 450 000 households. Reception of 80 to 150 TV programmes is ensured. Part of the operators of cable TV systems offer also an additional service – high-speed Internet access. The majority of operators already offer a triplex service – telephone, Internet and TV. Five (Six??) dominant operators of cable TV systems stand clearly out, namely Evrocom Cable, Evrotour-SAT TV, Centrum Group, Cable Bulgaria and Sofia Cable and NET 1. The ADSL service provided by the Bulgarian Telecommunication Company gains an ever growing popularity and it is expected that by the end of this(??) year the number of its consumers will exceed 100 000.

Mobile telecommunications. To date the territory of the city of Sofia and the surrounding area is covered by the cell networks of three licensed mobile operators – Mtel, Globul and Vivatel. The networks of all the three are digital to the UMTS-3G Third Generation standard. The higher speed (2100 MHz) permits receiving/sending of higher volume of information – messages, Internet-based services, such as e-mail, video-messages, video-conversations and mobile TV. The trend is towards constant increase of mobile subscribers even above the number of fixed telephone posts.

Access to Internet is a service, which is related to the information communications infrastructure in so far that its price and quality of provision serve as the basic criterion about the extent of development of the information communications infrastructure. According to preliminary estimates for the city of Sofia and the surrounding area the number of users is in the range of 320 000 to 370 000, including about 70,000 in the residential sector.

Development of the system

Equalization of the standards of telephone services of the city of Sofia and the surrounding area.

The telephone services provision in the surrounding area has been resolved by means of commutater systems of the Telesist 1 type. During this year phased replacement of these systems by EWSD, AXE or Alcatel system is envisaged. Also envisaged is replacement and installation of DSLAM commutators on the suburban websites for the purpose of offering broad-band subscriber access.

Release of information capacity for alternative operators
The capacity of the telephone exchanges of the Bulgarian Telecommunication Company (BTC) in the telephone network of Sofia used to be concentrated in million-groups “9” and “8” from the scheme of numbers for local dialling. After telephone liberalization in the recent years BTC released subscriber numbers plab for the needs of the to licensed alternative operators, whereat the subscriber numbers begin with the digit “4”.

The new operators of telecommunication services will most probably use a new generation of package-based multi-service networks based on optical transmission, which in turn would encourage competition and would have a positive impact on the prices and quality of the service.

Protection and penetration of optics in the subscriber access networks

Several development phases are possible:

- Digitalization and optics in the primary network (dislocated capacities from the exchange to the PSH and the so-called MSAN OUTDOOR capacities);
- Optics in the secondary network;
- Optical connection to the end-user.

From the point of view of economic feasibility the following may be recommended:

- For the surrounding area and the peripheral zones of the city of Sofia with predominant factor “Residence” – implementation of Phase One;
- For the compact central city (Central City Area??) – Phases One and Two;
- For the zones of concentration of functions of the state governance, as well as the zones with dominant factor “Business” – to go directly to Phase Three through the option “passive optical network”. That

may be achieved through installation of commutator cabinets near the subscribers.

The indicator for achievement of this objective is replacement of minimum 50 per cent of the copper cables in the access networks by optical ones by the year 2012.

Comprehensive review of the regulatory framework for both the in-house systems and the distribution networks of the different operators. Particular attention should be paid to the protection of the interface between the distribution networks and the in-house systems. It is necessary also to take account of the future multi-media servicing of the end-users via one single broad-band access line.

Modernization of the cable TV systems, related to transition to a digital standard for cable TV DVB-C till the end of 2012.

Construction of Metro-networks

The saturation of the territory of Sofia Municipality with optical cable systems (of the Bulgarian Telecommunication Company, cable TV operators, Internet service providers) allows the construction of several parallel Metro-networks to the “Gigabit Ethernet by Optics” standard at three hierarchic levels” - local, national and international. These networks are recognized as the principal elements of the modern information and communications infrastructure. Their application will allow the development of a multitude of new forms of services: administrative services, teleworking, new forms of education (including distant learning), as well as sharp increase of the quality of health care via information&communication networks to the personal doctors, rapid introduction of different forms of electronic business. The comprehensive use of this type of networks requires the establishment of a national high-speed Internet backbone network with adequate international links.

“Transferability of the subscriber number”

The rapid development of the information-and-communication technologies and the new generations of systems for management of telecommunications will make it possible in 2009 to keep the subscriber number in the event of transition from the network of one operator to the network of another operator, as well as in the event of change of the residence address and shifting of an office to a different address within the boundaries of the settlement telephone network.

The optical ring connection in the Surrounding Area and establishment of a unified information&communication infrastructure in the entire territory of Sofia Municipality will create favourable conditions for a number of activities, which have so far been concentrated on the area of the city of Sofia, to be dispersed and located in the Surrounding Area.

Consolidation of the optical networks

The existence of numerous operators of optical networks and the demand for a universal multi-service access put forward the requirement for interconnections of the networks with the aim of establishment of a **unified infrastructure** irrespective of the forms of ownership on individual fragments. The most ‘painless’ way to achieve the required degree of integration is the establishment of **an unified system for management, maintenance and reservation of the optical infrastructure**. A suitable form of establishment of such a system would be a joint-stock participation or subscription fee for all participating operators.

Conclusions

The priority development of a modern information and communication

infrastructure will contribute to the creation of real preconditions for promotion of the role of the city of Sofia as an international/regional centre in terms of political significance, as well as with respect to science, culture, economy and education.

4.9.7. Gas supply and product transportation pipelines

General provisions

According to the requirements of Art. 105 of the Law on Spatial Development of the Territory the Master Plans shall outline the location of the networks and facilities for gasification, as well as their links to the infrastructure networks, facilities and sites of national significance. In this sense the “Gasification” Part of the Master Plan contains the gas transportation networks and facilities for the city of Sofia and Sofia Municipality with their technical parameters.

The use of natural gas, one of the cleanest energy sources, is a good alternative allowing achievement of high environmental effect and complying with the legislative requirements concerning protection of the natural environment. It produces much less harmful emissions and possesses much higher energy efficiency and cost-effectiveness. The possibilities and advantages of natural gas, the low costs in its use as an energy sources in the residential sector and industry, the preconditions for introduction of new, environmentally clean technologies, make natural gas an attractive and competitive heat energy source. Its main advantages, besides the indisputable environmental effect, are as follows:

- No distribution losses;
- Possibility for direct combustion in the end-user’s appliance;
- Precondition for comfort and a new life-style at guaranteed independence of the end-user to regulate the volume of consumption.

The replacement of the solid and liquid fuels by natural gas eliminates the need of warehouses, unloading platforms, cinder dump hills, service road and railway transport, liquid fuel spillage and coal dust.

The implementation of gasification will ensure access of all the potential end-users from industrial, public/administrative buildings and residential buildings to the gas distribution network, which will supply them with natural gas.

Gas supply is a combination of the activities related to natural gas transportation, transit, storage, distribution and supply for meeting the consumers’ demand.

The sites and facilities for the activities related to natural gas transportation, storage and distribution on the territory of the country, which are interconnected, function as a unified gas transportation system operating under a common regime. The gas transportation and gas distribution networks are part of the gas transportation system as well.

The gas transportation network is a system of high-pressure gas pipelines and their inherent facilities operating under a common technology regime for transportation of the natural gas to the outlet of the gas metering station (GMS) or gas regulation station (GRC) / automatic gas regulation station (AGRC), to which consumers and/or gas distribution companies are connected. In the automatic gas regulation station / gas regulation station is performed reduction of the pressure to the necessary level and its automatic up keeping. Purification of the natural gas and metering of gas consumption are also conducted. The stations are equipped with control and metering devices and automatic controls for regulation of the operating parameters.

Natural gas is colourless, odorless and tasteless. For the purposes of easy detection of gas leakages (in the in-house systems of residential or public buildings) unpleasant odor is artificially added to the natural gas.

For this purpose mixtures of substances called odorants are added to it. According to Chapter Eight of the Ordinance concerning the design and safe operation of transportation and distribution gas pipelines and of the gas-fired equipment, installations and appliances the natural gas should be “odorated” by the operator of the transportation network. In the event the gas is not adequately odorated, it is envisaged to perform the addition of odorants in an installation installed in the automatic gas regulation station or in the urban gas regulation points.

The gas distribution network is a local or regional system of gas pipelines of high, medium or low pressure and their inherent facilities for natural gas distribution to the respective consumers within the territory allocated by virtue of the issued license. Natural gas distribution is performed along the gas distribution network from outlets of gas metering stations or outlets of gas regulation stations on the gas transportation network to the gas metering device at the end-user. The gas distribution networks ensure constant supply of gas to the consumers and at the same time they are safe to operate and easy to service.

On the real estates of the consumers are developed yard networks, which transport the gas from the boundary of the estate to the building. In the buildings are constructed in-house gas pipeline systems to the gas-fired appliances on the premises.

The technological communication connections, accompanying the gas transportation and gas distribution networks, provide the necessary communication between the consumers and the operator of the service gas transportation and/or gas distribution company.

Climatic data

The climate of the city of Sofia is moderate-continental, characterized by hot and dry summers and cold winters. Springs are cool and relatively late. The values of the average diurnal temperatures remain steady above 5°C in the period after 15 March. Autumn sets in late. The values of the average diurnal temperatures remain steady below 10°C as early as during the first half of October.

Average monthly and annual air temperature in °C

	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Year
T °C	-0.4	0.2	4.6	10.4	15.3	18.7	21.1	20.7	16.5	11.2	5.1	0.4	10.3

It is evident from the table of the monthly temperatures that the average annual air temperature is +10.3 °C and that all the average monthly temperatures in winter are positive, with the exception of January.

The calculation parameters for the heating period are as follows:

- calculation temperature for space heating – minus 16°C;
- period with average daily temperature $t_{average} < 0^{\circ}\text{C}$ - 58 days;
- degree-days - 2900.

The length of the heating period is 190 days.

Existing gas pipelines

Since 1975 the Republic of Bulgaria receives its natural gas supply solely from Russia along a main gas transportation pipeline ring of DN 700 mm and compressor stations to it, which maintain the gas pressure in the ring at about 55 bar. The gas transportation ring is supplied by a main gas pipeline of DN 1000 mm and P=55 bar coming from Russia, traversing the territory of Romania and crossing the Romanian-Bulgarian frontier in the area of the city of Kardam.

The northern and the southern branches of the gas transportation ring

are joined in the area of the village of Gorni Bogrov, which is situated at a distance of some 15 km to the east of the city of Sofia.

The use of natural gas in the city of Sofia began during 1976-1977 when the so-called “Sofia section” of the national gas transportation network was constructed.

Within the scope of Sofia Municipality the gas transportation pipelines run by the settlements Buhovo, Zhelyava, Yana, Gorni Bogrov, Botunets, Chelopechene, Novi Iskar, Mirovyane, Mramor, Voluyak, Bankya, Ivanyane and Malo Buchino. The main gas pipeline is made of steel pipes featuring 6.5 and 7.92 mm thickness and DN 700 (711.2 mm). The northern branch of the ring is made of Italian steel pipes and the southern – of Bulgarian steel pipes (produced in the city of Septemvri). The pipelines are laid in the ground with an earth cover of at least 0.80 m, but depending on the specific local conditions at some places the depth may go up to 3 m (underneath roads and railway tracks).

The gas pipeline is property of the state-owned enterprise *Bulgargas* SP plc. The maintenance, security, repair and operation of the main gas pipelines on the territory of Sofia City Municipality is performed by *Bulgargas-Botevgrad* Region. Parallel to the route of the gas pipeline are laid communication cables, which ensure operating management of the pipeline. The gas pipeline is marked on the ground by not less than 1.5 m high metal poles, painted in black and yellow stripes.

The city of Sofia and the area around it are supplied via gas transportation deviations from the two branches of the transportation ring. At each of deviations are constructed gas distribution stations, in which the high pressure (55 bar) of the transportation pipeline is reduced to pressure levels of 6 bar, 10 bar, 12 bar and 16 bar.

Gas transportation deviations have been constructed from some of the automated gas distribution stations to the main heat energy sources of *Toplofikatsiya-Sofia* SP plc: *Sofia-Iztok* TPP, *Sofia* TPP, *Lyulin* DHP and *Zemlyane* DHP together with the temporary DHPs *Ovcha Kupel 1* and *Ovcha Kupel 2*. Afterwards further gas supply deviations have been constructed for connection of more than 20 industrial enterprises and public-administration sites. The total length of the existing gas pipelines after the city gas distribution station and outside the network of *Sofiasgas* plc does not exceed 36 km.

The approximate length of the constructed gas distribution network property of *Sofiasgas* plc (the license-holder for natural gas distribution) on the area of Sofia Municipality is about 421 km, including:

- Gas distribution pipelines for 6 bar pressure - 13 km;
- Gas distribution pipelines for 12 bar pressure - 6 km;
- Gas distribution pipelines for 10 bar pressure - 81 km;
- Urban gas distribution network for 4 bar pressure – 321 km.

From the constructed gas distribution pipeline for *Energokabel* with working pressure P=6 bar (10 bar at the end phase) are supplied Gas Distribution Point 34-G in *Obelya* Quarter and Gas Distribution Point 35-G in *Moderno Predgradie* Quarter, via which it goes to the end-users in *Obelya* Quarter and *Lyulin* - *Nestle-Sofia* Industrial Zone, and in *Moderno Predgradie* Quarter and *Zaharna Fabrika* Housing Estate to *Inzhstroy* Temporary District Heating Plant.

From the constructed gas distribution pipeline for *Sofia* TPP with working pressure P=6 bar (10 bar at the end phase) via additional gas pipelines for maximum working pressure 10 bar are supplied the Industrial Zone with major consumers *Sopharma* plc, *Aroma* plc and *Hadgi Dimitar* Temporary DHP, *Suha Reka* Temporary DHP and *Levski-G* Temporary DHP, and consumers around the Locomotiv Depot.

From the constructed gas distribution pipeline for *Sofia-Iztok* TPP with working pressure P=6 bar (10 bar at the end phase) via additional gas pipelines with maximum working pressure 10 bar are supplied the village

of Kazichene and the *Iskar* Railway Station Industrial Zone and connection is made to the gas distribution network along the Southern Arch – via the *Gorublyane* Quarter, *Mladost* Housing Estate, *Bunkera* в.з., *Simeonovo* Quarter, *Dragalevtsi* Quarter, *Kinotsentar* Quarter, *Boyana* Quarter and *Gardova Glava-Knyazhevo* Quarter. A deviation along *Simeonovsko Shosse* Blvd., *Moguilata* St., *F. Kutev* St. and *Cherni Vrah* Blvd. is constructed as well for supply of *Vitosha* Quarter, *Krastova Vada* Quarter, *Hladilnika* Quarter, *Hladilnika* Industrial Zone and *Lozenets* Housing Estate.

From the constructed gas distribution pipeline for *Zemlyane* DHP with working pressure P=6 bar (10 bar at the end phase) via additional gas pipelines with maximum working pressure 10 bar are supplied the Industrial Zone around *Danon*, *Krasna Polyana* Quarter etc. From the deviation for *Ovcha Kupel 2* Temporary DHP is constructed a gas pipeline to the *Fenix* Icecream Factory.

From the Sofia-4 gas distribution station – the village of *Ivanyane* is constructed a distribution gas pipeline with maximum working pressure P=16 bar via agricultural land, *Suhodol* Quarter, *Gorna Banya* Quarter, *Ovcha Kupel* – old part Quarter, then it is branched and each of the branches reaches up to *Tsar Boris III* Blvd., where it supplies the distribution network with maximum working pressures 10 bar. One of the branches of the gas distribution network with maximum working pressure 10 bar runs along the Southern Arch and the other via *Pavlovo* Housing Estate and *Manastirski Livadi* Quarter.

From Sofia-4 Gas Distribution Station – the village of *Ivanyane* is constructed a gas distribution pipeline with maximum working pressure P=12 bar via agricultural land to the city of *Bankya*.

Existing facilities

On the area of the Sofia Section are situated 9 gas regulation stations (GRSs, AGRSs). All in all, in the existing AGRSs/GRSs in the region of Sofia are constructed or envisaged to be constructed regulation lines for the serviced sites as follows:

AGRS/GRS	Number of lines	Qmax, m³/h	Major consumers
Sofia-1 GRS, the village of Kazichene	1	150 000	1. <i>Druzhdza</i> Bus Yard – gas used also for charging buses 2. <i>Sofia-Iztok</i> TPP 3. <i>Biohalco</i> - <i>Steelmet</i>
Sofia-2 GRS, the village of Kumaritsa	2	150 000	1. <i>Hristo Smirnenki</i> KO3 2. <i>Stind</i> 3. <i>Editem Engineering</i> 4. <i>T. Petrov</i> M3 5. <i>Zebra</i> plc – <i>Novi Iskar</i> 6. <i>Sofia</i> TPP
Sofia-3 GRS, the village of Voluyak	3	50 000	1. <i>Lyulin</i> DHP 2. the city of <i>Bozhurishte</i> 3. the city of <i>Kostinbrod</i>
Sofia-4 GRS, the village of Ivanyane	2 + 2, not in operation	60 000	1. <i>Zemlyane</i> DHP 2. <i>Ovcha Kupel</i> 1 and <i>Ovcha Kupel 2</i> temporary DHPs
Sofia-Kremikovtsi GRS	1	150 000	<i>Kremikovtsi</i> SP plc
Yana AGRS	1	1 500	<i>GasstroyMontazh</i>
Izola Petrov AGRS	1	1 500	<i>Izola Petrov</i>
Oranzherii AGRS – the city of Novi Iskar	1	15 000	<i>Oranzherii</i>
Bravo AGRS	2	20 000	<i>Bravo</i>

The maximum consumption of natural gas per hour during the winter duty cycles of the gasified sites on the territory of Sofia Municipality amounts to about 450 000 m³/h and the annual consumption does not exceed 1 billion m³/h.

The existing system (main) facilities of *Sofiagas* plc are as follows:

- GDP 34-G – supplies *Obelya* Quarter, *Obelya-1* Housing Estate and *Obelya-2* Housing Estate;
- GDP 35-G – supplies *Moderno Predgradie* Quarter and *Zaharna Fabrika* Housing Estate;
- GDP 31-G – supplies the village of *Kazicheve* and the village of *Krivina*;
- GDP P – supplies the outer zone of *Sofia* Airport;
- GDP 33-G – supplies the northern part of *Iskar* Railway Station Industrial Zone;
- GDP 18-G – supplies *Lindner* Business Park and *Mladost-4* Housing Estate;
- GDP 19-G – supplies *Gorublyane* Quarter;
- GDP 32-G – supplies *Bunkera* в.з.;
- GDP 16-G – supplies *Simeonovo* Quarter and in the future also the village of *Bistritsa*, the village of *Zgeleznitsa* and the village of *Plana*;
- GDP 15-G – supplies *Simeonovo-Dragalevtsi* summer-houses zone;
- GDP 14-G – supplies *Dragalevtsi* Quarter;
- GDP 13-G – supplies *Kinotsentar* Quarter;
- GDP 12-G – supplies *Boyana* Quarter;
- GDP 10-G – supplies *Gardova Glava-Knyazhevo* Quarter;
- GDP 9-G – supplies the urban distribution network along the Southern Arch;
- GDP 27-G – supplies *Vitosha* Quarter;
- GDP 26-G – supplies *Krastova Vada* Quarter, the *Hladilnika* Industrial Zone;
- GDP 25-G – supplies *Hladilnika* Quarter, *Hladilnika* Industrial Zone and *Lozenets* Housing Estate;
- GDP 24-G and GDP 23-G – supply *Manastirski Livadi* Quarter;
- GDP 22-G – supplies *Pavlovo* Housing Estate;
- GDP 1-G and GDP 2-G – supply the city of *Bankya*;
- GDP 4-G – supplies *Suhodol* Quarter;
- GDP 5-G – supplies *Gorna Banya* Quarter;
- GDP 6-G, GDP 7-G and GDP 8-G – supply *Ovcha Kupel* Quarter;
- GDP 21-G – supplies the urban distribution network with 10 bar pressure for *Pavlovo* Housing Estate, *Manastirski Livadi* Quarter and later on will serve the Southern Arch.

Servitudes

The servitudes along the transportation gas pipeline, the gas pipeline deviations and the facilities at the gas pipelines are regulated in Ordinance No. 16/9 June 2004 concerning the servitudes of energy sites and Ordinance dated 16 July 2004 concerning the structure and safe operation of transportation and distribution gas pipelines and facilities, installations and appliances using natural gas (Ordinance in compliance with Art. 200, Paragraph 1 of the Energy Act) are as follows:

- Construction of cities, villages, summer house zones, public, residential and industrial buildings, railway stations, bus terminals and stops of the mass public transport, river and sea ports, HPPs, water treatment and water pumping stations is not permitted at a distance of less than 200 m near gas transportation pipelines of dia. DN 700. In the cases when the diameter of the gas pipeline is DN 500 the servitude of the above listed types of sites shall be 150 m.

- Construction of human settlements, summer house zones, urban parks and gardens, public, residential and industrial buildings, railway stations, bus terminals and stops of the mass public transport, river and sea ports, TV towers and retransmitters is not permitted at a distance of less than 200 m near automated gas regulation stations (AGRS/GRS) having a supply gas pipeline of dia. DN 700. In the cases when the diameter of the gas pipeline is DN 500 the servitude of the above listed types of sites shall be 175 m.
- Outside the urbanized territories:
 - Near the distribution steel gas pipelines the servitude represents 4m-wide strips on both sides of the gas pipeline;
 - Near the distribution polyethylene gas pipelines the servitude represents 2m-wide strips on both sides of the gas pipeline;
 - For distribution gas pipelines under field roads and in the servitudes of municipal and republican roads the servitude shall be a 1m-wide strip on both sides of the gas pipeline for pipelines with dia. up DN 300 and up to 2m-wide strip for pipelines with dia. from DN 300 to DN 700.
- In urbanized territories:
 - in the case of steel distribution gas pipeline the servitude represents strips on both sides of the pipeline, asymmetric to its axis, with width equal to the sum of the pipe radius + 1.2 m on one side of the pipe and the pipe radius + 4 m on the other side;
 - in all the other cases (including for polyethylene distribution gas pipelines) – 0.4m-wide symmetric strips on both sides of the pipeline.

Connection points

The connection points to the national gas transportation network and to the distribution gas pipeline network on the territory of Sofia Municipality are the existing system facilities (AGDS/GDS) and the existing distribution gas pipelines:

- Point No. 1 “a” and point No. 1 “b” – Sofia-3 GDS *Lyulin* – working pressure at the end phase P=10 bar, the constructed outgoing distribution gas pipelines towards the former *Energokabel* DN150 steel and towards the city of *Bozhurishte* – DN200 steel of the respective necessary capacity $q_{v(20)}=7\,000\text{ m}^3/\text{h}$ and $q_{v(20)}=20\,000\text{ m}^3/\text{h}$ (under standard conditions – at 20°C and 101,325 kPa);
- Point No. 1 “c” – Sofia-3 GDS *Lyulin* – working pressure at the end phase P=10 bar, PE-HD, MRS100, SDR11, DN250, required capacity $q_{v(20)}=13\,000\text{ m}^3/\text{h}$ (under standad conditions - at 20°C and 101,325 kPa);
- Point No. 2 – *Oranzherii* AGDS – the city of *Novi Iskar* – working pressure at the end phase P=4 bar, connected gas pipeline PE-HD, MRS100, SDR17, DN160. It serves for gas supply to the city of *Novi Iskar* and the village of *Mirovyane*, required capacity $q_{v(20)}=4\,000\text{ m}^3/\text{h}$;
- Point No. 3 – constructed distribution gas pipeline towards *Zebra* plc, with working pressure at the end phase P=6 bar, near *Hadji Dimitar* St. with working pressure at the end phase P=10 bar, connection gas pipeline PE-HD, MRS100, SDR11, DN160, required capacity $q_{v(20)}=5\,000\text{ m}^3/\text{h}$;
- Point No. 4 “a” – Sofia-2 GDS *Kumaritsa* with working pressure P=10 bar, connection gas pipeline PE-HD, MRS100, SDR11, DN160. It serves for supply of the village of *Kubratovo*, the village of *Svetovrachane* etc., required capacity $q_{v(20)}=6\,000\text{ m}^3/\text{h}$;

- Point No. 4 “b” – Sofia-2 GDS *Kumaritsa* with working pressure P=16 bar, connection gas pipeline DN400 and two units of DN300 each. It serves for supply of *Trebich* Quarter, *Iliyantsi* Quarter, the northern part of the city of Sofia, required capacity $q_{v(20)}=85\,000\text{ m}^3/\text{h}$;
- Point No. 5 “a” – constructed distribution gas pipeline for *Sofia* TPP – connection to constructed distribution gas pipeline DN250 steel for *Sofpharma platform – B and Aroma* with working pressure P=6 bar, near the crossing of *Prof. I. Georgiev* St. and *Konstantin Preslavski* St. – working pressure at the end phase P=10 bar, required capacity $q_{v(20)}=29\,500\text{ m}^3/\text{h}$;
- Point No. 5 “b” – constructed distribution gas pipeline for *Sofia* TPP with working pressures P=6 bar and $\varnothing 720\times 8\text{ mm}$ – connection to constructed distribution gas pipeline DN300 steel and further PE-HD, MRS100, SDR11, DN250 towards *Hadji Dimitar* Temporary DHP, *Suha Reka* Temporary DHP and *Levski-G* Temporary DHP, for *Voenna Rampa* Industrial Zone etc., near the crossing of *Parva Balgarska Armiya* St. and *Konstantin Preslavski* St. – working pressure at the end phase P=10 bar, required capacity $q_{v(20)}=44\,000\text{ m}^3/\text{h}$;
- Point No. 6 – *Izola-Petrov* AGDS – up to the village of *Chepintsi* – working pressure at the end phase P=10 bar, connection gas pipeline PE-HD, MRS100, SDR11, DN250. It serves for supply of the viallage of *Chepintsi*, the village of *Negovan* and the northeastern quarters of the city of Sofia, required capacity of the new line $q_{v(20)}=14\,000\text{ m}^3/\text{h}$;
- Point No. 7 – *Bravo* AGDS – up to the village of *Chelopechene* – working pressure at the end phase P=10 bar, connection gas pipeline PE-HD, MRS100, SDR11, DN250. It serves for supply of the village of *Chelopechene*, the area of the village of *Kremikovtsi* and the northeastern quarters of the city of Sofia, required capacity of the new line $q_{v(20)}=13\,000\text{ m}^3/\text{h}$;
- Point No. 8 – *Kremikovtsi* GDS – up to the village of *Gorni Bogrov* - working pressure at the end phase P=10 bar, connection pipeline PE-HD, MRS100, SDR11, DN250. It serves to supply the village of *Gorni Bogrov*, *Botunets* Quarter, the village of *Yana*, the city of *Buhovo*, the village of *Seslavtsi*, the village of *Kremikovtsi* and the northeastern quarters of the city of Sofia, required capacity $q_{v(20)}=13\,000\text{ m}^3/\text{h}$;
- Point No. 9 – *Ayana* GDS – up to the village of *Yana* - working pressure at the end phase P=4 bar, connection pipeline PE-HD, MRS100, SDR11, DN110. It serves for supply of the village of *Zhelyava*, required capacity $q_{v(20)}=500\text{ m}^3/\text{h}$;
- Point No. 10 “a” – *Sofia-1* GDS - the village of *Kazichene* - working pressure at the end phase P=10 bar, connection pipeline DN300 and afterwards it is split into two branches of PE-HD, MRS100, SDR11, DN250. It serves to supply the village of *Lozen*, the village of *Dolni Passarel*, the *Vranya-Lozen Triagalnika* summer house zone and the village of *Busmantsi*, the zone around the Sofia airport, required capacity $q_{v(20)}=27\,000\text{ m}^3/\text{h}$;
- Point No. 10 “b” – *Sofia-1* GDS – the village of *Kazichene* - working pressure at the end phase P=16 bar, connection pipeline DN400 steel and afterwards it splits into two branches of DN300 steel. It serves for supply of the southern and southeastern quarters of the city of Sofia, required capacity $q_{v(20)}=103\,000\text{ m}^3/\text{h}$;

- Point No. 11 – constructed distribution gas pipeline for *Sofia-Iztok* TPP and distribution PBD deviation working pressure P=6 bar and $\varnothing 630\times 8\text{ mm}$ near the crossing of *Okolovrastna* St. and *Tsar Boris III* St. in the village of *Kazichene* - working pressure at the end phase P=10 bar, connection pipeline PE-HD, MRS100, SDR11, DN200. It serves to supply the village of *Kazichene* and the village of *Krivina*, required capacity $q_{v(20)}=8\,000\text{ m}^3/\text{h}$;
- Point No. 12 – constructed distribution gas pipeline for *Sofia-Iztok* TPP and PBD with working pressure P=6 bar and $\varnothing 630\times 8\text{ mm}$, near *5001* St. and *Iskar* plc Pump-and-Paper Factory - working pressure at the end phase P=10 bar, connection pipeline PE-HD, MRS100, SDR11, DN250. It serves to supply the *Iskar* Railway Station Industrial Zone and *Druzhiba-1* Housing Estate, required capacity $q_{v(20)}=21\,000\text{ m}^3/\text{h}$;
- Point No. 13 – constructed distribution gas pipeline for *Druzjba* CKGT with working pressure P=6 bar and $\varnothing 159\times 4,5\text{ mm}$ - working pressure at the end phase P=10 bar, connection pipeline PE-HD, MRS100, SDR11, DN200. It serves to supply the *Iskar* Railway Station Industrial Zone and *Druzhiba-2* Housing Estate, required capacity $q_{v(20)}=4\,000\text{ m}^3/\text{h}$;
- Point No. 14 “a” – *Sofia-4* GDS – the village of *Ivanyane* - working pressure at the end phase P=12 bar, connection pipeline DN200 steel. It serves to supply the city of *Lozen*, the village of *Ivanyane*, *Malo Buchino* Quarter, required capacity $q_{v(20)}=15\,000\text{ m}^3/\text{h}$;
- Point No. 14 “b” – *Sofia-4* GDS – the village of *Ivanyane* – constructed distribution gas pipeline DN300 ateel and working pressure at the end phase P=16 bar. It serves to supply *Suhodol* Quarter, *Gorna Banya* Quarter and the western part of the city of Sofia, the Southern Arch of the city of Sofia, required capacity $q_{v(20)}=50\,000\text{ m}^3/\text{h}$;
- Point No. 14 “c” – *Sofia-4* GDS – the village of *Ivanyane* – new distribution gas pipeline DN500 steel and working pressure at the end phase P=16 bar. It serves to supply the western part of the city of Sofia and assists the existing gas pipeline DN300 (duplicating it up to *Suhodol* Quarter inclusive) for the Southern Arch of the city of Sofia, capacity $q_{v(20)}=184\,000\text{ m}^3/\text{h}$;
- Point No. 15 – constructed distribution gas pipeline for *Ovcha Kupel-2* Temporary DHP working pressure P=6 bar and $\varnothing 159\times 5\text{ mm}$, near the boundary with the plot of *Ovcha Kupel-2* Temporary DHP - working pressure at the end phase P=10 bar, connection gas pipeline PE-HD, MRS100, SDR11, DN160. It serves to supply *Ovcha Kupe-2* Housing Estate, *Ovcha Kupel-1* Housing Estate and *Ovcha Kupel – old part* Quarter, required capacity $q_{v(20)}=4\,500\text{ m}^3/\text{h}$;
- Point No. 16 – constructed distribution gas pipeline for *Zemlyane* DHP - working pressure P=6 bar and $\varnothing 630\times 8\text{ mm}$, near *306* St. and *Karpikozhuh* St. with working pressure at the end phase P=10 bar, connection pipeline PE-HD, MRS100, SDR11, DN110. It serves to supply *Fakulteta-the new part* Quarter, required capacity $q_{v(20)}=1\,600\text{ m}^3/\text{h}$;
- Point No. 17 – constructed distribution gas pipeline for *Zemlyane* DHP, working pressure P=6 bar and $\varnothing 630\times 8\text{ mm}$, near the crossing of *Nikola Mushanov* Blvd. and *Zhitnitsa* St. - working pressure at the end phase P=10 bar, connection pipeline $\varnothing 323,9\times 7,1\text{ mm}$. It serves to supply the industrial zone around *Danon* and *Darko*, required capacity $q_{v(20)}=22\,000\text{ m}^3/\text{h}$.

DETERMINATION OF NATURAL GAS CONSUMPTION

The total consumption for meeting the needs of natural gas of the city of Sofia and the territory of Sofia Municipality has been determined on the

basis of the Amendment to the Master Plan. In the Master Plan of Sofia Municipality are specified zones of different spatial planning categories and their parameters (maximum build-up density, maximum development density, minimum grean area). For every zone outside the urbanized territory the necessary quantities of natural gas are calculated with due account of its individual parameters. These quantities are calculated also for the urbanized territories, but in that case they are compared with the available building stock and then the higher value is selected.

For the available building stock of industrial and public/administrative consumers, which have boiler plants *in situ* or envisaged to be built, the consumption is determined using data about the type and quantity of installed boilers, the type and quantity of consumed fuels. For the rest – on the basis of expert assessment. For residential buildings natural gas demand is determined on the basis of the type and designation of the building, the heated area, the type of heat insulation of the building envelope, the desired indoor temperature of the interior and the outdoor temperature.

For city districts without district heating network 60 per cent gasification is envisaged for the existing buildings and 80 per cent for expected buildings of new construction.

In the city districts with district heating network 40 per cent gasification for existing buildings and 50 per cent for expected buildings of new construction.

The design and analysis of the gas transportation networks are performed with due consideration of the below listed factors:

- type and parameters of the natural gas source;
- required pressure for the different consumers, their concentration and number;
- size of the zone and characteristics in terms of laoyout, number of storeys and build-up density;
- availability of natural and artificial obstacles for the transition of the gas transportation network (rivers, railway tracks and nodes, main roads, rehabilitated streets and streets with high concentration of underground communications etc.).

Upon analysis of the output data and depending on the characteristics of the consumers the maximum hourly and annual gas consumption is determined, as well as the coefficient of simultaneous operation. On the basis of the above quoted data are conducted hydraulic calculations of the gas pipelines having different pressures.

GAS DISTRIBUTION NETWORK OF THE CITY OF SOFIA AND SOFIA MUNICIPALITY

Depending on the working pressure the gas pipelines are made of steel or polyethylene pipes. Distribution pipelines with working pressure 16 and 12 bar will be constructed of steel pipe and those with pressure of 10 and 4 bar – of polyethylene pipes.

The selection of the pressure value - 16 bar (1.6 MPa) is dictated by the maximum working pressure of the distribution pipelines according to the Ordinance concerning the structure and safe operation of transportation and distribution gas pipelines and the equipment, installations and appliances using natural gas. The distribution gas pipelines with maximum working pressure 16 bar are also implemented using steel, spiral-seam, straight-seam or seamless pipes and should comply with the requirements of BDS EN10208-1. The material, of which the pipes are made, is non-alloy or low-alloy killed and semi-killed carbon steel or other materials,

specified as suitable for transportation of natural gas at a certain pressure. The steel underground pipelines are protected against soil corrosion and stray-current corrosion according to BDS 15704-83 and BDS 15705-83, Ordinance concerning the structure and safe operation of transportation and distribution gas pipelines and the equipment, installations and appliances using natural gas. Because of the necessity of cathode protection and the inconvenience related to laying of surface stop-cock nodes in urban environment the penetration of steel gas pipelines in the main city part has been reduced to the minimum.

The distribution gas pipelines with working pressures of 10 bar are made of high-density polyethylene pipes PE-HD and MRS 10 in accordance with BDS EN 1555-1:2005 and BDS EN 1555-2:2005. The selection of the pressure value - 10 bar has been dictated by the maximum working pressure of polyethylene distribution gas pipelines as per BDS EN 12007-2:2001, as well as by the maximum permissible gas load for high-density polyethylene pipes of Class PE-HD, MRS 10 and SDR 11.

The distribution gas pipelines for working pressure 4 bar are made of high-density polyethylene PE-HD, MRS 10 in accordance with BDS EN 1555-1:2005 and BDS EN 1555-2:2005. The selection of the pressure value - 4 bar for the urban part has been dictated by the maximum permissible pressure for the high-density polyethylene pipes of Class PE-HD, MRS 10 and SDR 11 for diameter above DN 66 mm used in this project.

The selection of adequate pressure (maximum working pressure) is of particular importance for the efficient and cost-effective operation of the distribution network. In this specific case (depending on the point of connection – Please, refer to Item 1.6 Connection points) the first step of pressure regulation may be 16 bar, 12 bar, 10 bar (6 bar) or 4 bar. Since the maximum working pressure of 16 bar is used for supply via steel pipes of some existing gas regulation points (GDP 9-G and GDP 21-G), a 3-stage system for pressures regulation (16 bar, 10 bar and 4 bar) is used. The 3-stage pressure regulation systems means that there are 2 regulations of the pressure within the framework of the gas distribution network in the city. The maximum working pressure of 16 bar is reduced at GDP 9-G and GDP 21-G etc. After pressure reduction to 10 bar the polyethylene pipes are used for supply of the rest of the gas regulation points in the city. The radial-arrow configuration of the city of Sofia predetermines also the configuration of the 16 bar and 10 bar gas distribution network.

The existing gas pipelines (built during different periods of time and respectively to different norm requirements) have been taken into account in the process of design of the gas distribution network. Currently part of the existing distribution gas pipelines are suitable for working pressure of 6 bar, by at the end phase they are envisaged for re-assessment (after conducting of control calculations of the strength of the existing pipes and tests for strength and density) of their ability to operate under maximum working pressure of 10 bar with a view to the use of polyethylene pipes. In the event of insufficient capacity of the polyethylene pipes loopings are envisaged (duplicating gas pipelines) which should be laid at a later stage. Due consideration will be paid to the technical characteristics of the gas distribution points *in situ* and thenecessary minimum distances of the gas pipelines from buildings and facilities.

The range of used diamters is as follows:

- for gas distribution pipelines at 16 bar pressure: from DN 50 to DN 500;
- for gas distribution pipelines at 12 bar pressure: from DN 50 to DN 200;
- for gas distribution pipelines at 10 bar pressure: from DN 32 to DN 250 (PE-HD);
- for gas distribution pipelines at 4 bar pressure: from DN 32 to DN 250 (PE-HD).

The gas regulation points (GRP) reduce the natural gas pressure, perform purification and meter consumption for the purpose of control of gas distribution.

In the process of selection of the number, capacity and location of the GDPs account was taken of the existing situation, the topographic conditions of the area, the engineering infrastructure, the norm requirements concerning distances, the consumption rate per unit area, the possibility for ensuring 2-way gas supply and phased construction of the network, possibility for location in/on municipal property.

The gas regulation points are installed in metal cabinets. The cabinets feature vent holes for ventilation in the event of casual gas leakage and nameplates stating the type of equipment, the address and telephone number of the gas distribution company, as well as warning plate that the equipment is explosion-risky.

The size of the cabinets depends on the size of the equipment and varies from 1.2/0.9/1.6 m to 3.8/2.5/2.0 m. They are located in green areas, predominantly on municipal plots.

The routes of the basic gas distribution network with maximum working pressure of 16, 12 and 10 bar, which are not yet constructed, are described by city-district municipal regions. Some of the routes along main road exits from the city of Sofia are localized in the local lanes, in the road servitude outside the banquette or in cart tracks running parallel to the road.

In **Bankya City-district Municipal Region** the route of the basic gas distribution network for maximum working pressure 12 bar has been laid down along agricultural land, *Sofia St.*, *Tsar Osvoboditel St.* and along *Sv.Sv. Kiril i Metodii St.* in the village of Ivanyane up to GDP 3-G.

In **Ovcha Kupel City-District Municipal Region** the following is envisaged:

- looping (duplication gas pipeline) of DN500 from *Sofia-4 GDS* – the village of Ivanyane along agricultural land, *Suhodolski Pat St.*, along 2 *Yuni St.*, *Bregalnitsa St.*, *Zlatna Essen St.*, *Trayan Tanev St.* up to GDP 4-G;
- new distribution pipeline of DN500 and maximum working pressure 16 bar from the region of GDP 4-G along the following streets: *Badeshte St.* and *Suhodolska St.*, then goes on as DN400 along *Kuban St.* , *Vazrazhdane Blvd.* up to *N. Mushanov Blvd.* up to GDP 116-G – the predominant part of this section is situated in *Krasna Polyana City-district Municipal Region*;
- looping (duplication gas pipeline) of DN300 from GDP 4-G along *Trayan Tanev St.*, *Podlozishte St.*, *D. Shishmanov St.*, *Kamentsa St.*, *Tihi Kat St.*, *Liliya St.*, *Vechernitsa St.*, *N. Petkov Blvd.*, *Knyazhevska St.*, *Polk. St.* *Bachiyski St.*, *Damyaniitsa St.*, *Korenyatsite St.* and *Damyaniitsa St.* up to the crossing of *Damyaniitsa St.* with *Sredorek St.*;
- new distribution gas pipeline of DN300 and maximum working pressure 16 bar from the crossing of *Naroden Geroy St.* and *Rachka St.* along *Naroden Geroy St.*, *Lyublyana St.* and *Ovcha Kupel Blvd.* up to GDP 116-G.

In **Vitosha City District Municipal Region** is envisaged the following:

- looping (duplication gas pipeline) from *Naroden Geroy St.* along *Vihren St.*, *Bratya Buxton Blvd.* and *Pirin St.* up to its crossing with *Bulgaria Blvd.*;
- distribution gas pipeline with maximum working pressure of 16 bar

from *Sredselo Blvd.* along *Evliya Chelebi St.*, *Lyulinski Pat St.* and *Tsar Boris III Blvd.* up to GDP 11-G;

- distribution gas pipeline with maximum working pressure 10 bar from *Maestro Atanasov St.* along *Krayrechna St.*, *Paprat St.* and *Cherni Vrah Blvd.* up to the Ring Road.

In **Pancherevo City-district Municipal Region** the following is envisaged:

- distribution gas pipeline with maximum working pressure 10 bar along *Samokovsko Shosse St.* up to GDP 28-G and GDP 29-G;
- distribution gas pipeline with maximum working pressure 10 bar from *Sofia-1 GDS* – the village of Kazichene up to the village of Lozen. From it are envisaged deviations along *Tsarigradsko Shosse Blvd.* and the Ring Road up to GDP 110-G and along *Saedinenie St.* and *Borova Gora St.* (in the village of Lozen) to the south up to GDP 111-G in the village of Dolni Passarel;
- distribution gas pipeline deviating from that for the village of Lozen towards *Vranya-Triagalnika* summer cottage zone and the village of German with maximum working pressure 10 bar along agricultural land cart tracks, *Hristo Botev St.*, *Vela Peeva St.* and *Patriarh German St.* In the village of German up to GDP 29-G.
- Distribution gas pipeline with maximum pressure 16 bar, which starts at *Sofia-1 GDS* – the village of Kazichene, continues along *Okolovrastna St.*, past the southern industrial zone of the village of Kazichene and in southwestern direction goes via *Iskar City-district Municipal Region* and *Mladost City-district Municipal Region* and enters *Gorublyane Quarter* along *Shindra St.* and supplies GDP 20-G.

In **Mladost City-district Municipal Region** several branches are laid, beginning from GDP 20-G and supplying the southeastern part of the city of Sofia:

- two distribution gas pipelines in northern direction along *P. Krassov St.* and *D. Peshev St.* in order to get to the two local lanes of *Tsarigradsko Shosse Blvd.* and for connection to the gas distribution network in Iskar City-district Municipal Region. From Gorublyane Quarter in the direction of the city centre the distribution gas pipeline runs along the left-hand local lane of *Tsarigradsko Shosse Blvd.* after the road node of *Al. Malinov Blvd.* and *Brussels Blvd.* gets up to GDP 99-G for *Mladost-1* Housing Estate. From *Gorublyane Quarter* in the direction of the city centre the distribution gas pipeline along the right-hand local lane of *Tsarigradsko Shosse Blvd.* after the road node of *Al. Malinov Blvd.* and *Brussels Blvd.* crosses *Assen Yordanov Blvd.* and enters Slatina City-district Municipal Region and the deviation from it along *Brussels Blvd.* enters *Iskar City-district Municipal Region*;
- the distribution gas pipeline in southern direction along *Samokovsko Shosse St.* gets up to GDP 28-G and GDP 29-G;
- looping (duplication gas pipeline) of the already constructed gas pipeline in northern direction along *Samokovsko Shosse St.* and in western direction along *Inzh. G. Belov St.* and *D. Dichev St.* up to the crossing of *F. Avramov St.* and *D. Dichev St.* – up to GDP 109-G in *Mladost-3* Housing Estate;
- distribution gas pipeline along *Dr. At. Moskov St.* up to GDP 18-G;
- distribution gas pipelines along *Al. Malinov Blvd.* and *Brussels Blvd.*
- Duplicated distribution gas pipeline (looping) along *A. Lyapchev Blvd.*

In **Iskar City-district Municipal Region** the routes of the basic gas distribution network with maximum working pressure of 10 bar are laid along the following streets: *5001*, *D. Peshev*, *Munhen*, *Tsv. Lazarov Blvd.*,

Deliuska Vodenitsa, D. Peshev, Amsterdam, I. Beshkov, St. Stoyanov, 6019, Brussels Blvd., 5042 and Prof. Tsv. Lazarov.

In **Slatina City-district Municipal Region** the routes of the basic gas distribution network with maximum working pressure 10 bar are laid along the following streets: local lane of *Tsarigradsko Shosse Blvd.*, *Academician G. Bonchev, Vladovo, Krivina, G. Milev, Prof. Tsv. Lazarov Blvd.*, *Slatinska Reka, Kamchiya, VI. Minkov-Lotko, G. Spasov, Vitinya, Mimi Balkanska, Iztochna Tangenta, Pr. Tarakchiev* and *Chr. Kolumb Blvd.*

In **Izgrevev City-district Municipal Region** the routes of the basic gas distribution network with maximum working pressure 10 bar are laid along the following streets: local lane of *Tsarigradsko Shosse Blvd.*, crossing over of *Tsarigradsko Shosse Blvd.*, *Tintyava St.*, *Samokov St.*, *Dim. Nikolov Gichev, Tintyava, Darvenishko Shosse, V. Kalchev, Dr. Tsankov Blvd.*, *Darvenishko Shosse, Konstantin Shtarkelov, Academician M. Popov* and *Dr. Tsankov Blvd.*

In **Studentski City-district Municipal Region** the routes of the basic gas distribution network with maximum working pressures 10 bar are laid along the following streets: *Dr. G. M. Dimitrov Blvd.*, *Sv. Kliment Ohridski Blvd.*, *Plovdivsko Pole St.*, *Andrey Saharov, Plovdivsko Pole, A. Lyapchev Blvd.* (looping – two gas pipelines), *Sv. Kl. Ohridski Blvd.* (looping – two gas pipelines), *8-mi Dekemvri St.* (looping – two gas pipelines up to GDP 106-G – the crossing with *Rossario St.*, *Acad. St. Mladenov, Prof. At. Ishirkov, Prof. Dr. At. Stranski* and *Simeonovsko Shosse Blvd.*

In **Poduyane City-district Municipal Region** the routes of the basic gas distribution network with maximum workinf pressure 10 bar are laid along the following streets: *Parva Balgarska Armiya, Rezbarska, Prof. Iv. Shishmanov, VI. Vazov Blvd.*, *Vitinya, 549, Lambi Krastev, K. Fotinov, Vitinya, Botevgradsko Shosse Blvd.*, *Vitinya, Prof. B. Tsonev, K Fotinov, Letostruy* and the northern local lane of *Botevgradsko Shosse Blvd.*

In **Kremokovtsi City-district Municipal Region** the routes of the basic gas distribution network with working pressure 10 bar are laid along the following streets: the northern local lane of *Botevgradsko Shosse Blvd.*, *8 St.*, the northern local lane of *Botevgradsko Shosse Blvd.*, *46 St.*, the southern local lane of *Botevgradsko Shosse Blvd.*, *Botevgradsko Shosse Blvd.*, *35 St.*, *Botevgradsko Shosse Blvd.*, *V. Levski Blvd.* in the village of Gorni Bogrov, *3-ti Mart St.* in the village of Gorni Bogrov, *Chelopesheko Shosse Road, Ring Road, and Kitka St.* in the village of Chelopechene.

In **Novi Iskar City-district Municipal Region** the routes of the basic gas distribution network with maximum working pressure 10 bar are laid along the following streets: in the village of Chepintsi – *Kooperator, Stara Planina* and *Orpheu*; *Chepinsko Shosse Road*; from *Sofia-2 GDS* – *Kumaritsa* outside regulation up to the village of Kubratovo and the village of Svetovrachane; *Sintchets St.* in the village of Svetovrachane; *Stara Planina St.* and *Sv. Dimitar St.* in the village of Podgumer; outside regulation along agricultural land cart tracks to the south of the village of Podgumer, the village of Voynyagovtsi up to the village of Lokorsko and the village of Chepintsi; *D. Toskov Blvd.* in the village of Lokorsko; *H. Dimitar St.*, *Stadion St.* and *Yove Voyvoda St.* in the city of Novi Iskar; *Dobroslavsko Shosse Road, Stadion, St. Denkov, Gelkova Padina, Bardo* and *Dobroslavsko Shosse Road* in the village of Dobroslavtsi.

In **Serdika City-district Municipal Region** the routes of the basic gas distribution network with maximum working pressure 10 bar are laid along the following streets: *Birimirski Izvor St* – *Benkovski Quarter, Parva*

Balgarska Armiya St., Iliyantsi Blvd., *Parva Balgarska Armiya St.*, *Prof. I. Georgov St.*, *Lokomotiv St.*, *Kamenodelska St.* and *Grancharska St.*

In **Nadezhda City-district Municipal Region** the routes of the basic gas distribution network with maximum working pressure 10 bar are laid along the following streets: *Iliyansko Shosse St.*, *Garova St.*, *P. Panayotov St.* – two pipelines, and *Rozhen Blvd.* From *Sofia-2 GDS* – *Kumaritsa* a new route is being laid for distribution gas pipeline with maximum working pressure 16 bar and DN400 (or two pipelines of DN300), initially parallel to the transportation gas pipeline and later in southern direction along a new street – via *Trebich Quarter (F. Milanov St. amd Leska St.)* and *Iliyantsi Quarter (Djerman St., Rozhen Blvd. and Petuniya St.)* and afterwards along *Daliya St.* and *Rozhen Blvd.* up to GDP 125-G.

In **Vrabnitsa City-district Municipal Region** the routes of the basic gas distribution network with macimum working pressures 10 bar are laid along the following streets: *Ring Road, Zornitsa St.*, *Zavoya St.* and *Zornitsa St.* In the village of Voluyak, *V. Levski St.* in the village of Mramor, *Lomsko Shosse Blvd.*, *Obelski Pat St.*, *A. Mitskevich St.*, *Podkrepa St.* and *364 St.*

In **Lyulin City-district Municipal Region** the routes of the basic gas distribution network with maximum working pressure 10 bar are laid along the following streets: *Lui Pasteur Blvd.*, *Tsaritsa Yoanna Blvd.*, *Polk. St. Topuzov St.*, *Indira Gandhi St.*, *Dobrinova Skala Blvd.*, *Fortov Pat St.*, *400 St.*, *Gen. Assen Nikolov St.*, *G. Delchev St.*, *Prepolats St.*, *Prof. Dr. Al. Stanishev St.*, *Stefana Klincharova St.* *Gen. Mihail Savov St.*, *303 St.*, *Prof. Dr. Al. Stanishev St.*, *Dobrinova Skala Blvd.*, *Slivnitsa Blvd.*, *Ring Road.*

In **Krasna Polyana City-district Municipal Region** are envisaged the following developments:

- New distribution gas pipeline of DN500 and maximum working pressure 16 bar from the area of GDP 4-G along the following streets: *Badeshte St.* and *Suhodolska St.*, continuing as DN400 along *Kuban St.*, *Vazkresenie Blvd.*, *Rishki Prohod St.* and *N. Mushanov Blvd.* up to GDP 116-G;
- New distribution gas pipeline of DN300 and maximum working pressure 16 bar along *Zhitnitsa St.* from *N. Mushanov Blvd.* (looping – two pipelines) for 250 m;
- Routes of the basic gas distribution network with maximum working pressure 10 bar along the following streets: *Fortov Pat St.*, *Suhodolska St.*, *Kenali St.*, *N. Mushanov Blvd.*, *Dobrotich St.*, *Usta Gencho St.*, *Orlitsa St.*, *Vardar Blvd.*, *Aleko Turandja St.*, *Hr. Blagoev St.*, *Hashove St.*, *Al. Stamboliyski Blvd.*, *Todoraki Peshev St.* and *Tsaritsa Yoana Blvd.*

In **Ilinden City-district Municipal Region** the routes of the basic gas distribution network with maximum pressure 10 bar are laid along the following streets: *T. Alexandrov Blvd.*, *Naycho Tsanov St.*, *Teodossi Sinayski St.*, *Zografski Manastir St.*, *Tsar Simeon St.*, *Naste Stoyanov St.*, *Zografski Manastir St.*, *Slivnitsa Blvd.* and *Burgas St.*

In **Vazrazhdane City-district Municipal Region** the routes of the basic gas distribution network with maximum working pressure 10 bar are laid along the followings streets: *Tsar Simeon St.*, *Ossogovo St.*, *Slivnitsa Blvd.*, *Svishtov St.*, *Sv. Sv. Kiril i Metodii St.*, *Sredna Gora St.*, *Furna St.*, *Gyueshevo St.*, *Nikopol St.*, *Ohridsko Ezero St.* and *Kamen Andreev St.*

In **Krasno Selo City-district Municipal Region** the routes of the basic gas distribution network with maximum working pressure 10 bar are laid along the following streets: *Kamen Andreev St.*, *Vladayska St.*, *Ivaylo St.*,

20-ti April St., *Zhitnitsa St.* (looping – two pipelines to GDP 49-G), *Savet na Evropa St.*, *Balkandji Yovo St.*, *Balchik St.*, *Lerin St.*, *Kyustendil St.*, *N. Mushanov Blvd.* (looping – two pipelines), *G. Delchev Blvd.*, northwestern local lane of *Bulgaria Blvd.*, *Otechestvo St.* (looping – two pipelines) and *G. Nachevich St.* (looping – two pipelines).

In **Triaditsa City-district Municipal Region** the routes of the basic gas distribution network with maximum working pressure 10 bar are ;aid along the following streets: *Khan Presian St.* (looping – two pipelines), *Bulgaria Blvd.* (looping – two pipelines to GDP 55-G), *Bulgaria Blvd.*, *Bisser St.*, *Hr. Botev Blvd.*, *Solunska St.*, southeastern local lane of *Bulgaria Blvd.* from *Pirin St.* to *T. Kableshekov St.* looping – duplication of the gas pipeline *in situ*, *T. Kableshekov St.* (looping – two pipelines to GDP 24-G), *M. Veormer St.*, *As. Yordanov St.*, *I. Andonov St.*, *Srebarna St.*, *T. Djebarov St.*, *Yordan Bakalov-Stubel St.* and *Ring Road.*

In **Lozenets City-district Municipal Region** the routes of the basic gas distribution network with maximum working pressure 10 bar are laid along the following streets: *Cherni Vrah Blvd.* up to GDP 25-G, *F. Kutev St.*, *Moguilata St.*, *Ch. Mutafchiev St.*, *D. Krapchev St.*, *Yordan Stubel St.*, *As. Raztsvetnikov St.*, *G. Raychev St.*, *Simeonovsko Shosse Blvd.*, *Bisser St.*, *Ralitsa St.*, *Evl. Georgiev Blvd.* and *Dr. Tsankov Blvd.*

In **Sredets City-district Municipal Region** the routes of the basic gas distribution network with maximum working pressure 10 bar are laid along the following streets: *Dr. Tsankov Blvd.*, *Evl. Georgiev Blvd.*, *G. S. Rakovski St.*, *Patriarh Evtimii Blvd.*, *A. Kanchev St.*, *Solunska St.*, *Dyakon Ignatii St.*, *Gen. Gurko St.* and *Knyaz Al. Batenberg St.*

The main gas distribution network with maximum working pressure 4 bar in the quarters subject of the design project consists of one or several main rings for the purpose of ensuring reliability of gas supply. The gas is distributed to every consumer along a system of deviation gas pipelines coming out of these rings. The route of the main rings has been selected in a way permitting supply to the predominant part of the bigger consumers. The number of transitions via natural or manmade obstacles has been reduced to minimum. Transition along or across streets characterized by the heaviest traffic and those, along which trolley bus lines run has also been minimized and/or avoided. Along more than 16m-wide streets have been envisaged two distribution pipelines (in compliance with the requirements of Ordinance No. 8/1999 concerning Rules and Norms for localization of Engineering Conduits and Equipment in Human Settlements). The same applies for certain streets with tramway lines.

The gas pipelines of the gas distribution network shall be laid underground in street beds, sidewalks, green areas and municipal plots at a depth of at least 0.80 m. In sections, where there is no transport traffic this depth may be reduced to 0.60 m.

Ordinance No. 8/28 July 1999 concerning Rules and Norms for localization of Engineering Conduits and Equipment in Human Settlements regulates the localization of engineering conduits in human settlements. According to Annex 1 to the Ordinance the minimum horizontal distances from other underground conduits and equipment shall be as follows:

- to other conduits – 0.40 m (0.20 m in more cramped circumstances);
- to the curb stone line – 0.60 m;
- to foundations of buildings and poles of engineering conduits - 1 m;
- to the external side of rails of railway tracks - 5 m;
- to the external side of the rails of tramway tracks - 1 m;
- to tree stems - 1 m.

In the event of crossing of the routes of gas pipelines with other engineering conduits a minimum vertical clearance of 0.20 m shall be ensured in compliance with Annex 2 of Ordinance No. 8. Exceptions to this are the cases of crossing of the gas pipelines with high tension cables. In these cases the clearance shall be from 0.50 to 0.70 m (depending on the voltage).

In the event of parallel lying of gas pipelines and other engineering conduits a minimum horizontal clearance of 0.40 m (0.20 m in cramped circumstances) shall be ensured between their external surfaces.

In the event of proven impossibility to observe the prescribed distance to the foundations of buildings and poles of engineering conduits (1 m) it is envisaged to build casings, insulation slabs etc., preventing direct contact of the underground pipeline with the underground facilities, whereat the distance may be reduced to 0.5 m.

Simultaneously with the laying of the gas transportation pipes are laid also the cable lines for the technological communication cable network.

The construction of the distribution gas pipeline network in the city of Sofia complies with the established limitations with respect to protection of the sites of cultural, historical, ethnographic and architectural significance.

The approximate length of the newly designed gas distribution network of the city of Sofia is about 3 648 km (of which 457 km are already *in situ*), including:

- distribution gas pipelines for 16 bar pressure rating - 60 km (13 km already *in situ*);
- distribution gas pipelines for 12 bar pressure rating - 7 km (6 km already *in situ*);
- distribution gas pipelines for 10 bar pressure rating - 426 km (117 km already *in situ*);
- urban gas distribution network for 4 bar pressure rating – 3 155 km (321 km already *in situ*).

During the next design phase the number and location of the gas regulation points (GRP), as well as the length of the gas pipelines will be adjusted for the purpose of ensuring better functioning of the gas distribution network and the construction phases.

To meet the demand of the city of Sofia some $q_{v(20)} = 700\,000 \div 750\,000$ m³/h natural gas will be needed.

The minimum capacity of the independent lines envisaged for construction (and/or use) is as follows:

- in Sofia-4 GDS – the village of Ivanyane - $q_{v(20)} = 234\,000$ m³/h and the necessary capacity for the city of Bankya - $q_{v(20)} = 15\,000$ m³/h;
- In Sofia-1 GDS – the village of Kazichene: $q_{v(20)} = 103\,000$ m³/h (pressure 16 bar) and $q_{v(20)} = 27\,000$ m³/h (pressure 10 bar);
- In Sofia-2 GDS – *Kumaritsa*: $q_{v(20)} = 85\,000$ m³/h for the northern part of the city of Sofia, $q_{v(20)} = 6\,000$ m³/h for the village of Kubratovo, the village of Svetovrachane etc. and another $q_{v(20)} = 5\,000$ m³/h for the gas pipeline deviation for *Zebra* plc – the city of Novi Iskar;
- In Sofia-3 GDS – the village of Voluyak: $q_{v(20)} = 20\,000$ m³/h, and the capacity used for the city of Bozhurishte (at the end phase) - $q_{v(20)} = 20\,000$ m³/h;
- In Sofia-Kremikovtsi GDS: $q_{v(20)} = 13\,000$ m³/h;
- In Oranzherii AGDS: $q_{v(20)} = 4\,000$ m³/h;

- In *Izola-Petrov* AGDS: $q_{v(20)} = 14\,000$ m³/h – new line;
- In *Bravo* AGDS: $q_{v(20)} = 13\,000$ m³/h – new line;
- In *Yana* AGDS: $q_{v(20)} = 500$ m³/h.

At the gas regulation points (GRP) is performed reduction of the pressure of the natural gas incoming from the distribution gas pipeline and entering the gas distribution network – from 16 bar to 10 bar, from 12 bar to 4 bar, from 10 bar to 4 bar or from 16 bar to 4 bar.

Th capacity of the facilities (GRP) has been determined on the basis of the peak consumption for 100 per cent of the public and administrative sites and industrial enterprises, the envisaged quantities of natural gas for the future development of the zones according to the Amendments to the Master Plan of Sofia Municipality and the quantities needed for the existing buildings (Please, refer to Item 2, Determination of natural gas consumption rates). Their localization has been coordinated with the spatial planning of the city, the distribution of the natural gas flows, the configuration of the system and the regulatory requirements.

In *Bankya* City-district Municipal Region are localized the already constructed GRP 1-G, GRP 2-GB and GRP 3-G. GRP-3G supplies the village of Ivanyane and the village of Malo Buchino, which is situated in *Ovcha Kupel* City-district Municipal Region.

In *Ovcha Kupel* City-district Municipal Region are localized the already constructed GRP 4-G, GRP 5-G, GRP 7-G, GRP 8-G and GRP 21-G, as well as GRP 46-G.

- GRP 46-G – supplies *Ovcha Kupel* -2 Housing Estate.

In the *Vitosha* City-district Municipal Region are localized the already constructed GRP 6-G, GRP 9-G, GRP 10-G, GRP 12-G, GRP 13-G, GRP 14-G, GRP 15-G, GRP 16-G, GRP 17-G and GRP 22-G, as well as the newly planned GRP 11-G. It shall serve for supply of the western part of *Knyazhevo* Quarter, the *Killite* summer house zone, the village of Vladaya and the village of Marchaevo.

In the *Pancherevo* City-district Municipal Region are localized GRP 28G, GRP 29-G, GRP 30-G, GRP 31-G, GRP 32-G, GRP 110-G, GRP 111-G and GRP 120-G.

- GRP 28-G – supplies the *Kosanin Dol* summer cottage zone and the TsSKA Sports grounds;
- GRP 29-G – supplies the village of Pancherevo and the village of Kokalyane;
- GRP 30-G – supplies the village of Lozen;
- GRP 31-G – supplies the village of Kazichene and the village of Krivina (*in situ*);
- GRP 110-G – supplies the *Vranya-Lozen Triagalnika* summer house zone (localized to the southeast of the Vranya Farm);
- GRP 111-G – supplies the village of Dolni Passarel;
- GRP 120-G – supplies the village of German.

In *Mladost* City-district Municipal Region are localized the already constructed GRP 18-G and GRP 19-G, as well as GRP 20-G, GRP 20a-G, GRP 97-G, GRP 98-G, GRP 99-G, GRP 100-G, GRP 107-G, GRP 108-G and GRP 109-G.

- GRP 18-G supplies *Lindner* Business Park and *Mladost-4* Housing Estate;
- GRP 19-G supplies *Gorublyane* Quarter;
- GRP 20-G и GRP 20a-G supply the southeastern part of Sofia (there the pressure is reduced from 16 bar to 10 bar);

- GRP 97-G supplies *Druzhiba-2* Housing Estate;
- GRP 98-G and GRP 100-G supply the zone enclosed between *Tsarigradsko Shosse* Blvd., *Assen Yordanov* Blvd., *Prof. Tsvetan Lazarov* Blvd. and *Christofor Kolumb* Blvd.;
- GRP 99-G and GRP 107-G supply *Mladost-1* Housing Estate and *Mladost-1A* Housing Estate;
- GRP 108-G supplies *Mladost-2* Housing Estate;
- GRP 109-G supplies *Mladost-3* Housing Estate.

In *Iskar* City-district Municipal Region are localized GRP 33-G, GRP 91-G, GRP 92-G, GRP 93-G, GRP 94-G, GRP 95-G and GRP 96-G.

- GRP 33-G supplies the northern part of the *Iskar* Railway Station Industrial Zone (*in situ*);
- GRP 91-G supplies the village of Busmantsi, *Abdovitsa* Quarter and *D. Milenkov* Quarter;
- GRP 92-G supplies the zone of Sofia Airport;
- GRP 93-G, GRP 95-G and GRP 96-G supply *Druzhiba* Quarter, *Druzhiba-1* Housing Estate and the southern part of the *Iskar* Railway Station Industrial Zone;
- GRP 94-G supplies *Druzhiba-2* Housing Estate.

In *Slatina* City-district Municipal Region are localized GRP P, GRP 101-G and GRP 102-G.

- GRP P supplies an inside part of Sofia Airport;
- GRP 101-G and GRP 102-G supply *Yavorov* Housing Estate, *Geo Milev* Housing Estate, *Hr. Smirnenski* Housing Estate and *Slatina* Quarter.

In *Izgrev* City-district Municipal Region is localized GRP 103-G.

- GRP 103-G supplies *Izgrev* Housing Estate, *Iztok* Housing Estate and *Dianabad* Housing Estate.

In *Studentski* City-district Municipal Region are localized GRP 27-G, GRP 104-G, GRP 105-G and GRP 106-G.

- GRP 27-G (*in situ*) and GRP 106-G supply *Studentski Grad* and *Vitosha* Quarter;
- GRP 104-G and GRP 105-G supply *Mussagentisa* Housing Estate and *Darvenitsa* Housing Estate.

In *Poduyane* City-district Municipal Region are localized GRP 80-G, GRP 81-G, GRP 82-G, GRP 84-G, GRP 85-G and GRP 86-G.

- GRP 80-G supplies *H. Dimitar* Housing Estate;
- GRP 81-G supplies *St. Karadja* Housing Estate;
- GRP 82-G and GRP 86-G supply *Levski-G(4)* Housing Estate, *Levski-V(3)* Housing Estate and *Levski* Quarter.
- GRP 84-G and GRP 85-G supply *Suha Reka* Housing Estate, *Poduyane* Quarter and *Hr. Botev* Quarter.

In *Kremikovtsi* City-district Municipal Region are localized GRP 87-G, GRP 88-G, GRP 89-G, GRP 90-G and GRP 112-G.

- GRP 87-G supplies *Vrazhdebna* Quarter;
- GRP 88-G supplies *Zapandja* Neighborhood and *Batareyata* Neighborhood;
- GRP 89-G and GRP 90-G supply the village of Gorni Bogrov, the village of Yana, the city of Buhovo, the village of Seslavtsi, the village of Kremikovtsi, the village of Chelopechene and Botunets Quarter;
- GRP 112-G supplies the village of Dolni Bogrov.

In *Novi Iskar* City-district Municipal Region are localized GRP 44-G, GRP

72-G, GRP 73-G, GRP 74-G, GRP 75-G, GRP 76-G, GRP 83-G and GRP 126-G.

- GRP 44-G supplies the village of Dobroslavtsi, the village of Zhiten, the village of Katina and the village of Balsha;
- GRP 72-G supplies part of the city of Novi Iskar;
- GRP 73-G supplies the village of Kubratovo;
- GRP 74-G and GRP 75-G supply respectively the village of Svetovrachane and its industrial zone;
- GRP 76-G and GRP 126-G supply *Gnilyane* Quarter of the city of Novi Iskar, the village of Podgumer, the village of Voynyagovtsi and the village of Lokorsko;
- GRP 83-G supplies the village of Chepintsi and the village of Negovan.

In *Serdika* City-district Municipal Region are localized GRP 67-G, GRP 71-G, GRP 77-G, GRP 78-G and GRP 79-G.

- GRP 67-G supplies the zone around the Central Railway Station;
- GRP 71-G supplies *Benkovski* Quarter;
- GRP 81-G supplies the industrial zone around *STIND*;
- GRP 78-G and GRP 79-G supply *Orlandovtsi* Quarter and *Malashevtsi* Quarter.

In *Nadezhda* City-district Municipal Region are localized GRP 69-G, GRP 70-G, GRP 123-G, GRP 124-G and GRP 125-G.

- GRP 69-G supplies *Nadezhda-1* Housing Estate, *Nadezhda-2* Housing Estate and *Nadezhda-3* Housing Estate and *Tolstoy* Housing Estate;
- GRP 70-G supplies the industrial zone around *Iliyantsi* Quarter;
- GRP 123-G supplies *Trebich* Quarter;
- GRP 124-G supplies *Iliyantsi* Quarter;
- GRP 125-G supplies the northern part of the city of Sofia.

In *Vrabnitsa* City-district Municipal Region are localized GRP 34-G, GRP 35-G, GRP 42-G, GRP 43-G, GRP 115-G and GRP 122-G.

- GRP 34-G supplies *Obelya* Quarter, *Obelya-1* Housing Estate and *Obelya-2* Housing Estate;
- GRP 35-G supplies *Moderno Predgradie* Quarter and *Zaharna Fabrika* Housing Estate;
- GRP 42-G supplies the village of Voluyak;
- GRP 43-G supplies the village of Mramor;
- GRP 115-G supplies the industrial zone to the south of the village of Voluyak;
- GRP 122-G supplies a new entertainment complex – the so-called Northern Park.

In *Lyulin* City-district Municipal Region are localized GRP 36-G, GRP 37-G, GRP 38-G, GRP 39-G, GRP 40-G, GRP 49-G and GRP 114-G. They supply the industrial zone around *Nestle-Sofia* plc, *Lyulin 1-10* Housing Estate, *Republika* Quarter and the village of Phillipovtsi.

In *Krasna Polyana* City-district Municipal Region are localized GRP 45-G, GRP 47-G, GRP 57-G, GRP 62-G, GRP 63-G, GRP 117-G, GRP 118-G and GRP 121-G.

- GRP 45-G supplies the zone around the *Lyuben Karavelov* BCU;
- GRP 47-G supplies the *Fakulteta* Quarter;
- GRP 57-G, GRP 62-G and GRP 63-G supply *Krasna Polyana* Housing Estate, *Razsadnika-Konyovitsa* Housing Estate, *Ilinden* Housing Estate and *Gevgeliyski* Quarter;
- GRP 117-G and GRP 118-G supply the southwestern and western parts of Sofia (in them the pressure is reduced from 16 bar to 10

bar).

In *Ilynden* City-district Municipal Region are localized GRP 64-G and GRP 65-G.

- GRP 64-G supplies *Ilynden* Housing Estate;
- GRP 65-G supplies *Banishora* Housing Estate (промишлената жк “Банишора”).

In *Vazrazhdane* City-district Municipal Region are localized GRP 58-G, GRP 66-G and GRP 68-G.

- GRP 58-G supplies *Serdika* Housing Estate;
- GRP 66-G and GRP 68-G supply the western Central City Area.

In *Krasno Selo* City-district Municipal Region are localized GRP 48-G, GRP 49-G, GRP 50-G, GRP 51-G, GRP 53-G and GRP 59-G.

- GRP 48-G supplies *Ovcha Kupel-1* Housing Estate;
- GRP 49-G supplies *Slaviya* Housing Estate and *Lagera* Housing Estate;
- GRP 50-G and GRP 51-G supply *Belite Brezi* Housing Estate, *Borovo* Housing Estate and *Kasno Selo* Housing Estate;
- GRP 53-G supplies *Hypodruma* Housing Estate;
- GRP 59-G supplies the southwestern Central City Area and *Zona B-5* Housing Estate.

In *Triaditsa* City-district Municipal Region are localized GRP 23-G, GRP 24-G, GRP 52-G, GRP 54-G and GRP 55-G.

- GRP 23-G and GRP 24-G supply *G. Delchev* Housing Estate and *Manastirski Livadi* Housing Estate (already constructed)
- GRP 52-G supplies *Strelbishte* Housing Estate
- GRP 54-G supplies the southern Central City Area
- GRP 55-G supplies *Ivan Vazov* Housing Estate and *Lozenets* Housing Estate

In *Lozenets* City-district Municipal Region are localized GRP 25-G, GRP 26-G and GRP 56-G.

- GRP 25-G and GRP 26-G supply *Hladiinika* Quarter, *Krastova Vada* Quarter, *Mircho Draganov* Quarter and the *Hladiinika* Industrial Zone (already *in situ*);
- GRP 56-G supplies *Lozenets* Quarter and *Ivan Vazov* Housing Estate.

In *Sredets* City-district Municipal Region are localized GRP 60-G and GRP 61-G.

GRP 60-G and GRP 61-G supply the Central City Area.

The described gas transportation and gas distribution network and their inherent facilities on the territory of the city of Sofia and Sofia Municipality have been illustrated on the enclosed drawings as follows:

Сф-335-01 – Gas pipeline network in the main urban area	Scale 1:10 000	1 sheet
Сф-335-02 – General scheme of the gas pipelines network	Scale 1:25 000	4 sheets

During the next design phase the length of the gas pipelines might be changed with a view to ensuring optimum functioning of the gas distribution network.

GAS PIPELINE DEVIATION FROM THE GAS DISTRIBUTION NETWORK TO THE CONSUMERS

Deviation and facility for connection to the distribution network is a combination of equipment, devices and gas pipelines designated for regulation and/or commercial metering of the natural gas supplied to a consumer or a group of consumers.

Depending on the pressure, to which the respective consumer will be connected, the gas pipeline deviations are implemented using steel or polyethylene pipes. They are dimensioned for maximum hourly consumption of the consumer and are coupled to the distribution gas pipelines using technologies, which are typical for the respective material.

According to the norm rating currently in force stop cocks are envisaged for every deviation. The stop fixtures are installed on the ground in cabinets or niches and underground in pits for steel pipelines or on the ground for the polyethylene pipelines. The locations envisaged for installation of the stop fixtures should be easy-to-service and at the same time adequate technical measures for limiting casual access to them are envisaged.

The gas pipeline deviations end with appropriate facilities. Most frequently they end with a gas regulation and gas metering point (GRMP), whose purpose is to regulate the pressure or to record the gas consumption for commercial purposes. Depending on the specific circumstances, the pressure in the gas pipeline and the technological requirements it is possible to have only a gas metering point (GMP).

At the end of the gas pipeline deviations for residential users in single-, 2- and 3-family houses a gas regulation and metering board (GRMB) is installed. In the case of apartment blocks a gas regulation board (GRB) is installed at the end of the gas pipeline deviations and gas metering boards (GMBs) are installed on the floor landing in front of the individual consumers (flats).

The facilities are usually installed at the boundary of the consumer's estate – next to the fence, on a blind wall or any other appropriate location in due compliance with the set norms concerning the distances.

Depending on the type of consumer, his/her location with respect to the distribution gas pipelines, the location of the installed capacities and the consumption level, the polyethylene deviations are implemented in different versions:

- When the deviation is built during the construction phase its connection to the pipes of the distribution gas pipeline is effected using a bracket with a pipe end-piece or a threeway coupling;
- When the deviation is built later, the connection is effected using a pressure cut-in valve with an elongated tubular deviation or pressure cut-in fixture.

TECHNOLOGICAL COMMUNICATION CABLE NETWORK

The design envisages laying cable conduits for technological communication cable network (TCCN) simultaneously with the laying of the gas pipelines. The network comprises main pipeline, connecting the distribution cabinets (DC) with passive devices inside and pipes laid inside the distribution cabinets to individual consumers, whereat the latter have a smaller diameter than the main ones.

In addition to this cable conduit a pipe designated for a ring within the human settlement is laid along some routes in the same ditch. The cable, which will be pulled through the thus laid cable conduits, will be used for telemetry purposes – all services related to consumption metering, testing and operation of the gas distribution network and other communication services. The cable conduit is located at 10÷20 cm clear horizontal distance to the left or to the right with respect to the

gas pipeline axis and at 20÷30 cm vertically above the gas pipeline. The cable conduits are laid in PE-HD or PVC pipes with diameters from DN32 to DN110.

The minimum earth layer above the pipes for the TCCN should be not less than 50 im. The tele-communication network is composed of optical cables to the points of concentration of big subscribers and optical or copper cables to the individual subscribers. The 0.6 m high distribution cabinets (DC) for TCCN, which serve for distribution of pipelines and cable shafts (CS) with 1, 2 or 3 covers and dimensions from 0.4 x 0.9 m to 1.2 x 0.9 m and depth from 0.6 to 0.9 m, are laid on the sidewalks over bases (pedestals) with dimensions 0.3 x 0.6 m. They are used for branching of the cable conduits in different directions. When inserting the pipes in the shafts and cabinets the curves should not be less than 15R (15x the radius) and in the case of PVC pipes it is mandatory to use two elbows at 45° each.

PRODUCT SUPPLY

Existing situation

The product pipeline from *Lukoil Neftochim Burgas* plc near the city of Burgas to the city of Sofia was fully completed in January 1977. It is built using steel pipes of DN 350 mm up to the city of Plodviv and DN 250 mm in the section from the city of Ihtiman to Sofia. The product pipeline is laid at an average depth of 1.5 m. It is used for transportation of motor diesel oil only. The section from the city of Ihtiman to the city of Sofia is capable of transporting to Sofia maximum 100 000 t motor diesel oil per annum. The product pipeline route is marked on the surface by metal or reinforced concrete poles with sheet steel plate featuring red slanting strips on a yellow background. The product pipeline is owned by *Lukoil Neftochim Burgas* plc.

The maintenance, security and operation of the product pipeline are performed by *Lukoil Neftochim Burgas* plc. The current repairs in the section “the city of Ihtiman – the city of Sofia” are performed by the *Ihtiman* Petrol Yard. The cathode protection of the product pipeline is performed by a specialized group of *Lukoil Neftochim Burgas* plc. Parallel with the product pipeline is laid a communication cable for ensuring operational management of the pipeline.

Product pipeline facilities

The main facilities along the route of the product pipeline serving to ensure its normal functioning are the petrol storage yards and pumping stations. There are no pumping stations *in situ* on the territory of Sofia Municipality. There exists only the *Iliyantsi* Petrol Yard, situated in the northern part of the capital. The total area of the yard is 192 000 m². The capacity of the storage tanks is 100 800 m³, including 88 000 m³ for light colour products and 12 800 m³ for lubricants.

The location of the petrol storage yard offers a possibility for expansion in the future, if necessary.

On the enclosed map in scale 1:25 000 (Cф-335-02) are illustrated the product line route and the site of the *Iliyantsi* Petrol Yard.

Servitudes

The servitudes along the product pipeline are regulated by Ordinance No. 16 of 9 June 2004 concerning the servitudes of energy sites and by the Ordinance concerning the structure and safe operation of petrol pipelines and petrol product pipelines and are 30 m on each side of the product pipeline. The security zone of the pumping stations is 100 m from the boundaries of the site in all directions.

In the event of construction in the vicinity of the product pipeline security zones of 75 m on each side of the pipeline should be observed. Near the *Iliyantsi* Petrol Yard the following servitudes should be observed:

- to residential and public buildings – at least 150 m;
- to industrial buildings – at least 100 m;
- to roads and road facilities – at least 40 m;
- to railway tracks – at least 90 m.

RECOMMENDATIONS

Upon analysis of the current situation and the future development of Sofia Municipality the following recommendations have been formulated with a view to the optimal and reliable development of the gas distribution network on the territory of the city of Sofia and Sofia Municipality:

- Connection of the gas distribution pipelines with maximum working pressure 16 bar and 10 bar in the southern part of the city and construction of the connection “the village of Kazichene – Gorublyane Quarter”;

- Implementation of the East-North connection of the gas distribution networks with maximum working pressure 10 bar from the region of one of the three gas distribution stations – *Sofia-Kremikovtsi* GDS, *Bravo* AGDS and *Isola Petrov* AGDS or from the village of Kazichene - Gorublyane Quarter region - to the gas distribution network for *Suha Reka* Temporary DHP and *Levski-G* Temporary DHP;

- Implementation of the West-North connection of the gas distribution networks with maximum working pressure 10 bar from the region of *Sofia-3* GDS – the village of Voluyak to the constructed gas distribution network in the industrial zone *Nadezhda-Voenna Rampa* Quarter;

- Construction of gas distribution networks with maximum working pressure 10 bar in the northern part of Sofia Municipality and completion of the construction of the so-called “Northern Arch”;

- Penetration in the settlements, quarters and zones of the Northern Arch, the northern quarters not connected to the district heating network, parallel with the increase of the density of the network in the Southern Arch and further development of the network there (this process should be implemented also during the first four phases described above as well);

- Gradual radial penetration in the Central City Area, both in the district-heated and non-district heated zone (according to the described scope of the gas supply to the residential sector – please, refer to Item 2, “Determination of natural gas consumption”).

4.10. COMMUNAL FACILITIES

4.10.1. Objective of the study

The main objective of the study is to clarify the changes that have taken place in the database concerning approved decisions, projects and concessions during the period 2001-2007 and to update the information about the incurred changes in graphic and textual format.

The scheme devoted to the Communal Facilities in the city of Sofia has been amended with addition of the new plots for construction of facilities

(a plant) for solid urban waste and landfill sites (as per the decisions on the “Project for solid urban waste management in Sofia”).

4.10.2. Updating of the plots for communal facilities in the city of Sofia and Sofia Municipality on the basis of approved new decisions of the Sofia Municipal Council, recommendations from conducted public hearings and other proposals submitted in the period 2001-2007

- New sites and yards for solid urban waste:

a) Plant for mechanical bio-treatment (MBT) of solid urban waste and dumpsite for non-hazardous urban waste in the *Sadinata* Locality, the land of the village of Yana, area 335 dca (new site).

b) Installation for composting of solid urban waste at Khan Bogrov, area 70 dca (in the 2003 Master Plan this site was envisaged for construction of solid urban waste treatment plant).

c) Site for treatment of non-hazardous waste, *Kremikovtsi* 3CK(?), area 126 dca (for recycling of construction waste).

d) Landfill at Suhodol Quarter – opening of the landfill for further use until full exhaustion of its capacity.

- New dumpsites for earth mass:

a) By virtue of Order No. RD-09-3884 / 26 September 2008 part of land plot No. 182 with an area of 303 dca (the total area of the plot is 455 dca) from the KBC land of *Vrazhdebna* Quarter, *Kremikovtsi* City-district (exclusive state property), has been allocated for performance of activities related to de-contamination of waste and earth mass produced as a result of construction activities on the territory of Sofia Municipality through dumping.

b) expansion of the *Vrazhdebna* Dumpsite yard (Kyulov Tvardak) with residual area of 207 dca.

c) new site in the land of the village of Dolni Bogrov – to the southwest of the tailing pond;

d) new site in the land of the village of Gorni Bogrov (to the southeast of the cemetery) with an area of 12 dca – for some 30 000 to 35 000 m³;

e) new site in the land of the city of Novi Iskar (the former clay quarry for the Ceramic Works, area of approximately 220 dca);

- New site for a facility for ecological decontamination of hazardous hospital waste (incinerator):

The *Sgurootvala* Locality – *Malashevtsi* Quarter – a plot allocated for industrial activities (Пл), near the northern freight tangent – site No. II-65-II, real estates Nos. 1695, 1705 and 1706 (a total of 7 dca).

- Cemeteries:

a) New cemeteries:

- on the territory of the surrounding area in the land of the village of Kazichene, area 735 dca

- the village of Voluyak – to the west of the village, area 77 dca

- *Botunets* Quarter – to the east of the settlement, 25 dca

- the city of Bankya - *Ivanyane* Quarter, *Ravnishte* Locality, 55 dca

- the city of Bankya – *Ivanyane* Quarter, *Pazarski Pat* Locality, 20.5 dca

- the city of Bankya – *Hypodruma* Quarter, 50.5 dca

b) Expansion of cemeteries envisaged in the 2003 Master

Plan:

- *Kremikovtsi-Seslavtsi* – in southeastern direction by 25 dca

- *Botunets* Quarter – incorporation of Moslim cemetery and a new plot at the eastern side with an area of 22 dca
- the village of Bistritsa – shift of the new cemetery envisaged in the 2003 Master Plan (area 24 dca) in southern direction for reasons related to the terrain

- *Gorna Banya* Quarter – expansion by 20 dca
- *Bakarena Fabrika* Quarter – in northern direction, 9.5 dca
- the city of Novi Iskar – *Kurilo* Quarter, in southeastern direction, 15 dca
- the village of Gorni Bogrov – 14 dca in western direction
- the village of Voluyak – 10 dca in western direction
- the village of Krivina – 8 dca
- the village of Mramor – expansion in western direction by 6 dca

- the village of Malo Buchino – 5.5 dca in western direction
c) Cemetery in long-term perspective – to the north-west of the *Lyulin* Housing Estate, area 648 dca

4.10.3. New concession contracts for extraction of ores and minerals signed in the period 2001 - 2007

- prospecting for a quarry for extraction of minerals (sand) in the area of the village of Mramor – later cancelled as a result of protests of civil associations;

- prospecting for a quarry for extraction of ores and minerals in the area of the villages of Dolni Bogrov, Kazichene and Ravno Pole – in the process of additional negotiations as a result of protests of the population of the affected settlements;

- quarry for extraction of minerals (sand) in the area of the villages of Kubratovo, Svetovrachane and Negovan with endorsed concession contract but without approved Environmental Impact Assessment Report. It was recorded in the proposals for Amendment to the Master Plan in 2007, but at a later stage it was proposed for cancellation because of the absence of a worked out and approved Environmental Impact Assessment and other requirements related to compatibility in respect of corridors for birds, mammals etc. along the river Iskar valley.

4.10.4. Large-scale facilities and yards for maintenance of the engineering networks:

a) Facilities and yards of the water supply and sewerage network:

More significant changes in this system are observed in the number and locations of the local treatment plants, which have been described in detail in the Section “Engineering infrastructure – water supply and sewerage”.

The proposed amendments in the development of the communal facilities as compared to the Master Plan projections are related above all to the construction of the yards for solid urban waste treatment and recycling and the development of the cemetery parks. Their territorial orientation and construction is obstructed by the opinions of citizens’ associations having local interests and visions, which differ from those of the common issues of the municipality as a whole. In a number of cases the proposed amendments are the result of compromises on different aspects of the problems.

5. ENGINEERING-GEOLOGICAL AND HYDRO-GEOLOGICAL CONDITIONS AND GEOLOGICAL RISK

The objective of this study is to update the geological information in

a graphic and textual format concerning any changes incurred in the ground water levels as a result of climate change and technogenous activities. The forecast projections for territorial assessment of the terrains comply with the results from the specialized programmes:

- Micro-seismic regioning and geological risk on the territory of the city of Sofia and Sofia Municipality;
- Utilization of the hydro-thermal resources (mineral waters) on the territory of the city of Sofia and Sofia Municipality;

The herein presented material is accompanied by the following schemes:

- Engineering-geological zoning of the territory of the city of Sofia and Sofia Municipality;
- Micro-seismic regioning and geological risk on the territory of the city of Sofia and Sofia Municipality;
- Thermal waters bearing zones and deposits of thermal mineral waters on the territory of Sofia Municipality;
- Strategy (spatial model) for utilization of the hydro-thermal resources on the territory of Sofia and Sofia Municipality.

Geological structure

In geological respect the Sofia District occupies part of different morpho-tectonic structures of the Sredna Gora tectonic zone. It is characterized by significant stratigraphic and lithographic variety, high tectonic style and ample water bearing capacity. For that reason engineering-geological, hydrological and tectonic (seismographic) conditions are of primary importance from the point of view of the different types of construction works and the sustainable development of the city.

5.1. ENGINEERING-GEOLOGICAL CONDITIONS FOR CONSTRUCTION ON THE TERRITORY OF SOFIA MUNICIPALITY

On the basis of archived data from many years of studies on the territory of Sofia and the Sofia Hollow and after their comprehensive analysis for the purposes of the Master Plan an engineering-geological zoning of the city of Sofia has been compiled in scale 1: 10000.

The engineering-geological regioning unites the zones with identical geological conditions, emphasizing the plots featuring conditions, which are unfavorable for construction activities.

The Amendment to the Master Plan of Sofia Municipality reflects the lowering of the levels of ground waters as a consequence of climate change and technogenous activities.

The impact of each of the structural elements of the geological environment is taken account of in a forecast horizon:

- Geological-lithoidal characteristics (geological structure);
- Geo-morphological structure (relief);
- Depth and properties of the deposits of ground water (hydro-geological conditions);
- Exogenous physical-geological phenomena and processes (landslides, landslips);
- Endogenous (tectonic) manifestations and seismic activity;
- Processes caused by human / technogenous activity (changes in the geological base as a consequence of economic activities);
- Thermal mineral waters (resources).

On the basis of the differences in the lithoidal (geological) composition, the earth base, which will be affected by the influence of construction works, has been divided into **two major regions (A and B)**.

The construction-related base in **Region A** consists of magma and sediment **rocks**, characterized by high strength and low distortion properties and high load capacity.

The construction-related base of **Region B** is represented by sediment semi-rock formation and crumbly variations (clay and sand) of Pliocene and Quaternary age.

The territories with predominant spread of the Pliocene sediment rocks are clustered as Sub-region B.1 and in their turn they are subdivided in 8 sections, marked by Roman digits from I to VIII. From a geological point of view these territories are favorable for construction purposes.

Sub-region B.2 unites plots, which are unfavorable for construction activities, since the construction falls on top of deposits of Quaternary geological age (relatively young deposits). These plots have been grouped in 6 sections (from IX to XIV), which are characterized by **specific building soils**: marsh clays, putty, technogenous embankments, pits and quarries, landslides, tectonic and seismic zones, marshland. Design on such terrains should provide for specific measures for consolidation of the ground base.

1.2. HYDRO-GEOLOGICAL CONDITIONS ON THE TERRITORY OF SOFIA MUNICIPALITY

In hydro-geological respect Sofia and the Sofia Hollow are rich in **fresh and mineral ground waters**.

5.2.1. The fresh ground waters are of ground nature under pressure. They are linked in a complex hydraulic relationship and form a water-bearing horizon.

The ground waters not under pressure are accumulated in the river (alluvial) and lake (Pliocene) sand-and-gravel sediments, while the waters under pressure are tied up to the deeper located Pliocene sands and gravels. The depths of their locations vary from 1m to 15 m with a seasonal fluctuation of the range of 1m.

5.2.2. Thermal mineral waters on the territory of Sofia Municipality

Sofia is a **unique European capital** as regards its hydro-thermal resources.

Mineral waters were one of the major settlement-formation factors related to the emergence of the city of Sofia as a human settlement and that fact is depicted on the coat of arms of the city as well. **Eight types of thermal water bearing zones** have been identified within the territorial scope of Sofia Municipality. In spatial respect they are clustered and this makes the city the sole European capital possessing nature wealth of that kind.

In three of these zones the mineral water is characterized by low content of dissolved substances and exclusive potable properties. In the remaining five the mineralization is higher and the chemical composition – multi-facet. In one of the zones the water possesses genetic and substance similarity to the famous and exotic sodium-Glauber mineral waters of Karlovi Vari (The Czech Republic).

The thermal mineral waters are tied up to two main groups of geologic formations and structures – the hollow underlayer and the surrounding mountain slopes forming together the Sofia thermal mineral water basin. Depending on the type of the water retaining rocks the mineral waters from the respective water bearing horizons differ in terms of physical properties, chemical and gas content. One specific peculiarity is their

higher temperature, related to the depth of their formation.

The mineral waters pour out on the surface freely along tectonic clefts and cracks in the form of springs in the southern part of the basin and in its bigger northern and eastern parts they are depicted through boring, whereat in this way ever deeper laying water-bearing horizons are reached. In Sofia and the Sofia Hollow have been discovered **42 mineral water sources. The delivery rate of mineral waters of varying composition and properties that may be economically tapped is about 450-500 l/sec, including about 40 MW geothermal energy.**

The currently operating natural and bore mineral water sources deliver hardly 110-120 l/sec. mineral waters, of which not more than 35-40 l/sec. are utilized.

As regards the temperature, the mineral springs fall under the category of hyper-thermal (above 37°C) and hypo-thermal (from 20°C to 37°C). The waters with the highest temperature are those of the deposits Kazichene-Ravno Pole (81°C).

In terms of the indicator “mineralization” the waters are characterized as moderately mineralized (mineral content from 2 to 15 g/l). The deposits with the lowest mineral content are those in Gorna Banya (0.13 g/l), Knyazhevo (0.14 g/l) and Zheleznitza (0.22 g/l) and with the highest – those in Iliyantsi (4.77 g/l), Mramor and Chepintsi (3.55 g/l). As regards the chemical composition acid-thermae in combination with content of meta-silicic acid predominate. In some of the deposits the water contains traces of sulphates, carbonic acid, carbonate etc.

Mineral waters suitable for bottling as *table water* are those of Gorna Banya, Bankya, Ivanyane, Dragalevtsi, Simeonovo, Sofia-Centre, Zona B-5, Boyana, Pancharevo and Knyazhevo. Suitable for bottling for *medicinal purposes* are the waters in Iliyantsi and Chepintsi.

The mineral waters on the territory of Sofia Municipality and the city of Sofia are a **major resource for development of balneological and recreational activities**. Some portion of these waters may be used for the purposes of greenhouse farming and space heating.

The versatile potential of mineral waters makes possible their utilization in the following directions:

- Cure, rehabilitation and preventive treatment of citizens and visitors of the city of Sofia;
- Active recreation (relaxation), sports and entertainment for the inhabitants and guests of the capital and the settlements adjacent and gravitating to it.
- Recreation and entertainment for the transit passengers and tourists travelling along the road arteries of the city and its surrounding area;
- Bottling and distribution of mineral waters for medicinal purposes;
- Extraction and exploitation of geo-thermal energy for space heating, air conditioning and domestic hot water supply to medical and rehabilitation sites, recreation, administrative and other sites.

In urban planning aspect and in compliance with the “**Strategy for comprehensive utilization of the hydro-thermal resources on the territory of Sofia Municipality**”, approved as part of the 2003 Master Plan, the below listed types of hydro-thermal centres have been identified and marked in the respective specialized scheme according to their social function and designation, the mineral waters used on the facility and their physical properties, the location of the facilities and other factors.

- Traditional balneological (water cure and rehabilitation) and recreation centres (existing and new ones) for treatment, rehabilitation, prophylaxis and recreation – “SPA” centres;

- Curative, rehabilitation and recreation centres in the countryside, situated in mountain areas with favorable nature milieu and well-preserved environment;
- Inter-settlement (or inter-neighborhood) facilities for active recreation, sports and entertainment;
- Tourist facilities along the roads for short-term rest and entertainment;
- Enterprises (workshops) for bottling of mineral waters and production of extractable medicinal derivatives from them.

As a result of some new investigations concerning the northern territories of Sofia Municipality and recommendations ensuing from the public hearings and other proposals submitted in the period 2001-2007 updating of the plots for urban and extra-urban SPA centres on the territory of the city of Sofia and Sofia Municipality was performed.

In the northern territories there exists potential of three types of mineral waters possessing different genetic and qualitative characteristics. This factor calls for envisaging of actions for their tapping, including reservation of plots for building the appropriate facilities. The planning regime defined in the Master Plan as “Тзсн”, aims at ensuring their function in a spatial aspect irrespective of the form of ownership.

The northern zone contains and produces waters with increased content of dissolved substances (850-1800 mg/l), alkali (sodium bicarbonate) content, considerable content of sulphide sulphur and certain organic substances. The conditions of formation and depositing, along with the content of sulphide sulphur, organic matter and other geo-chemical reducers impart to these waters important from the medicinal prophylaxis point of view reduction (anti-oxidation) properties.

Depending on the depth of the water-bearing horizons and the water-exchange links among them the temperature of the waters in the zone varies in the limits from 35° (40°C) to 50°C (55°C).

The new sites for SPA centres with accommodation in the countryside are as follows:

- a) the village of Lokorsko-Voynegovtsi;
- b) the village of Kremikovtsi-Seslavtsi;
- c) the village of Balsha-Katina.

5.3. GEOLOGICAL RISK ON THE TERRITORY OF THE CITY OF SOFIA AND SOFIA MUNICIPALITY

Taking into account the risk-bearing geological factors and processes in their role as stops and modifiers of the underground and surface construction in specific zones and territories is very important for the planning and building of Sofia. What is meant are **zones featuring active and potential landslide processes, increased seismic activity and very high levels of ground waters**. Among them are identified plots, which are unfavorable from the point of construction and in which additional consolidation of the earth base or special engineering consolidation of the buildings and facilities is necessary. On the main drawing of the Master Plan these plots are marked by an asterisk.

5.3.1. Zones with manifested and potential landslides

Active and latent landslides in the urban space and around the city have been identified and specified in the area of:

- *Lagera* Housing Estate – the high slope of the river Vladayska;

- *Lozenets* Quarter – the steep slope of the former brick factories (Southern Park);,
- *Western Park* Housing Estate - the northeastern slope of *Golyama Konyovitsa* in the direction towards the river Suhodolska and along the right-hand river bank;
- *Reduta* Quarter;
- *7th kilometer*;
- the northern slope of Losenska Mountains (German and Lozen);
- Kokalyane, Pancherevo, Bistritsa.

The mechanisms of emergence and development of landslide processes are linked to the following prerequisites:

- Steep slopes towards the river bed, formed as a consequence of continuous washing away and erosion activity;
- Drainage of ground waters in the foothills of the slopes, causing wetting and excessive accumulation of moisture in the clay layers of the slope massif;
- Availability of plastic clays, which when excessively damp begin to run down and create slippery surfaces;
- Existence of longitudinal crack-fault dislocations, which cause vertical movements and stimulate landslide processes through episodic seismic activation.

The measures for stabilization and consolidation of landslide terrains aim at removal or curtailing of the reasons causing the emergence of landslides. These measures comprise the following:

- Vertical planning of the terrain with minimizing of the gradient angles;
- Rapid evacuation of surface and rainfall waters and adequate drainage of the ground waters wetting the landslide massif;
- Correction of river courses and surface water runoffs for the purpose of stopping their washing away action;
- Consolidation and stabilization of the landslide body through embankments, silica saturation, electro-chemical treatment etc.

In the consolidated and stabilized landslide terrains is permitted construction of low-rise buildings, built on common foundation slabs and columns depending on the depth of location of the sliding surfaces.

5.3.2. Zones with increased seismic activity

According to *Norms for design of buildings and facilities in seismic-risky areas* (1987) and *Ordinance No. 2/23 July 2007 concerning design of buildings and facilities in seismic-risky areas* the territory of Sofia Municipality falls in a zone with a possible earthquake level of 9th degree according to Medvedev's scale and feature seismic coefficient 0.27. The seismic potential of the area is due to cracking-and-fault tectonic movements inherited from Neocene times, which determined the formation of the Sofia Hollow (or tectonic ditch) and the relative towering of the surrounding mountain massifs. Particularly important is the role of the crack-and-fault dislocations along the primary northeast-southeast orientation of the hollow.

Among these stands out impressively the fault cluster along the line *Simeonovo-Dragalevtsi-Boyana-Knyazhevo-Gorna Banya-Bankya*. With it are connected several seismic foci and natural thermal mineral water springs. Another seismogenic line has been identified between *Konyovitsa*, the hydro-thermal deposit at *Ovcha Kupel* and *Lozenets*. It is connected with the epicenter of the strong earthquake of September 1858, which had provoked the next-in-the-row eruption of thermal water at *Ovcha Kupel*.

Important roles in the seismic-tectonic activity of the Sofia area play also a number of crack-and-fault formations running laterally to the main tectonic axis with southwestern-northeastern orientation. Along these are formed the courses of the rivers *Vladayska*, *Boyanska*, *Perlovska*, *Vartopo* and *Suhodolska*.

Because of the significance of the seismic risk for Sofia a **micro-seismic zoning of the territory of the city of Sofia** was conducted for the purposes of the Master Plan. It contains specification in micro-seismic aspect of plots characterized by the highest probable seismic risk with respect to construction and habitation. It is assumed that these are spaces, in which the seismic coefficient (*Kc*) exceeds 0.30 and reaches up to 0.35. This corresponds to possible strength of the earthquakes of degree *IX – IX+* according to the above mentioned Medvedev scale.

Construction in the outlined plots presumes higher structural requirements and additional structural checks and calculations for the existing buildings and facilities.

5.3.3. Zones with high ground water levels

This applies to zones, in which the ground water levels in the ground water-bearing horizon reach permanently or seasonally the ground surface or a depth of up to 2 m below it. The zones with shallow ground waters have been identified as follows:

- In the eastern part of the city of Sofia: *Druzhba* Housing Estate and *Vitosha-Simeonovo* HPP;
- In the southern part of the city of Sofia: *Manastirski Livadi* Locality, *Krastova Voda* Locality and *Malinova Dolina* Locality;
- In the western part of the city: *Tresulite* Locality, *Barite* Locality and near the river *Suhodolska*.
- In the northern part of the city: *Ilyentsi* Quarter, *Svoboda* Housing Estate and *Benkovski* Quarter.

The water conductivity of the water retaining sediments is in the range of 20 to 165 m²/24 hours and the coefficient of filtration varies from 1m/24 hours up to 20-25 m/24 hours.

In terms of chemical composition the waters are mainly not very aggressive towards concrete.

In civil engineering and residential aspect the high levels of ground waters request measures oriented towards drying, drainage and protection of construction equipment and facilities from the aggressive impacts of water and the chemicals contained in water and prevention of any breakdowns. In addition, the water-conducting bodies around the facilities increase the disruptive effect of earthquakes and in this sense have a decisive importance also from the point of view of the engineering assessments and the measures for prevention of seismic risks.

6. ECOLOGY

ANNOTATION OF THE AMENDMENT TO THE MASTER PLAN OF SOFIA MUNICIPALITY

The draft for Amendment to the Master Plan of Sofia Municipality is complex in its nature and affects all the functional subsystems – work, residence, recreation, services, transport, engineering infrastructure and protection of the environment. All these have been covered to a different extent and the changes in any of them will have an impact of varying strength on the components of the local environment.

• Boundaries

The preliminary draft for Amendment to the Master Plan of Sofia Municipality covers the territory of the municipality within the boundaries defined in the process of elaboration of the previous Plan, approved in 2006. All plans and schemes, related to the ecological aspects of the document, are worked out to cover the territory of the city and the territory of the municipality in compliance with the established administrative division of the city, the municipality and the district.

• Timeframe

The timeframe of the plan, i.e. the period of time for which strategic proposals may be made on the basis of the worked out scenarios for the future development of the capital and its population, is 2030. One of the reasons for making immediate amendments to the just approved plan is the fact that the demographic development ran ahead of the projects of the 2003 Master Plan of the city of Sofia. This development is, in its turn, the consequence of the higher rates of socio-economic development as compared to the approved Master Plan, which has led to enhancement of the attractiveness of the capital.

THE AMENDMENT TO THE MASTER PLAN AND THE ENVIRONMENTAL CONDITIONS

The environment-related amendments to the Master Plan of Sofia Municipality reflect the comments and recommendations ensuing from the conducted public reviews of the plan, from consultations with different institutions and the broad public hearings and expert assessments, from submitted position papers and expert opinions, including from the Report on the Environmental Impact Assessment of the Preliminary Draft dated 2002.

Grouped by functional sub-systems the amendments cover the following groups of proposals:

• Functional system “Residence”:

- Proposals for expansion of the area of the planning zones for “Residence”, including proposals for changes in the regulation regimes of the individual zones;
- Incorporation of the worked out drafts for updating of the Detailed Regulation Plans of some housing estates (*Mladost*, *Lyulin*, *Dianabad*, *Iztok*), of the plots allocated for green areas, plots for schools and child care facilities;
- Reservation of certain plots for housing construction in a long-term perspective, above all in the form of expansion of existing settlements, situated peripherally along the boundaries of Sofia Municipality;

• Improvement of the transport communication system:

- Including improvement of the environmental situation through evacuation of the transit traffic flows and creation of conditions for curtailing the use of private vehicles;
- Analysis and incorporation of the feasible proposals: the northern high-speed tangent, the northern and southern by-passes (duplicate routes) of *Tsar Boris III Blvd.*, the communication connection *Al. Malinov Blvd.* - *Evlogui Georguiev Blvd.*, the western arch of the Sofia Ring Road, *Al. Malinov Blvd.*, etc.
- Study of the possibilities for alternative routes along the western tangent (the portion traversing the Western Park with a view to maximum preservation of the afforested plots); boulevard running along the river; extension of *Tsaritsa Yoanna Blvd.* up to *Slivnitsa Blvd.*; *Nikola Gabrovski St.* from *Samokovsko Shosse Road* – along the railway track – *Srebarna St.* – up to *P. Yu. Todorov Blvd.*; *Rozhen Blvd.* etc.

- Identification of potential locations for underground and multi-storey public parking facilities in the Central City Area and along the main street network, linked to the routes of the mass public passenger transport;
- Further development of the scheme of mass public passenger transport, especially in the portion rail transport.

• Improvement and development of the Green System

The proposals for further development and optimization of the Green System – one of the most important components with respect to improvement of the environmental situation – are aimed at preservation of plots, which have been built as substantial elements of the system:

- Marking of all the existing local gardens in the urban area, which are incorporated in the different planning zones;
- Study and marking of the implemented greenery areas in the housing estates and the areas with complex build-up;
- Marking of the implemented parks and gardens in the settlements of the surrounding area;
- More precise specification of the mandatory servitudes under **ТЗВ** regime at locations where their boundaries are not sufficiently clear;
- Expansion of the existing cemeteries both in the urban area and in the surrounding area and allocation of suitable plots for new cemeteries in the southeastern part of Sofia Municipality.

• Further development and optimization of the elements of Sub-system “Work”

- Change of the planning regimes of the industrial zones situated in the central part of the city, which possess adequate potential for restructuring and renewal for the purposes of their development into multi-functional centres;
- Changes in the distribution of the groups of territories, planning zones and alone-standing plots in the urban area and outside its boundaries;

• Resolution of the problem with waste treatment

In the efforts for updating of the Master Plan attention was paid to a matter, which occupies an important place as well - the acute problem related to the planning allocation of plots for dumpsites and other facilities and installations for solid urban waste treatment. On the basis of a series of studies, comparative analyses of alternative sites and technologies, numerous consultations with the broad public, with local and foreign experts, including due consideration of the recommendations from the previous evaluation of the approved Master Plan, the following was reviewed in detail:

- Proposals for alternative sites for dumping of solid urban waste within the boundaries of Sofia Municipality;
- Study of the possibility for building an alternative site for solid urban waste treatment on the area of the *Kremikovtsi 3CK*;
- Proposals for sites for dumping of black and white household appliances and for hazardous waste;
- A plot for construction of a waste incineration plant, including dumpsite for the waste from the incineration technology.

It is possible to extract from the thus systematized amendments to the Plan the most important environmental objectives, which are laid down in it and which would promote more sustainable development of Sofia Municipality through the following: protection of the Green System, improvement of the transport communication system, diminishing of the relative share of industrial areas, resolution of the problems related to waste management etc.

METHODOLOGY OF THE STUDY

One of the primary tasks of the urbanistic-environmental studies is highlighting of the threshold boundaries of ecological equilibrium, i.e. the “limits” of permissible deviations in the individual components of the natural, urbanized and settlement environments for ensuring healthy living conditions and sustainable development. Matrix-criteria have been compiled on the basis of this aspiration for ecological equilibrium and “collated” with the plan of the territory, thus helping to identify its environmental potential and how favorable are the conditions in its individual parts. The deviations from the matrix-criteria take into consideration the direction and need of the activities for bringing the values of the individual indicators closer to the criteria for ecological equilibrium, as well as their type and extent.

Further resolution of the identified problems has been realized by means of a conceptual (theoretical) scheme aimed at maximum effectiveness. Alignment of the conceptual scheme with the real capacity of the territory while taking due account of the specific urbanistic functional and spatial requirements and their matching to the ecological requirements help outline the directions for achieving the optimal solution.

In order to take into account the ecological situation the following aspects have been studied:

- the state of the natural environment for the purposes of discovering its ecological potential;
- the current state of the anthropogenic environment resulting from human intervention;
- by means of aggregating the results from the above an urbanistic-ecological analysis was performed in order to clarify the relationships between natural and anthropogenic components of the milieu and the ecological diagnosis formulated after comparing the results from that interaction with the matrix-type criteria.

The conclusions from the urbanistic-ecological analysis, the depicted causes for the emergence of one or another ecological situation and the degree of distortion of the ecological equilibrium help identify the ways and means, the direction and the appropriate actions for restoring the equilibrium. The feedback – expected changes in the quality of the environment as a result of implementation of the activities envisaged in the plan and the degree of approximation to the matrix-criteria – highlights the effectiveness of the project solution and outlines the substance of the ECOLOGICAL FORECAST.

Therefore, the aim of the urbanistic-ecological analysis and synthesis is not only to unveil the reasons for deterioration of the environment, but also to map the ways and means for its rehabilitation, optimization and sustainable development.

BASELINE INFORMATION

The baseline information used in this material covers the following major sources:

- Amendment to the Master Plan of Sofia Municipality (scale 1:10000 and 1:25000)
- Executive summary to the Amendment to the Master Plan of Sofia Municipality
- Schemes of the main systems and sub-systems, annexed to the Amendment to the Master Plan of Sofia Municipality
- The Master Plan of Sofia Municipality currently in force – Final draft with the Executive summary and schemes annexed to it
- Report on the Environmental Impact Assessment in connection with the Master Plan of Sofia Municipality (Preliminary draft) - 2002

- Environmental Impact Assessment in connection with the Master Plan of Sofia Municipality (Preliminary draft) - 2008
- Updated data about the major components concerning the state of the environment, provided by the Assignor

The issue of “sustainable development” is the dominant paradigm of the project. For this reason in the process of urbanistic studies the balancing role of ecological unity in the resolution of the social and utilitarian needs of man is assigned an equitable place in the concept for spatial and functional organization of the milieu.

Natural environment

LOCATION

Sofia is situated in the Sofia Plain, which is characterized by a flat relief, surrounded by the massifs of the Balkan Mountains and the Vitosha Sredna Gora Mountains to the north and south, the Dragoman Elevations to the west and the Vakarel Heights to the east. Its average altitude above sea level is 550 m. It is located on a heavily indented part of the earth's crust, which is preconditioned by the fact that the larger portion of the Sofia Plain sits on deep-lying faults, protracting as wide belts deep inside it. The so-called Sofia Ridge extends in the Sofia Plain from the village of Sarantsi to the east up to Dragoman to the west, featuring about 60 km in length and about 20 km in width. In southern direction it reaches a belt of fault structures running along the northern edge of Vitosha Mountains and Lozen Mountains. The development of the ridge is characterized by high intensity of differentiated non-tectonic motions and as a consequence of it by high seismic activity up to intensity degree IX and seismic coefficient 0.27 (one of the highest in the country).

REGIME OF THE CLIMATIC ELEMENTS

According to the climatic division of the country Sofia belongs to the South Bulgarian hollow sub-region of moderate continental climate region. The hollow-type relief and the relatively high altitude above sea level contribute to the well-demonstrated specifics of the local climate. The hollow-type nature of the terrain creates favorable conditions for retention and radiant cooling of the air masses in the event of rushing in of anti-cyclone cold continental air.

Thanks to these specifics winters are relatively cold and springs – cool. This comes to explain also the late end of the last spring cold weather days and the relatively cooler summers. Autumn, somewhat warmer than spring, is also “revenged” and is characterized by later ending. The average date of the first freezing weather is 25-30 October and that of the last spring weather – 9-11 April. The average duration of the non-chilly weather is 200-206 days.

RADIATION AND LIGHTING REGIME

The average annual sum of sunshine is 2065 hours (1824 h ÷ 2258 h). Sunshine maximum is in August (302 h). The aggregate radiation is 121 Kcal/cm² with maximum in July (17.3 Kcal/cm²) and minimum in December (3.3 Kcal/cm²). The radiation balance has negative values in the period December-January (-0.44 ÷ -0.49 Kcal/cm²).

ATMOSPHERIC PRESSURE

The mean annual atmospheric pressure is 952.9 xPa with October maximum (954.7 xPa) and April minimum (950.0 xPa). The least amplitude of the atmospheric pressure is typical for the summer months.

TEMPERATURE REGIME

The mean annual air temperature in Sofia is +10.2°C. The lowest average monthly temperature is observed in January (–1.8°C) and the highest – in

July (21.0°C). The average maximum temperatures are in the range of 34.0 ÷ 36.0°C. The absolute minimum is 38.08°C. Maximum temperatures are most frequent in July and August (26.0 ÷ 30.0°C).

The absolute minimum is –31.2°C. The average of the absolute minimum temperatures are in the range of -15.0 ÷ -16.0°C. Negative temperatures are typical for about 100 days in the year, including about 30 days with maximum low temperatures.

The temperature regime in the built-up urbanized areas of the capital is on the average by 1.0°C higher than that in the surrounding areas. In certain city-districts during the hot summer months these values are much higher.

PRECIPITATION REGIME

The average annual amount of precipitation in Sofia is 625 mm. The days with some kind of precipitation are 125 per annum on the average. The absolute maximum annual precipitation rate is 960 mm. The average annual number of days with snowfall is 33 and with rainfall and snowfall – 12. The annual average of sleet and hailstorm may be said to be every 4 days (hailstorm is observed most frequently in May). During the year there are about 50 days with snow cover, the first instance of snowing being usually by the end of November and the last – in mid-March. On the average it is snowing for 1.2 ÷ 6 days.

The average relative air humidity features minimum values in the summer (August - 9% ÷ 61%) and maximum ones in winter (January - 85% ÷ 90%). The relative humidity in densely built-up city areas is on the average by some 3% ÷ 4% lower than that in the surrounding area.

Until the 1980's the annual precipitation rate had a well-manifested continental nature with maximum in June and minimum in February. During the recent decade a certain change in the precipitation regime has been observed. Ever more clearly is manifested a regime characterized by maximum rainfall in spring and drought in summer, autumn and even winter, combined with higher temperatures throughout the year and hence merger of the seasons – transition from winter directly into summer and from summer directly into winter. One may rather speak about two seasons – a rainy season and a dry season. Although it might be too early to speak about a trend, but there are signals in that direction and it seems that the climate of Bulgaria is shifting from the transitional-continental to the subtropical climate belt.

FOGS

As a consequence of the frequent temperature inversion and atmospheric pollution, above all under the influence of the main factor – radiation cooling – the number of foggy days is large – about 30 day per year. In terms of annual distribution the maximum is in December (8 days) and a frequent phenomenon (in winter) is having fogs lasting for more than 24 hours.

CLOUDINESS

Maximum cloudiness is observed in December and January. In summer the cases of overcast weather are due mainly to atmospheric pollution, in which dust and ash predominate.

WINDS

The hollow-type nature of the territory and the high massifs of the Balkan Mountain Range and Vitosha Mountains precondition the atmospheric process with respect to both the direction and the speed of the local winds. Western winds predominate, followed by northwestern and eastern winds. The same as with the rest of the local climate components, in the case of local winds diminishing of winds speed by some 1 ÷ 3 m/sec is observed in the densely built-up urban areas as compared to that in the surrounding

area. As an annual average about 50% of the time the weather is calm – with wind speeds < 1 m/sec, which is very unfavorable. The closeness of Vitosha Mountains is a precondition for the formation of the so-called mountain breeze (foehn) with speeds from 0.5 to 3 m/sec., but its manifestation is rare – 7-8 days per annum on the average.

BIOCLIMATIC CLASSIFICATION

Beside its influence on a number of economic activities, weather is also an important bioclimatic factor. Its significance for the bio-comfort of the human beings ensues from the physiological as well as purely mechanical impact of weather-related factors on human organism. It has a specific influence of important vital functions of the human organism – cardio-vascular, respiratory, nervous etc. in connection with the burden on the thermo-regulatory system and the degree of thermal equilibrium between the human body and the environment. The nature conditions as a complex result from the interaction of the individual components are most clearly manifested in the local climatic conditions. They are characterized by quantitative indicators and their comparison by specific criteria permits qualitative assessment as well.

The major leading factors of climate are as follows:

- Air temperature
- Predominant winds and wind speeds
- Air humidity

A number of studies by physiologists, hygiene experts and other professionals provide a chance to identify parameters within the limits of which the above mentioned climatic factors have an impact on the human organism and outline the “Zone of biological comfort”.

At the same time these same studies point to the thresholds for “above” and “below” which may cause disturbances in the functioning of the human organism – overheating as a consequence of high temperatures, low humidity and stale air and cooling as a consequence of low temperatures, high humidity and strong wind. These circumstances of “above” and “below” comfort level are classified respectively as “discomfort-causing overheating” and “discomfort-causing cooling”, while the state of adequacy (or balance) between the human organism and the environment is classified as “comfort”.

From the whole multitude and variety of evaluations we have used here, with a view to utmost simplicity for the user and in compliance with the baseline information in our possession, the joint work of Bulgarian and Russian experts in physiology and hygiene entitled “Objective criteria for evaluation of the leading climatic factors for performing ordinary work in typical for the respective season clothing” (Table 1).

Table No. 1

Length of the period		Indicators			Evaluation
Number of days	% in a year.	t°C	humidity %	wind m/sec	
39.30	10.77	below 0°	above 80	< 1.0	Discomfort-causing cooling
52.03	14.26	0 - 5	30 - 70	3 - 3.5	Cold
118.13	32.37	5 - 15	30 - 70	0.5 - 3.0	Cool
135.66	37.15	15 - 25	30 - 70	0.5 - 3.0	Comfort
19.88	5.45	> 25	< 30	< 0.5	Discomfort-causing overheating

Criteria for bio-climatic evaluation

Parallel with the “comfort” and “discomfort” zones are identified also the transitional conditions, characteristic for the climate in Bulgaria, to which the human organism is adapted and which it stands

without particular stress. These conditions have been defined by the categories “cool” and “cold”. With their introduction the classification and evaluation of the major climate factors obtains the form illustrated in Table 2.

Table No. 2

Climate factors			Bio-climatic evaluation
Air temperature	Wind speed m/sec	Relative humidity %	
Below 0°C	Above 1	Above 70	Discomfort-causing cooling
0÷5,0°C	1÷3,0	30÷70	Cold
5÷15°C	1÷3,0	30÷70	Cool
15÷25°C	1÷3,0	30÷70	Comfort
Below 25°C	Below 0.5	Below 30	Discomfort-causing overheating

Complex bio-climatic classification of natural conditions

The complex bioclimatic classification of the natural conditions has been made for the purpose of highlighting the favorable and unfavorable aspects of the climate and of taking into account their impact on the human beings. Comparison between the data from the local meteorological station and the thus formulated criteria permits preparation of special “passports” of the territory, in which the length or the relative share of each category of weather (in bioclimatic aspect) in multi-annual, annual, seasonal, monthly or diurnal section is reviewed depending on the requirements of the study.

The bioclimatic passport of the city of Sofia in compliance with the above mentioned criteria has been compiled on the basis of analysis of the leading climate factors:

- Radiation and heat conditions
- Wind cycle
- Air humidity

The assessment of the radiation and heat conditions comprises analysis of:

- the flow of the actual summary solar radiation on plots with different gradients and orientation
- transparency of the atmosphere
- overcast sky
- diurnal fluctuations of air temperature
- probability of different gradations of air temperature
- complex characteristic – combination of temperature with the other meteorological elements

The assessment of the wind cycle comprises analysis of:

- recurrence of winds in the main rhumbs in diurnal and annual section
- probability of different gradations in wind speed in accordance with the approved criteria
- the standstill phenomenon (the combination of very weak winds with stable thermal stratifications)
- complex characteristic of the wind together with the other meteorological elements

The assessment of the air humidification cycle comprises the following:

- study of the air humidification cycle in diurnal, monthly, seasonal and annual section
- number of foggy hours and days, etc.

These analyses are based on the daily observations by the regional hydro-meteorological stations (PXMC) for a period of 10 to 50 years, processed

by means of the methods of complex climatology and through application of graphs of recurrence of natural conditions. The assessment of the climatic conditions has been performed using the introduced bioclimatic classification of the natural conditions.

The complex bioclimatic classification of natural conditions has been compiled for the purpose of highlighting the favorable and unfavorable aspects of climate and of taking into account their impact on human beings= Comparison between the data from the local meteorological station and the thus formulated criteria permits preparation of special “passports” of the territory, in which the length or the relative share of each category of weather (in bioclimatic aspect) in multi-annual, annual, seasonal, monthly or diurnal section is reviewed depending on the requirements of the study

BIOCLIMATIC PASSPORT

The bioclimatic conditions in the city are not very favorable. This is evident from the bioclimatic passport of the city, compiled on the basis of a specific matrix of criteria (Table 3). Discomfort-causing climatic conditions are typical for a total of 59.18 days (16.22 per cent), on 135.66 days the climatic conditions of the environment are favorable for the main human activities and during the remaining 170 days the weather is cold or cool, whereat the latter prevails.

The reason for these results is due to the specific climatic conditions of the city, resulting from several major factors:

- The Sofia Plain is a hollow, surrounded by mountain massifs, with not very good ventilation and obstructed runoff of the air masses. These are the causes for the calm local weather (no wind during 50 per cent of the days in a year), the large number of foggy days – 33 (Vrazhdebna – 47.1), the formation of a “frost lake” in winter. Western winds predominate, followed by northwestern and eastern winds. Strong winds (N; NW) are observed for only 1-3 per cent of the time.

Table No. 3

Climate factors	Evaluation		
	comfort	overheating	cooling
Air temperature, °C	15÷25	Above 25	Below -5
Wind speed, m/sec	0,5÷3,0	Below 0.5	Above 5
Relative humidity, %	30÷70	Below 30	Below 70

Bioclimatic passport - Sofia

- The heavily urbanized area of the city, the industrial activities and space heating arrangements, the high percentage of artificial coating and covering materials, which absorb solar radiation, are some of the reasons for additional heat energy release (albedo values: Sofia - 0.15; surrounding zone - 0.25, Vitosha Mountains - 0.50). These factors in their entirety as a complex cause the formation of a “heat island” in summer – the ambient temperature in the city centre has increased after the year 2000 by some 1.0°C – 1.5°C as compared to that of the surrounding area.
- Sofia is situated in the periphery of the zone of intersection of the isolines of the lowest January and the highest July temperatures in Europe.

The complex action of these factors is due to the high temperature amplitudes, which in annual section go up to 70°C. The combination of the air temperatures with the other main climate components – wind and relative air humidity, leading to discomfort-causing manifestations in winter (fogs, high humidity,

minus temperatures – a “frost lake”) and in summer (low/very high humidity, high air temperatures, still weather – “heat island”) – are accompanied by negative meteotrope reactions of the human organism and reduced labour capacity.

Studies of the effect of the performed work and related effort reveal that during the period of overheating-based discomfort the output is on the average by some 43 per cent lower, i.e. beside biological aspect the bioclimatic conditions have also a social and economic effect.

The analysis of the local climatic conditions in the context of the bioclimatic classification permits to make the following summary conclusions, arranged for better clarity by seasons:

• **Winter**

In winter the time, when the outdoor air temperature oscillates around 0°C, accounts for a considerable share of the period (from 13 to 42 per cent during the different months). Combined with the very wet weather and predominant western winds these temperatures lead to bioclimatic parameters defined as “discomfort-causing cooling of the environment”. They create negative meteotrope reactions and especially in the event of stronger wind the human organism has difficulties in agreeing with them. The period of “discomfort-causing cooling” for Sofia covers 39,3,30 (?) days or 10.77 per cent of the year. What is characteristic is that this period is not continuous (neither in diurnal nor in any other longer period of time) and during the different years alternates at different frequency with periods of “cold” and “cool” weather but the climate parameters reach grave extreme values. These extreme values are the reason for aggravation of a number of chronic diseases during that period, which has also a definite social effect.

• **Spring and autumn**

In spring, in connection with the increased influx of solar radiation the relative share of “non-frosty weather” also increases. As early as in March the average statistical data show absence of “discomfort-causing cooling” and manifestation of the periods of “cold” weather (13-25 per cent), “cool” weather (43-58 per cent) and “comfort” weather (44-17 per cent), whereat cool weather predominates. These favorable climate manifestations continue in April and in May they account already for 75% of the time, thus falling within the period of “comfort” weather. “Comfort” is usually formed under conditions of stable anticyclone, when the pace of the major meteorological elements is adequate and to which the human organism is best adapted. Nevertheless, a frequent phenomenon, especially during the months of March and April, is transition of weather fronts across the zone and transformation of the air masses. Under these conditions the weather is cloudy, overcast and wet, the solar radiation is screened by the clouds, although for short periods of time, and as a result UV radiation features an impulse nature. Under these conditions the stroke of the meteorological elements is accompanied by abrupt non-periodical changes, as a result of which negative meteotrope reactions emerge and certain diseases might aggravate. According to the approved classification these periods are evaluated as “cold” and “cool” and account for (together with their manifestations in autumn) respectively 52.03 days (14.26 per cent of the year) and 118.13 days (or 32.37 per cent).

• **Summer**

The favorable changes in the structure of climate, manifested most tangibly in May, continue until the second decade of June. The sunny, moderately humid weather, determines the relative share of comfort climatic conditions. They cover 37.15 % of the time in spring, the beginning of summer and autumn or a total of 135.66 days.

After the second decade of June together with the increase of the relative share of the “sunny, hot and very dry weather” and the even more unfavorable “very hot and very dry weather” sets in the impact of the most unfavorable period of discomfort-causing overheating of the ambient environment. The same as with the “discomfort-causing cooling”, the “discomfort-causing overheating” is not a continuous period and alternates with “comfort” periods, but here also the meteorological elements reach their extreme values. The temperatures rise to above 40°C, air humidity is low. These meteorological elements are combined with still weather or weak, dry and hot western winds. Typical for that period are all the conditions for overheating of human organism and even people with normally functioning thermal regulation have difficulty in coping with the effort to maintain their constant body temperature. This period accounts for a total of about 20 days per year, but for the different urbanized parts it is longer and is the reason for strongly reduced labour capacity, sickness spells, fatigue etc.

The herein presented data is necessary but not sufficient for a more comprehensive study of the natural conditions. That is so because the local climatic conditions are a consequence, a complex result of the action of a number of components of the environment – the natural landscape – relief, exposure, gradients, ground cover etc. Therefore the picture, obtained from that passport is “true” but not at all “accurate”, since the elements of the natural landscape – the relief, ground cover etc. and the “manmade landscape” imposed over it – the urban build-up, its density and nature, type of the street network, the existence or absence of vegetation, the artificial coatings and other components of the anthropogenic environment contribute to the formation of the so-called “micro-climate”, which is different for the individual parts of the territory and the comparison of the elements of this micro-climate with the introduced criteria leads to the highlighting of the ecological potentials of every part of the city.

BIOClimATIC-LANDSCAPE EVALUATION

The objective of the complex bioclimatic-landscape evaluation of the territory is to study how the landscape elements (natural or manmade) have contributed to the formation of one or another micro-climate and exposure of the positive and negative aspects of its manifestation on the human organism, while the results from the conducted study may be used for micro-climatic regioning of the territory. The conclusions from the study and the discovered causes outline the direction and extent of the necessary measures for improvement of the environmental conditions.

Following the analytical principle of moving from the general to the particular, we have reviewed firstly the following:

- Changes in the climate factors under the conditions of the natural landscape; and
- Changes in the climate factors under the conditions of anthropogenic environment or of the so-called “manmade landscape”, i.e. the micro-climate in the individual city parts and spaces.

The combination of the climate indicators with the landscape elements (natural and manmade) – relief, orientation of the slopes, depressions and elevations, the urban build-up, its density and nature, type and orientation of the street network, the existence or absence of vegetation, water areas, artificial coatings and pavements etc. lead to the formation of the respective micro-climates, characterized by different ecological potentials. As an example we may quote the results from studies of the micro-climate in the city of Sofia, where on one and the same day and hour at different points of the city under different conditions have been measured temperatures varying by more than 20°C, air humidity values varying by more than 30% and wind speeds varying by more than 3.0 m/sec etc.

The objective of the complex climatic-landscape evaluation of the territory is to expose the micro-climatic characteristics of the individual urban areas using as a starting point the ecology of man (?) (ecology *vis-à-vis* human beings and their needs??) and the introduced criteria. екологията на човека

The complex bioclimatic-landscape ranking of the territory is obtained after summing up of the data from the micro-climate studies and their comparison with the matrix-criteria. This ranking is a reflection of the influence of the different elements of the landscape, of the ground cover, the build-up, its density and type, i.e. the impact of all the elements of the natural and anthropogenic environment on the natural conditions. In this way the so-called “Bioclimatic Landscape Complex” of the city of Sofia (Table 14) was produced. In addition to its abstract, tabular format, it contains also a spatial aspect, i.e. it may be superimposed on the (plan of the?) territory. As a result of that it is already possible to outline the individual zones in the urbanized area and surrounding areas and to classify them by their degree of environmental-friendliness.

Table 4

Elements of the environment	Elements of the micro-climate			Rating	
	Temperature	Wind speed	Air humidity	Deviation from the criteria	Ecological regime
	K1	K2	K3	K4	
Sofia Plain	+3.2 ÷ +4.4	± 1	± 1	-1.5	A2-A3
Foothills of Vitosha Mountains, the Balkan Mountain Range	-4.0÷ ± 0.0	± 1	+ 1.5	-	A1
Park environment	- 2.0 ÷ ± 0.0	-0.1	+ 1.2	-0.3	A1-A2
Built-up plots Zone I	+1.3 ÷ +7	± 0.0	± 0.0	-1.4	A1-A2
Built-up plots Zone II	+4.0 ÷ +8.2	-0.2	-0.5	-1.5	A2
Built-up plots Zone III	+4.3 ÷ +9.8	-0.3	-1.0	-1.7	A3
Built-up plots Zone IV	+6.2 ÷ +10.5	-0.5	-1.5	-1.8	A4

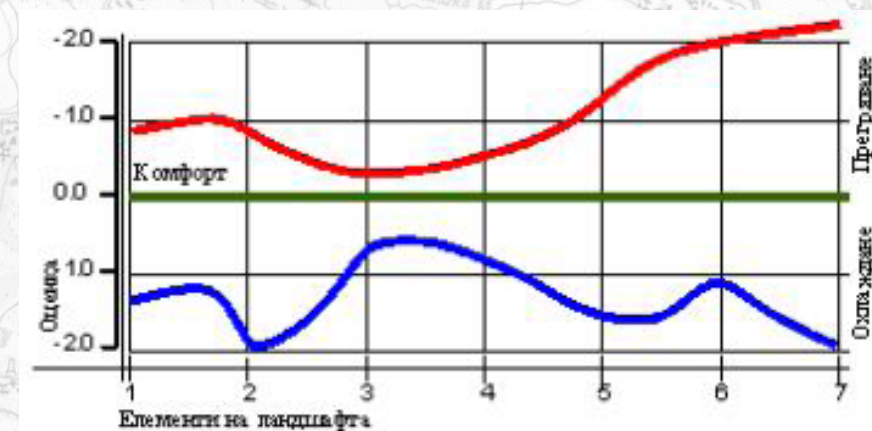
Bioclimatic landscape complex Sofia.

The below listed coefficients have been introduced in the bioclimatic landscape complex:

- For ambient temperature: Coefficient K1, reflecting in plus (+) or minus (-) the difference from the introduced criterion for comfort – 25°C on the average in summer.
- For wind speed: Coefficient K2, reflecting in plus (+) or minus (-) the difference from the introduced criterion for comfort – 0.5 to 3.0 m/sec.
- For air munidity: Coefficient K3, reflecting in plus (+) or minus (-) the difference from the introduced criterion for comfort - 30-70 %.

The deviations from the introduced criteria, shown in the column “rating” with Coefficient “K4” reflect the differences in ± in percentage in the length of time with discomfort manifestations of the climate (for instance 1.5 = 15% of the time) in annual aspect. Depending on the degree of deviation from the introduced criteria, the calculations made and the data from the field observations an attempt for classification of the elements of the environment according to how favorable are they (ranking / degree) is made in the “Ecological regimes” column.

The existence of more than one degree in the “Ecological regimes” column is an illustration of the fact that during the different seasons one and the same environment may belong to a higher degree to the “comfort” zone in summer and vice versa – to a higher degree to the “discomfort” zone in winter as compared to the neighbouring zones. To summarize, with the help of the introduced criteria the ecological regimes of the territory may be classified in the following manner:



- Regime A1 – natural environment without violations and featuring minimum impact of anthropogenic components; in the process of comparative analysis defined as the most favorable;
- Regime A2 – urban environment with stronger impact of the nature components and moderate impact of anthropogenic components; favorable;
- Regime A3 – urban environment with predominance of anthropogenic components and low influence of nature components; relatively favorable;
- Regime A4 – urban environment with the largest share of anthropogenic components and the lowest share of nature components; the most unfavorable;

Using the data from Table 4 the Graphs on Fig. 1, illustrating the deviations from the introduced criteria by individual components of the urban landscape have been constructed.

As a result of the conducted study the following zones, classified by degree of favorability have been outlined:

• Zone A1 – the most favorable

It covers the area of Bankya, the southern parts of Gorna Banya, the foothills of Lyulin Mountains, the slopes of Vitosha Mountains with the quarters adjacent to the southern section of the Ring Road – Boyana, Dragalevtsi, Simeonovo, Gorublyane to the north and the southern parts of Buxton, Manastirski Livadi, Studentski Grad, Mladost 3, the plots around and to the north of Lozen, as well as the human settlements in the foothills of the Balkan Mountain Range to the north. In this zone the micro-climatic conditions are characterized during the warm seasons by lower temperatures (and amplitude in diurnal section), higher relative air humidity and better ventilation conditions. In winter, on the opposite, the manifestations of the period “discomfort-causing cooling” are more evident (higher relative air humidity - 10-18 per cent, wind speed - 3-5 m/sec).

• Zone A2 - favorable

The isolines of this zone, in direction west-east, cover Suhodol, the southern parts of *Ovcha Kupel 1* and *Ovcha Kupel 2* Housing Estates, Krasno Selo,

Borovo, Motopista, and also the adjacent area (from 100 to 300 m) around the big park massifs – Southern Park, Hunting Park, *Borisova Gradina* Park, Darvenitsa, Mladost 1 and Mladost 2. The micro-climatic conditions there are more unfavorable than those in Zone A1. The period of “discomfort-causing overheating” is longer by 18-22 per cent for the expense of the “comfort” period. Alternatively, during the cold seasons in the year the periods of “cold and cool” weather are by 8-12 per cent longer for the expense of the “discomfort-causing cooling” as compared to Zone A1.

• Zone A3 – conventionally favorable

Zone A3 covers the area of Fillipovtsi, the southern parts of *Lyulin* Housing Estate, Western Park, Razsadnika, Krasna Polyana, *Serdika* Housing Estate, the area around the Palace of Culture – up to *Patriarch Evtimii* Blvd., the southern parts of Geo Milev Quarter, *Druzhba-1* and *Druzhba-2* Housing Estates; to the north the area of Iliyantsi, Benkovski Quarter – Kubratovo – Chepintsi. The micro-climatic conditions here are relatively favorable - the period “discomfort-causing overheating” is significantly longer (by 20-25 per cent on the average) for the expense of the “comfort” period as compared to Zone A1; the periods “cool” and “cold” weather are approximately the same as in Zone A2, while the period “discomfort-causing cooling” is slightly longer (lower wind speeds, longer stay of foggy weather).

• Zone A4 - unfavorable

The zone with unfavorable natural conditions A4 covers the areas to the north of the isoline of Zone A3. It extends over the areas of Obelya, Moderno Predgradie, Zaharna Fabrika, Banishora, almost the entire Central City Area, Vladimir Zaimov, Hadji Dimitar, Suhata Reka, Vassil Levski, Hristo Botev, Vrazhdebna, as well as the area of Sofia Airport. In this area are manifested the two unfavorable climate manifestations – “discomfort-causing cooling” and “discomfort-causing overheating”. In winter one may observe here a “frost lake” (in still weather), longer foggy periods. In winter the temperatures are by $1 \div 3.6^\circ$ lower as compared to Zone A3 and in summer by $3 \div 8^\circ$ higher at longer period of still weather and significantly lower ($8 \div 15$ per cent) relative humidity.

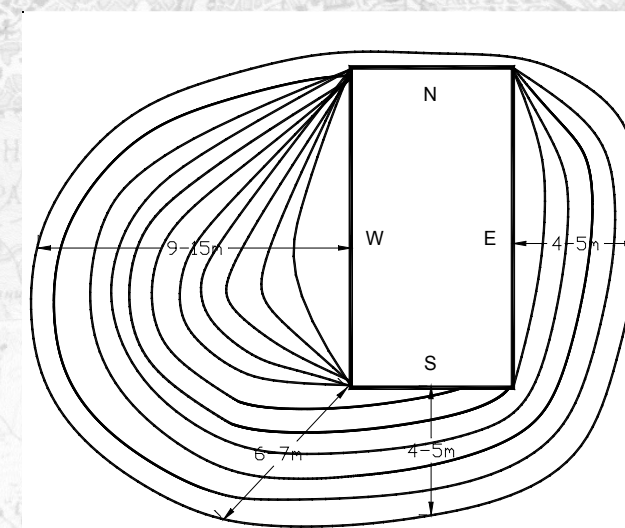


Fig. 2 Radii of heat radiation

A visual example of the influence of the artificial coverings and pavement and the build-up on the bioclimatic conditions is presented in Table 5 - data from field measurements in a housing estate in summer. From the quoted data it is evident above all that the extreme values for the air temperatures are measured in immediate vicinity to the façade of the building. Western facades are characterized by the highest temperatures, followed by the southern and eastern façades. From the same observations it is evident that the impact of

the warmed up western façades continues even after the 10th m above the ground (at the height of 150 cm the temperature is 42.3°C and that of the inner neighborhood space outside the radiation zone is 26.9°C), while at the eastern façades the temperatures become equal after the 5th m.

The conclusions that may be made when the radii of the heat radiation are compared using the data from Table 5 are that the radiation radii of the western façades are 10-15 m, of the eastern façades 6-7 m and of the eastern ones 4-5 m. The reason for that is the flow of solar radiation on the vertical surface of the buildings.

In the course of the measurements the following values were obtained:

- East - 222 cal/cm²/day
- South - 126 cal/cm²/day
- West - 221 cal/cm²/day
- North - 39 cal/cm²/day

The seeming inconsistency – lower influx of solar radiation from the west as compared to the eastern façades but considerably higher radiation from the western façades - may be explained with the fact that western façades are heated in the afternoon, when the temperature of the air and the surrounding objects is higher.

From the above example one may draw a number of conclusions allowing implementation of a series of elementary “micro-meliorative” measures, which may briefly be summarized as follows: (i) Careful assessment of the orientation of the buildings with respect to the four cardinal directions; (ii) The building façades should be maximum indented by loggias, balconies etc., which ensure maximum obstruction of the direct flow of solar radiation; (iii) The brighter the colour of the façade the less heat will be accumulated; (iv) Recreation corners should not be located in the zone of long-wave radiation; they should rather be planted with high-stem tree species, which would provide shading to both the terrain and the façades themselves; (v) Location of a small water effect site would increase air humidity, noting that a 15 per cent increase of the air humidity is equal to temperature drop by 3.5°C; (vi) In the process of build-up of the quarters break-through towards the predominant winds should be sought for the purposes of ensuring ventilation of the space; (vii) The build-up along the quarter perimeter should not exceed 70 per cent, etc.

WATERS

The analysis and assessment of the surface and ground waters is performed for the purposes of evaluation of the water reservoirs and rivers as an urban development factor, as a resource for economic and residential needs, their impact on construction activities, their protection against pollution, outlining of the zones of water catchments etc.

The surface waters on the territory of Sofia Municipality are represented by the river Iskar and its tributaries. The spring area of the river covers the high-altitude central part of Rila Mountains. The length of the river up to Novi Iskar is 114 km and its water catchment basin extends over 3 662 km². All the rivers are categorized as Category I receivers from their springs to the first settlement on their way and as Category II receivers after it.

The city of Sofia is water supplied from the rivers originating from Vitosha Mountains and Rila Mountains and from ground waters abstracted in the surrounding area and the hollow. For the purposes of transporting the water to the city the Vitosha pipeline, the Rila pipeline and the *Iskar* Dam pipeline have been constructed. The Vitosha water pipeline was constructed in the beginning of the 20th c. and is still in use till the present. The Rila water

pipeline is in operation since 1933. The two water pipelines may ensure 55 million m³/year, which is far from sufficient. The shortage is compensated by the *Iskar* Dam – 250 million m³/year. It was constructed for the needs of irrigation, power generation and water supply for industry, but presently it is the major source for drinking water supply to Sofia. It provides drinking water to 1 250 00 inhabitants after adequate treatment at the *Pancherevo* and *Bistritsa* Drinking Water Treatment Plants. It is worth noting that water consumption in Sofia is quite high: 1990-1993 – 285 million m³/year; 1995 (at the imposed regime) – 208 million m³/year; 1998 - 251 million m³/year. Under the current “Norms for design of water supply systems” water consumption in 2020 should reach 310 l/inhabitant/day at current norms in the majority of the European countries 200 l/inhabitant/day.

The local water sources have a small capacity (1-10 l/sec) and are used for partial water supply of certain quarters and industrial water supply from companies’ own sources.

Industrial enterprises consume different quantities of water depending on the type of their production and technology cycles. The biggest consumer is the *Kremikovtsi* Combined Metallurgical Works, but beside it on the area of the municipality operate 250 more companies, including 115 of national significance, which consume millions of m³/year.

MINERAL WATERS

On the territory of Sofia Municipality are discovered 50 important water sources, 10 of which are of national significance. If one adds those having smaller discharge rate the figure would exceed 150. A considerable portion of the available water sources comply by their main physical and chemical composition to the requirements of the European norms for table water (8 types of mineral waters are covered by BDS 14947-80), which is the reason for their broad use by the local population. The temperature of the mineral waters varies from 24°C to 81°C, which represents an almost entirely untapped potential as a renewable energy source for space heating not only in spa facilities, but also in buildings, greenhouses, etc.

The characteristics of mineral waters are extremely varied and comprise all the natural groups (hydro carbonate sodium, hydro carbonate sulphate sodium, hydro carbonate calcium-magnesium, fluorite, silicon, non-sulphate etc.), which predetermines the big opportunities for their use for balneology, sports and recreation purposes, bottling, etc.

This exclusively valuable nature resource is not utilized rationally, a large portion of the waters is not used at all, there are no protection zones around most of the deposit sites and elementary hygiene conditions are often not observed.

NATURE ENVIRONMENT. ECOLOGICAL FORECAST.

With the Amendement to the Master Plan of Sofia Municipality no significant changes may be expected, that might lead to radical change of the local climate. Certain negligible changes have been noted only in certain characteristics of the local climate, resulting rather from cyclic changes in the meteorological situation than to the planning and construction interventions. The changes of the climate will affect above all the micro-climate characteristics of the environment.

In order to have significant changes in the local climate very dramatic changes in the planning characteristics of the territory of the compact city and the surrounding area would be necessary. Indicators about the ascendance of such changes unfortunately do exist. As compared to the period of the previous paper the increased share of the urbanized territories, the accelerated rates of

construction, the increased motorization rate and the failure to implement the concepts for creation of green corridors and zones and of theme parks have negative impact on the micro-climate, since there is no improvement of the conditions for access of fresher air from the surrounding mountains towards the territory of the compact city and the surrounding area, which would have contributed to diminishing of the days with extreme climatic conditions, fogs and temperature inversions.

Negative changes might be expected in the event of further expansion of construction, which had led to heavy urbanization of the areas adjacent to the city main roads, the Vitosha foothills, including in immediate vicinity to the boundaries of the nature park under the same name and in the most attractive parts of the municipality, accompanied by inflicting damages to cultural and nature values. Such an unorganized urbanization results in negative impact on all the components of the environment. A negative example in this respect is the proposal contained in the Amendement to the Master Plan of Sofia Municipality to take away considerable areas from the Western Park and allocate them for housing construction.

Among the small number of positive examples is the curtailing of this path of development through the Nature 2000 Project, which delays the processes of accelerated urbanization of sensitive zones with rich biodiversity.

Since considerable parts of the territory of the compact city are already (over) built-up, one may hardly expect significant changes in the micro-climatic regioning except in negative direction. Considerable changes may not be expected in the surrounding area either, since it is being intensively developed as well.

The envisaged Amendement to the Master Plan does not contribute to changes in the major components of the natural conditions (temperatures, humidity, winds, solar radiation, etc.). As a result of the envisaged actions one might expect local changes in the micro-climate conditions in individual parts of the city as a result of concrete implementation, but they will not affect the declared bioclimatic regioning and bioclimatic indicators.

From substantial importance for protection of the ecological potentials of the natural environment are the projections for development of the Green System, including the selection of tree and other plant species, which are suitable for the local conditions and which may be relied on for improvement of its properties. Deciduous tree species predominate in the city – plane-tree (sycamore), lime-tree, poplar, chestnut, acacia etc. Various exotic species are well naturalized in the city parks, while the *Vranya* Park, the *Borisova Gradina* Park and the Botanical Garden are sites representing real dendrariums.

At the background of the existing climate and micro-climate problems the city suffers from an acute need of much more greenery. For the purpose of improving the properties of the environment it is necessary to reach saturation with greenery to the level of about 40 m²/inhabitant green areas, organized in a unified Green System. What would be most appropriate are above all tree species – they ensure shading of the artificial coatings, the building façades, purifying, ozonizing and humidifying of the city air and they also act as protection against winds in winter (the evergreens). It is worth reminding that 1m³ leaf-mass exceeds more than tenfold the dust-catching and micro-climate-creating function of 1 m² grass area.

Currently the green areas in the city are in a poor state – ill-maintained, with considerably lower area because of their massive “expropriation” for build-up. The existing public green areas amount to 1 723.77 ha. They comprise the existing city parks (*Borisova Gradina* Park, *Borisova Gradina* Forest

Park, *Loven* (hunting) Park, Southern Park, Western Park, Northern Park, *Knyazhevo* Pine Forest), city-district parks [*Druzhba*, *Hypodruma*, *Ovcha Kupel*, *Borimechkov*, *Lyulin*, *Oborishte*, *Gerena*, *Bratska Moguila*, *Zala Festivalna*, Soviet Army Monument, *Gradska Gradina* (City Garden), *Mir I Druzhba* (Peace and Friendship) etc.], local gardens (squares) – *Vazrazhdane*, in front of the hotels *Moscow*, *Orbita*, *Kempinski Zografski*, *Novotel Evropa*, *Krystal* etc., as well as greenery strips, transport nodes and adjacent plots, including along streets of the main street network. At the background of the current population size the saturation rate is 15.58 m²/inhabitant, including 12.47 m²/inhabitant belonging to the city and city-district parks and local gardens and squares and 3.15 m²/inhabitant from the greenery strips and transport nodes.

The development of the Green System envisaged in the Amendement to the Master Plan, especially in the section dealing with the theme parks in the surrounding area, will improve the conditions of the natural environment and will have a positive impact on the landscape as well, since the proposals are related to modern treatment, rehabilitation and regulation of the territory. With the proposals for transformation of the industrial plots into mixed multi-functional zones and the related activities for recultivation and secondary use of damaged plots, with the expansion and enrichment of the Green System, the state of the natural and anthropogenic landscapes will improve.

Natural factors are the primary driving force for the emergence of every human settlement. For Sofia these are the mountains, acting as a natural fortress, the rivers – as waterways and water source, and of course – the fertile valley. These natural factors are a “classic” representative of the so-called external “environment” – a prerequisite for the emergence and a major set of factors for the functioning of any urban system.

The conducted studies on the subject “Natural conditions” provide answers to the questions what is the relation to and influence of these factors - presently on the functioning of the city and in the future - on its development. The information collected under this subject has permitted conducting of urbanistic analyses in the following major aspects:

- Ecological: with the aim to analyze and evaluate the living conditions provided by nature for the human beings as well as for the rest of the representatives of flora and fauna, etc.
- Eco-economic: with the aim to analyze and evaluate the resources provided by nature – soils and fertility of the land, ores and minerals, waters etc. (“Eco-“ means the most careful use of non-renewable natural resources).
- Technogenic: opportunities for and degree of favorability for construction of the necessary urban infrastructures – gradients, relief, structure – engineering-geological conditions, surface and ground waters, seismic risk etc.
- Urbanistic-environmental: in order to formulate a complex evaluation of the living environment.

As a result of the studies of the ecological potentials of the natural environment a specific type of atlas of maps and a summary map of the territory has been elaborated, offering a kind of baseline for future studies. In this way were outlined also the boundaries of the ecological regimes – “Natural environment forecast” – marked appropriately on the map under the same title.

ANTHROPOGENIC ENVIRONMENT

The objective of the study of the anthropogenic environment is to provide information about the “layers” of traces of human activities at the background of natural environment and its ecological state, expressed in different forms of interrelated (eco) systems, characteristic for the various parts of the

territory. More particular attention is paid to the ecological parameters in the anthropogenic environment depending on the location, the envisaged norms and indicators, public works and functioning of the individual zones. By means of a specifically selected system of criteria the influence of industrial activity, transport and the residential sector is taken account of as factors imposing the heaviest burden on the ecological equilibrium.

The analysis covers the localization of the industrial areas as regards the residential areas and their impact on the latter. The site localization criteria have been determined by the envisaged classification of industrial activities and the MX33 required for them. In the draft-Amendment to the Master Plan of Sofia Municipality certain improvements in that direction are proposed for “handling” of the rampant development of industrial activities in zones, in which that is not permissible, and evacuation of these activities to new plots, some of which have infrastructure *in situ*, but are deserted and stay out of use.

Aspecial map, on which the MXC33 have been marked with due consideration of the resultant “layers”, has been elaborated for assessing the influence of industrial and other accompanying activities.

ATMOSPHERIC AIR POLLUTION

Some 30 per cent of the industry nationwide is concentrated on the area of Sofia Municipality and the city of Sofia. Considerable portion of the enterprises causing air pollution are still located in the residential areas or in immediate vicinity to them. This situation obstructs the efforts for clear distinction of pollution caused by the industrial zones.

The major industrial sources of harmful pollution of the atmospheric air are the enterprises of the sector “Metallurgy”, whose main representatives are *Kremikovtsi* plc and *Sofia Copper* plc, as well as a large number of smaller foundries, above all for casting of non-ferrous metals from scrap. As a consequence of their production activities sulphur oxides, nitric oxides, lead aerosols and dust, including heavy metals, hydrogen sulphide and phenols are produced.

The energy sector is the sources of nitric oxide, carbon oxide, hydrosulphide, and south and dust emissions. South and SO₂ are emitted mainly by the local district heating plants in industrial enterprises running on liquid fuels.

The plants of *Toplofikatsiya-Sofia* plc use natural gas. No exceeding of the Norms for Permissible Emissions with the exception of nitric oxides has been observed in their operation (they perform their own permanent monitoring). The plants possess complex permits.

The chemical industry emits pharmaceutical dust, vapours from organic solvents (*Sopharma* plc), SO₂, hydrosulphide, mercaptans, common dust, south, hydrocarbons and VOC emissions (*Lakprom* plc).

The numerous small industrial enterprises with their organized and unorganized emissions, above all dust, also have their specific contribution to the pollution of the atmospheric air in the capital.

The data from the inventory of emissions originating from industrial activities reveal that:

- The industrial activity of *Kremikovtsi* plc produces 94 per cent of the emissions of duct, 75 per cent of the SO₂ emissions and 25% of the emissions of nitric oxides.
- The main source of nitric oxides is the natural-gas-fueled combustion systems, above all the capacities of the TPPs of

Toplofikatsiya-Sofia plc.

- The unorganized landfills are a source of carbon dioxide and methane.
- The data about dust emissions do not comprise such emissions from one big source – the construction sector, since they are not measured.

The relative share of pollution of the ground-level layer of atmospheric air with industrial pollutants is as follows:

- *Sulphur dioxide*. The highest values exceeding the threshold concentration per hour has been recorded on the area of *Triaditsa* city-district. The measured value is 1.22 times above the threshold daily norm. The annual norm for protection of the natural ecosystems is also exceeded - 20 µg/m³. The biggest sources of SO₂ creating the ground-level concentrations are the TPPs and the *Kremikovtsi* Combined Metallurgical Works.
- *Nitric dioxide*. There is no exceeding of the threshold norms. The highest one-time concentration has been calculated for the area of *Vazrazhdane* (city-district? Square?).
- *Dust*. Exceeded one-time norms in the area of Chepintsi-Negovan. The highest annual concentration has been recorded in the area of Stolnik.
- *Lead aerosols*. No cases of exceeding of the threshold norms. The highest one-time concentration has been calculated in the area of the village of Stolnik – 2 km to the east of the *Kremikovtsi* Combined Metallurgical Works. The highest average annual concentration has been calculated at a distance of 3-4 km to the west of the Combined Works.
- *Cadmium, mercury*. No cases of exceeding of the threshold norms have been observed for either of the two polluters. The highest annual concentration for the two has been calculated in the area of *Vazrazhdane* (city-district?).
- *Polychlorinated bephenyls*. There are no threshold concentrations for PCBs. The highest concentration has been calculated in the area of *Vazrazhdane* (city-district?).
- *Dioxin and furans*. There are no threshold concentrations for DIOX. The highest concentration has been calculated in the area of Chepintsi and Negovan.
- *Total suspended dust, fine dust particles below 2.5 µg/m³ (FDP_{2.5}) and below 10 µg/m³ (FDP₁₀)*. Excessive values have been reported for all points. This fact is a trend that has set in in recent years, so it is necessary to undertake measures for improvement of the air quality in the area immediately around the *Kremikovtsi* plc, where the concentrations of dust in the air (especially FDP₁₀), gas pollutants (especially hydrosulphur and phenol) and heavy metals are particularly high.

The automobile transport represents serious problem as a source of air pollution in Sofia. The reason for that is the high motorization of the capital and the inadequate for such traffic volume road infrastructure. In addition, the automobile transport in Sofia with its low level of environmental-friendliness is one of the most serious polluters of the air in the city. The data from the emissions inventory of the city of Sofia show that automobile transport accounts for 57 per cent of the total emission of NO_x, 93 per cent of CO emissions, 70 per cent of CO₂ emissions, 83 per cent of the emissions of N₂O, which calls for particular attention to the problem with traffic in Sofia.

For the needs of air transport in Sofia operates the largest international airport in the country, which also attracts automobile traffic.

In the course of assessment of the quality of atmospheric air in Sofia the emissions from vehicle traffic have been studied and the pollution levels by the following harmful substances have been investigated:

- Pollutant groups – sulphur oxides (SO_x), such as (SO₂), nitric oxides (NO_x), volatile organic compounds not containing methane (NMVOC), methane containing volatile organic compounds (VOC), methane (CH₄), carbon oxide (CO), carbon dioxide (CO₂), nitrous oxide (N₂O), ammonia (NH₃).
- Heavy metals – cadmium (Cd) and lead (Pb).
- Stable organic pollutants – polycyclic aromatic hydrocarbons (PAH), dioxins and furans (DIOX), polychlorinated biphenyls (PCBs).
- Dust particles – fine dust particulates (FDP_{2.5} and FDP₁₀), south.

The summary data from the conducted investigations provide grounds for the following regioning of the territory as regards atmospheric air pollution:

- Central City Area, the zones with dense build-up and intensive traffic – between *Vazrazhdane* Square, *Hristo Botev* Blvd., *Slivnitsa* Blvd., *Stochna Gara*, *Pametnik Levski* Square, *Orlov Most* (Eagles Bridge), *Evlogui Gueorgiev* Blvd., *P. Evtimii* Blvd. and *Hristo Botev* Blvd. This localization of the most polluted part of the city, characterized by situations of absence of wind, undergoes a change in the event of emergence of weak to moderate wind – it shifts and expands mainly in leeward direction or in other directions, when conditions for blocking of air currents emerge. In the event of higher wind speeds (above 8-10 m/sec) the concentrations of pollutants diminish considerably (with the exception of dust because of sucking of dried soil into the air).

- City areas situated immediately adjacent to powerful industrial sources of emissions, like TPPs and DH plants, along streets and crossroads with intensive automobile traffic or areas, which frequently fall leeward of powerful sources with high stacks (for instance 3-4 km to the east and to the west of the *Kremikovtsi* Metallurgical Combined Works and not near the combined works).

- Local centres in quarters with dense build-up, relatively intensive traffic and situated near significant local sources like TPPs, DH plants and gravely polluting industrial plants. Their identification requires a denser network of monitoring stations.

An example for this type of zone is *Hadji Dimitar* Quarter (featuring grave pollution with SO₂, NO₂ and dust; existence of local DHP, “Automobile Transport-Malashhevtsi” and intensive traffic; the quarter is situated in one of the lowest parts of Sofia in terms of altitude). Deteriorated air quality quite often is observed also in the central parts of *Geo Milev* Quarter (SO₂, dust), *Gara Iskar* (*Druzhba* Housing Estate; NO₂, phenol, H₂S), around the National Centre of Hygiene (*Triaditsa* City-district), *Krasno Selo* Quarter, Pavlovo and a number of other areas of this type, whose identification requires a much denser network of stations for sampling as compared to the curently operating ones with the National Agency for Ecological Monitoring and those belonging to the Regional Inspectorate for ---- (??HАCEM и тези на ПИОКО3). These are urban areas marked by conditions of poor ventilation, situated on the low-level terraces and near intensive sources of air pollution. High concentrations are formed there most frequently in periods of “still” weather and in certain cases also in the event of “transfer” from neighboring parts of Sofia or from the city of Pernik. These zones of higher risk coincide with those identified in the Environmental Impact Assessment Report prepared for the 2003 Master Plan of Sofia Municipality.

From the analysis made of the current state of the environment with respect to the “Atmospheric air” component the following summary conclusions may be drawn:

- As regards air pollution the areas of Kremikovtsi, Gara Yana, Botunets and Gorni Bogrov are in the most critical situation because of pollution with fine dust particles, gas pollutants (phenol, hydrogen sulphurate) and heavy metals (lead and manganese);
- The most polluted zones in the Central City Area are around the crossroads, *Vazrazhdane* Square, *Hristo Botev* Blvd., *Slivnitsa* Blvd., *Stochna Gara*, The *Levski Monument* Square, the Eagles Bridge, *Evlogui Geogiev* Blvd. and *P. Evtimii* Blvd. because of pollution with lead, copper and dust;
- The areas in the vicinity of TPPs and DHPs, *Hadji Dimitar* Quarter, *Geo Milev* Quarter and *Gara Iskar* Quarter are in unfavorable position because of deteriorated natural ventilation.

Additional factors, contributing to air pollution by considerable amounts of suspended dust and harmful exhaust gases, are the poor state-of-repair of the road and engineering infrastructure and the construction and repair activities underway at different times in different parts of the city.

WATER POLLUTION

This involves assessment of the water reservoirs and rivers as a factor for emergence and development of urban structures, as a resource for meeting economic and residential needs and of their influence for construction activities, of their protection against pollution and with respect to outlining of the zones of water catchments etc.

The surface waters on the territory of Sofia are represented by the river Iskar and its tributaries. Its spring area covers the high-altitude part of Rila Mountains. The length of the river up to Novi Iskar is 114 km and its water catchment basin extends over 3 662 km². Up to the first human settlement along their course all the rivers are categorized a Category I receivers and after the first human settlement – a Category II receivers.

Sofia is water supplied by the rivers with springs in Vitosha Mountains and Rila Mountains and from ground waters abstracted on the area of the city and the hollow. Transportation of the waters to the city is ensured via the constructed Vitosha water pipeline, Rila water Pipeline and the Iskar Dam water pipeline. The Vitosha water pipeline was constructed at the beginning of the 20th c. and is still in use. The Rila water pipeline is in operation since 1933. The two water pipelines may supply 55 million m³/year, which is far from sufficient. The shortage is compensated by the Iskar Dam - 250 million m³/year, constructed for irrigation purposes, power generation and industrial water supply, but presently a main source for drinking water supply to Sofia. After treatment at the Pancherevo and Bistritsa Drinking Water Treatment Plants the volume of the supplied water ensures drinking water for 1 250 000 inhabitants. It is worth noting the high water consumption of the city of Sofia: in the period 1990-1993 – 285 million m³/year; 1995 (under the imposed rationing) – 208 million m³/year; 1998 - 251 million m³/year. Under the currently enforced “Norms for design of water supply systems” the water consumption in 2020 should reach 310 l/inhabitant/day, while the norms in the majority of the European countries is 200 l/inhabitant/day.

The local water sources have small capacity (1-10 l/sec) and are used for partial water supply of some quarters and industrial water supply from proprietary water sources.

Industrial enterprises consume different water quantities depending on the type of their production and the technology cycles. The biggest consumer is

Kremikovtsi Combined Metallurgical Works, by beside it on the area operate some 259 companies, including 115 of national significance, which consume millions m³/year.

SOURCES OF WATER POLLUTION

• Wastewater

The wastewaters produced in the city of Sofia and Sofia Municipality are of residential and industrial origin. The major sources of wastewaters are the 140 bigger companies (Table 3), concentrated mainly in the city-districts *Serdika*, *Iskar*, *Poduyane*, *Lozenets*, *Krasno Selo* and the settlements Novi Iskar and Kremikovtsi. In the process of their production activity these companies generate about 116 million m³/year wastewater. 43 or 31 per cent of these companies have wastewater treatment facilities.

The existing wastewater treatment plants ensure purification treatment degree from 40 to 100 per cent. A total of about 50 per cent of the wastewater from the industrial companies undergo treatment in these plants, the majority coming out in good condition for further use – most often up to 100 per cent recovered. The treatment processes are mainly mechanical – sedimentation, filtering, mud-and-grease separation.

Almost all of the other companies discharge their wastewaters in the urban sewerage system and a very small number steadily discharge small quantities in the nearest water receiver.

• Water treatment

The urban wastewater treatment plant receives for treatment all the wastewaters produced on the territory of Sofia Municipality by the residential sector, industry and rainwater runoff via the existing sewerage network. The designation of the wastewater treatment plant is to safeguard the receiver – the river Iskar – by ensuring the river water till its discharge in the river Danube quality level, which permits its re-use, i.e. compliance with the requirements for Category II water receiver.

Industrial wastewaters should beforehand be treated at the local treatment facilities to a degree, which permits their safe discharge in the urban sewerage system.

The treatment plant is situated on an area of 60 ha in the area of the village of Kubratovo. As early as during its commissioning in 1984 certain technical problems were encountered, which hindered its normal operation, technology regime and the end treatment effect. In 2001 the urban wastewater treatment plant underwent reconstruction, which permitted to reach the current efficiency parameters: 480 000 m³/day and maximum water quantity 550 000 m³/day at БПК₅ - 180 µg/l and suspended substances – 160 µg/l and achievement of the design parameters and meeting of the requirements of EU Directive 91/272/EEC.

Under the current indicators the properties of the river Iskar water are as follows:

- Before the exit from the urban wastewater treatment plant the treated water does not comply with the requirements for Category II receiver in terms of the indicators БПК₅ – 2.2 times above the threshold concentrations, ammonia nitrogen – 1.92 times above the threshold concentrations, nitrite nitrogen – 2.25 times above the threshold concentrations and phosphates – 2.35 times above the threshold concentrations.
- After the exit – after mixing of the river waters with the waters treated at the plant – the waters do not comply with the requirements only

in terms of the indicators nitrite nitrogen – 2.18 times above the threshold concentrations and phosphates – 2.78 times above the threshold concentration.

The improvement of the quality of river waters is due to the dissolution with treated wastewaters, which results in diminishing of the indicator values.

The dehydrated sediments from the operation of the plant are dumped together with the waste from the Kremikovtsi mine on the dumpsites near the village of Lokorsko. This is an inappropriate solution from environmental point of view and therefore a different solution is needed, for instance independent or joint treatment of the solid urban waste produced by Sofia.

The river Iskar is the main river in Sofia Municipality. Its water catchment area from Pancherevo up to Kurilo is 2 250 km². Its tributaries traverse areas with intensive industrial activities: Novi Iskar – the rivers Iskar, Lesnovska, Kakach; Serdika – the river Suhodolska; Slatina – the river Slatinska; Poduyane – the river Perlovska. The qualities of surface waters are controlled by 11 points of HACEM (4 on the river Iskar, 4 on the river Perlovska, 1 each on the rivers Kakach, Lesnovska and Blato). According to the submitted information all the rivers on the area of Sofia Municipality should be Category II water receivers.

The following findings result from the analysis of the available data:

- The mineral content in the surface waters is not high: the river Iskar - 250÷400 mg/l; the rivers Kakach and Blato - 350-500 mg/l; it is the highest in the river Lesnovska – above the norm.
- The most frequent pollutants are: insoluble matter (2-5 times above the threshold concentrations), ammonia and nitrate nitrogen, phosphates, oil products, iron and manganese (up to 5 times above the threshold concentrations).
- The organic pollutants are everywhere above the norm: БКП₅ – up to 6 times; ХПК – up to 5 times; ammonia nitrogen – 5 to 30 times; nitrite nitrogen 10-20 times above the threshold concentrations; oxygen deficit – up to 2 times below the threshold concentrations. Pollution with oil products is everywhere – 10 to 300 times above the threshold concentrations.

The river Lasnovska is the most polluted one – with permanent presence of dissolved substance manifold above the threshold concentration; ammonia (30 times) and nitrate nitrogen (10 times), oil products – 30 times, iron – 5 times and manganese 6 times. The source of that pollution is the *Kremikovtsi* Combined Metallurgical Works.

The river Iskar is also polluted – at Kurilo presence of lead 1.1 times above the threshold concentration has been found; in the river Gradska before its discharge in the river Iskar – cadmium, up to 300 times above the threshold concentrations. After Novi Iskar the river is polluted with organic matter БПК₅ 1.5-4.5 times, insoluble matter – 5 times and nitrogen compounds ammonia and nitrates) – up to 10 times above the threshold concentrations.

SOIL POLLUTION

The soil condition studies have been subordinated to the urban development requirements – the high category agricultural plots in their capacity of stop to territorial development, those within the developed boundaries – with a view to the needs of park landscaping, whereat in all cases the general measures related to protection of the humus horizon and its refill, re-cultivation, etc. are envisaged.

Because of the flat nature of the territory landslide, landslips and taluses are

not observed; traces of such phenomena are observed in the surrounding area. There are no processes of saltiness. The investigated soils possess a light mechanical compositions and low humus content. At many locations on top of the natural soil there are fills of unknown origin, in which traces of pollution, including with heavy metals, have been found. Ground waters are not aggressive.

Damaged soils are those, in which the surface soil horizons of the soil as a whole are mechanically distorted. Obviously almost the entire urban territory may be assigned to this category. As a result of the implemented urbanization measures – construction of buildings, road network, pavements and underground facilities etc. - the soil-formation process is in practical aspect discontinued. In the process of construction works the soil horizons have been displaced and mixed through the digging and filling activities. At certain places the humus accumulation horizon has been dug out and dumped elsewhere, but in the majority of cases it is evacuated, covered or mixed with the lower horizons. These soils change their type and according to the modern notions in the field of soil science change into type “anthropogenic”, subtype “urbogenic”.

No complex studies of the state of the soils have been conducted on the territory of the city of Sofia within its regulation boundaries. Individual works (G. Shevkenova, Sv. Gencheva) deal with the soils of certain green areas in Sofia. From their studies and some later partial ones it has been found that in the *Borisova Gradina* Park, *Borisova Gradina* Forest Park, Hunting Park, Southern Park, Western Park, Northern Park, *Knyazhevo* Pine Forest the soils are almost fully preserved and in terms of morphological structure almost do not differ from the natural soil, with the exception of the surface horizons. In the case of the latter certain exhaustion and deterioration of some precious agro-chemical properties is observed.

The rest of the green areas have been created on anthropogenic soils, typical for urban environment, with clearly manifested typical characteristics and in terms of origin, composition and properties differ considerably from the natural soils. They do not possess a normal natural profile – their layers are “anthropogenic” in composition, depending on when and what has been dumped on the respective location. They feature light chemical composition, low humus, nitrogen and phosphorous content. Their moisture absorption capacity is very low because of the high water conductivity and their weak water retaining capacity. The quantity of typical soil microorganisms in them is very small and the ratio between the groups of microorganisms is different from that in natural soils. The content of microorganisms is the smallest in the layers rich in construction waste. In the case of presence of urban waste the bacteria forms predominate, followed by aminomicelum and fungus micro flora.

The reduced share of actinomicets in the total share of micro-organisms reduces the antibiotic capacity of the soil for self-cleaning from pathogenic bacteria forms that have occasionally got into it.

SOURCES OF SOIL POLLUTION

The major sources of soil pollution in Sofia are the industrial enterprises (TPPs, *Kremikovtsi* Combined Metallurgical Works), automobile transport, the applied anti-frost chemicals, the petrol stations, railway stations and solid urban waste. The main paths of pollution are the atmospheric deposit of dust and aerosols, transportation and dumping of solid urban waste and construction waste, the infiltration of water polluted with harmful substances, construction works etc.

• Pollution with heavy metals

Studies of soil contamination with heavy metals in the country have been conducted in the areas for agricultural use and in the natural forest ecosystems. The established average values for contamination with heavy metals are in the range of: lead – 25 ± 15 mg/kg, zinc – 75 ± 20 mg/kg, copper – 30 ± 25 mg/kg, cadmium – 0.3 ± 0.2 mg/kg and chrome – 60 ± 30 mg/kg and nickel – 25 ± 20 mg/kg. According to data from the scientific literature the manganese content in the soils in the country is considerably higher than the average worldwide and reaches up to and above 1000 mg/kg (as compared to an average of 850 mg/kg).

The contamination of the soils with heavy metals and arsenic is a fact for a large portion of the agricultural land on the land areas of *Kremikovtsi* City-district – Sofia Municipality. The investigations conducted in the period 1999-2001 in the framework of the National System for Ecological Monitoring with the Ministry of Environment and Waters revealed that during the period under review there was no change in the accumulated quantities of heavy metals for all the monitored 10 control points (Mramor, Novi Iskar, Svetovrachane, Kubratovo, Negovan, Lokorsko, Chelopechene, Botunets, Seslavtsi and Gorni Bogrov). For point “Yana” the high levels of contamination with lead have been corroborated (3.5 times above the threshold concentrations) and with arsenic (4.5 times above the threshold concentrations).

The analysis of the results from two large-scale detailed studies (by the *Spectrotech* Company and a research team under international project SNSF/7 IP 062642) for the period 1997-2003 gives no grounds to sustain that contamination with heavy metals in the area of *Kremikovtsi* plc has increased during that relatively short period. This finding is corroborated also by the studies in the framework of the monitoring programme of the Executive Agency for Environmental Protection. According to data from the Executive Agency for Environmental Protection in the period 2004-2006 no new levels of soil contamination with heavy metals (Cu, Zn, Cd, Pb, Ni, Cr and As) have been registered.

During the period 2002-2005 all the measured contents of polychlorinated biphenyls show no increase of the reference values regulated by the national legislation. At this stage the performed agricultural activities do not lead to new burdening of the soils because of the diminished use of fertilizers and chemicals for plant protection. According to data from the Executive Agency for Environmental Protection for 2003 there are no new registered cases of pollution with pesticides.

All the studies prove that contamination with heavy metals is characteristic for the eastern part of the Sofia Plain – adjacent to the *Kremikovtsi* Metallurgical Works. With the increase of the distance from the combined works the concentrations of lead demonstrate a trend towards diminishing. The most heavily polluted areas are those to the east-northeast of the combined works – the land of the village of Buhovo and the village of Yana. The areas situated in the neighborhood – in the land of Seslavtsi, Botunets and Gorni Bogrov – are fields with pollution levels 2-3 times above the threshold concentrations. The land areas of Dolni Bogrov and Chelopechene fall in the zone of permissible pollution with lead, whereat in their southern parts the pollution levels are the lowest. Pollution is observed in the land area of Dolni Borgov, probably under the influence of the dust sedimentation by the tailing reservoir.

Similar diminishing of the concentrations has been observed also in the case of pollution with zinc, but the areas in which the threshold concentration have been exceeded up to two times are considerably small. In the case of this pollutant one should not forget its connection to the use of nitric fertilizers.

Such trend is not observed with respect to cadmium and hence this type of contamination should not be connected directly with the activities of the combined works, although the highest values have been measured in the land area of Gorni Bogrov, probably also under the influence of the dust sedimentation by the tailing reservoir.

Soil contamination with heavy metals has direct impact on the species cultivated in these areas. The most susceptible to that influence are the leaf forages, vegetables, cereals. The land areas of Buhovo and Yana stand out as regions, in which the locally cultivated fodder contains more than 5 mg/kg of lead. Within the boundaries of the region of pollution fall Gorni Bogrov, Seslavtsi and Botunets. Cultivation of species, whose economic characteristics are defined by the vegetation mass (straw, forage, vegetables) there exists veterinary risk and risk for human health. About 20 per cent of the samples taken from cereals grown in these zones also demonstrate accumulations above the threshold concentrations.

The studies in urban environment are less in number, since the urbanized territories are not used for agricultural production and open soil surface exists only in the parks, whose areas are relatively limited. Such studies have still been conducted on the area of Sofia as well and one may deduct from them quite useful and important information. From these studies it has been found out that in the *Borisova Gradina* Park in the vicinity of the *Tsarigradsko Shosse* Blvd. the quantities of lead are $2.2 \div 1.9$ times above the threshold concentrations, of zinc – $1.5 \div 1.2$ times above the threshold concentrations and of cadmium – $2.2 \div 1.8$ times above the threshold concentrations. The intensive pollution is extended at a distance of up to 100 m from the artery. In addition to the soil studies investigations were conducted also of the chemical composition of the dead forest ground cover, since it acts as a store for all the sediment atmospheric pollutants. It has been found that at a distance of 5 m from the boulevard the lead content is 251.8 mg/kg and a distance of 300 m - 45.8 mg/kg, i.e. the reduction is 5.6 times. In the case of cadmium these differences are 2.93 – 2.39, for zinc – 2.2 – 1.3 times. No pollution with copper, nickel, manganese and cobalt has been found. It is reckoned that the contamination with cadmium is due to the use of zinc compounds, in which cadmium is involved as part of the manufacture of car tires. Significant quantities of cadmium are contained also in the petrol derivatives. These findings have been corroborated at other locations as well – *Hristo Botev* Blvd., *P. Evtimii* Blvd., *Ruski* Blvd. etc. – with respect to the soils in the greenery strips along the lanes: lead $2.8 \div 9$ times above the threshold concentrations, cadmium $3.4 \div 4.8$ times above the threshold concentrations, etc.

• Pollution with petrol products

Soil pollution with petrol products is of local nature and has been found near petrol stations, parking lots, lanes along the roads. The soil possesses the self-cleaning capacity to get rid of lubricants, oil products and other organic pollutants through microbiological decomposition.

The impact of oil products on soils manifests itself in a change of the carbon/nitrogen ratio in favour of carbon, whereat in the process the natural circle of nitrogen and nitrification is disturbed. The ratio between the two elements may be restored through application of nitric fertilizers, which in turn leads to water pollution. This is not necessary under urban conditions, since soils are not used for cultivation of agricultural produce and no grave spills of oil products occur.

• Salinization

Salinization of soils in urban environment is caused by the application of chemicals for defrosting of streets in winter. Salts in solid and liquid state are used for that purpose – most often industrial salt, containing NaCl_2 , MgCl_2

and MgSO₄. Industrial salt is mixed with sand and spread along the streets. Magnesium lye with almost the same chemical content is used as a liquid agent against frost. The larger portion of lye runs off together with the surface waters, but part of it acts as a source of salinization of soils above all via the snow piled on the sidewalks or pushed by the snow-ploughs at the side of the roads.

The problem arises from the increased quantity of exchanged sodium, which has a peptizing impact on the colloids in the soil. Soil enrichment by sodium-containing waters leads to deterioration of their water and air regime, increase of the pH value and destruction of their structure.

Chlorine and sulphate ions have a weaker impact on the soil properties because of the fact that they are washed away by the rainfalls and during watering, which has been proven through the identified diminishing of their quantities at the end of the autumn.

The following summary conclusions about soil pollution and deterioration of the properties of the plots may be drawn from the analysis of all the data:

- The soils in the northeastern part of the municipality are gravely polluted with heavy metals. The source of this pollution is the *Kremikovtsi* Combined Metallurgical Works. The plant produce is also contaminated. Structural changes in plant-growing (industrial and other field crops).
- The larger portion of the soil cover in the urbanized area is deteriorated and represented by soils of anthropogenic fill with distorted physical and chemical characteristics, moisture and air regime, lower self-cleaning capacities.
- Among the various pollutants of the urbanized territory specific attention should be paid to contamination with heavy metals, from which the soils cannot get rid through their self-cleaning capacity, since these pollutants are not susceptible to biological disintegration. At this stage no methods for removal of the heavy metals are applied in our country. One of the ways to reduce pollution with heavy metals is shift to unleaded petrol, general design improvement of the motors and the devices for purification of exhaust gases.
- In cases of new construction the digging works are not carried out selectively and the humus horizon is mixed and dumped away together with the lower horizons as a construction waste.
- The good practices in preservation of the humus horizon during construction of certain housing estates should be followed on all the new construction sites irrespective of their size. To this end it is necessary that the municipality should take the initiative, for instance the issue of permits for earth masses should be bound to the requirement to dump the humus horizon in a specialized dumpsite and the rest – in a dump hill for construction waste.
- Soil pollution may be curtailed to a considerable extent through reduction of the general pollution of the environment, better organization and efficiency of waste collection and above all through ensuring clean air.
- An important step for improvement of the current state is development of monitoring of soil conditions through survey of pollution, acidification, salinization and other impacts.

The availability of up-to-date information and concrete data about the individual sites combined in a unified information system will provide an opportunity for selection and identification of adequate technologies for soil maintenance as a necessary environment for development of agriculture and of the urban green system.

ACOUSTIC LOADING OF THE ENVIRONMENT

Noise is one of the major factors for unfavorable impact on the population in big cities. The development of industrial production, the intensive development of passenger, freight and air transport means, the mass urban passenger transport are sources of noise, which causes grave disturbances on the human beings. The studies show that after the 1960's the noise level increases by 1 dB/year and already reaches levels, which cause not only psychic irritations but also physiological illnesses past remedy.

The harmful influence of noise depends on its physical characteristics. The most irritating ones are the high frequencies and the most unpleasant perceptions are caused by noises, whose level and spectrum fluctuate constantly and unevenly. The high noise loads lead, in the case of prolonged work in environment with noise level >85 dB (A), to weakening of the hearing capacity by 15 dB for frequencies from 500 to 2000 Hz. Noise of such level is a frequent phenomenon along the city main loads with heavy traffic, in manufacturing environments with average noise levels and in large premises without noise dampers. These levels are higher in many public catering facilities and levels of 120 dB are something common in discothèques, at certain concerts etc.

Noises of lower strength but with continuous impact are not less harmful and cause nervous and psychic fatigue, diminishing of the creative potential, the general work capacity and the effect from the office time breaks. One should not forget that the auditory receptors function during sleep as well. For this reason the acoustic loading in the middle of the night is an important problem for the normal life of people as well.

NORM SETTING FOR URBAN NOISE

The Law on Protection against Noise (SG Vol. 74/2005) is in force as of 1 January 2006. It settles the issues related to the evaluation, management and control of environmental noise caused by the automobile, air and water transport, as well as by industrial systems and facilities, including the categories of industrial activities specified in Annex No. 4 with Art. 117, Paragraph 1 of the Environmental Protection Act, and the local sources of noise.

Specific criteria have been worked out for the purposes of assessment of the acoustic loading of the environment – “Norms for permissible threshold noise levels” - for different types of production and mental activities, for normal everyday living conditions and rest. In principle, the major objective of these norms is protection of human health, but in actual life the approved criteria demonstrate a compromise between the necessary reduction of noise and the economic feasibility of the generally expensive measures for its combating. That is to say that the set norms for permissible threshold noise levels have values, under which the conditions for work and living are bearable. We should add here that according to the Technical Commission No. 43 on acoustics of the JSO (?ISO) in the process of norm-setting the noise levels are divided into the following degrees:

- Noise, whose level is >120 dB, is considered to cause damage to the hearing organs;
- Noise with level 100÷120 dB for the low frequencies and 80÷90 dB for the middle and high frequencies may cause irreparable changes in the hearing organs and in the event of long-term impact may lead to sickness;
- Noise with level 50÷80 dB hinders understanding of human speech;
- Noises with levels around 50÷60 dB have harmful influence on the nervous system of man and disturb human activities and rest.

On the basis of this division have been developed the norms used for

determining the permissible threshold noise levels in urbanized territories, in which the elementary human activities are performed – work, residence, recreation and services (Table 5).

Permissible threshold norms for sound pressure

Territories and zones in human settlements		Sound level dB(A) Daytime	Sound level dB(A) At night
Residential zones and territories	1.1 Existing urbanized parts	55	45
	1.2. Existing urbanized parts along main arteries	60	50
	1.3. On new plots	50	40
	1.4. On new plots next to main arteries	55	45
2. Central city areas		60	50
3. Industrial areas and zones		70	70
4. Areas for public and individual recreation		45	35
5. Plots for hospitals, sanatoria and other hospital facilities		45	35
6. Zones for educational and R&D activities		45	35

SOURCES OF NOISE

The principal sources of noise in Sofia are the transport vehicles. The main noise background is created by the motor vehicles – automobiles, trucks and the mass urban passenger transport. As a result of the mass import of Western automobiles the car park has been thoroughly replaced. Although the majority of the motor vehicles are second hand units, the level of noise emitted by them is considerably lower that that of the units of earlier make. The highest noise levels are generated the mass urban transport vehicles, especially the outdated buses. High noise levels are produced also by the tramway and trolley bus transport, by the railway tracks traversing the city and the aircraft landing and taking off from Sofia Airport.

Ranking the second are the sources of noise common to everyday life – talks, shouting, loading and unloading works, waste collection, children playing (schools, kindergartens, playgrounds) etc. The stagnation of production activities is the reason for their ranking on the third place for the time being. One of the permanent fixed sources of noise is *Stochna Gara*.

ACOUSTIC LOADING OF THE ENVIRONMENT CAUSED BY TRANSPORT VEHICLES

The analysis is based on data from measurements of noise generated by transport in Sofia, performed at 49 points in the city. An assessment of the dynamics of acoustic loading of the environment has been worked out without any comments concerning whether the points have been correctly located in the urban environment.

The analysis of the information used shows that the highest noise levels are characteristic for *K. Velichkov Blvd./Pirotska St.*, *Slivnitsa Blvd./Budapest St.* (right-hand side), *Slivnitsa Blvd./Budapest St.* (left-hand side), *Maria Luisa Blvd./Struga St./Zhitnitsa St./Kyustendja ST.*, *Al. Stamboliyski Blvd./Strandja St.* etc. The average values at these points are in the range from 71.3 to 75.7 dB(A).

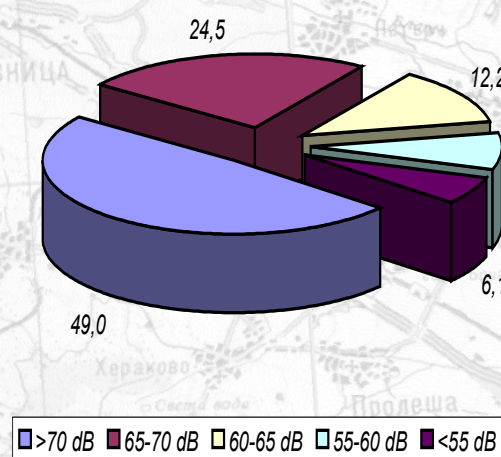


Fig. 3. Structure of noise loading

From the total of 49 points 24 have noise levels above 70 dB(A). Correlated to the total number of measurements this figure indicates that 49 per cent of all the zones have noise levels above 70 dB(A) and there is a clear trend towards increase. 24.5 per cent of all the points have noise levels from 65 to 70 dB(A). Noise levels from 60 to 65 dB(A) have been measured at 12.2 % of all the points and only at 7 points the noise level is below 60 dB(A).

A steady trend of increase of the levels of noise loads is observed. As different from the period of the 1960's till mid-1970's, when the increase used to be by almost 1 dB(A)/year, in the course of 10 years (from 1975 till 1985) the noise had increased by a total of 0.7 dB(A), which was an indication for a clear trend of retention of the noise levels. During the next 10 years a significant drop was observed – by 6.8 dB (A) – connected probably with the sharp drop in the economy and the related consequences – gravely diminished goods turnover. The second reason is the replaced to a considerable extent automobile fleet – the noisy Soviet vehicles have been replaced by Western vehicles, which although second hand still have better noise characteristics, and that independent of the almost doubled motorization rate. During the next 10-year period, however, increase of the noise levels was observed again – by about 1 dB(A) annual average. In the measured values, especially during the recent years, an increase of the relative share of the higher values of noise load has been noted for the expense of the lower values (the relative share of the points with higher values increases as compared to the total number of points). For the last year of the period (2007) a general slight increase of the average noise levels by 0.5 to 1.0 dB(A) has been found as compared to the previous years.

The main city main roads (incl. the railway tracks) traverse densely populated city districts in order to service the city as required. Irrespective of the quality of the residential and public building stock, be it constructed some 50 years ago, or only 5 years ago, or be it in the process of construction, it should be noted categorically that no measures are taken for protection against noise, even in the interior, not to speak about the residential quarters or sites, which are particularly sensitive to noise (hospitals, schools, child care facilities, etc.).

Despite the implemented reconstructions of the major city main streets and the constructed transport nodes the automobile traffic in the city continues

to be mixed and not sufficiently differentiated. At the face of the increased motorization (nearly 500/1000 – 2007), the primary street network is “gasping” from the overloaded traffic. For several years now traffic congestions are the gravest urban problem of Sofia. Congestions in the traditional city centre know no peak hours and during the peak hours almost the entire primary street network is crowded by solid, slowly crawling traffic flows. Under these congestions the noise levels are not the highest, since the car motors run at low r.p.m., but are steady and very annoying. During starting, however, when the traffic is “unclogged”, the decibels make a significant “leap”. Even without traffic congestions at the regulated crossroads the forcing of the motors at abrupt start and the follow-up acceleration of the cars also cause peak values of the emitted noise. The same effect is observed also at the stops of the mass public passenger transport. The worn out buses beside throwing out poisonous clouds of exhaust gases at the start, step up further the noise impact as a result of the slamming doors and motor acceleration.

The graph shown on Fig. 4 has been worked out for taking due account of these peak instances in the noise load of the environment as well as of the calmer moments – during the evenings and holidays. It illustrates the weekly, daily and hourly unevenness of acoustic loading of the environment with due consideration of the measured maximum and minimum noise levels.

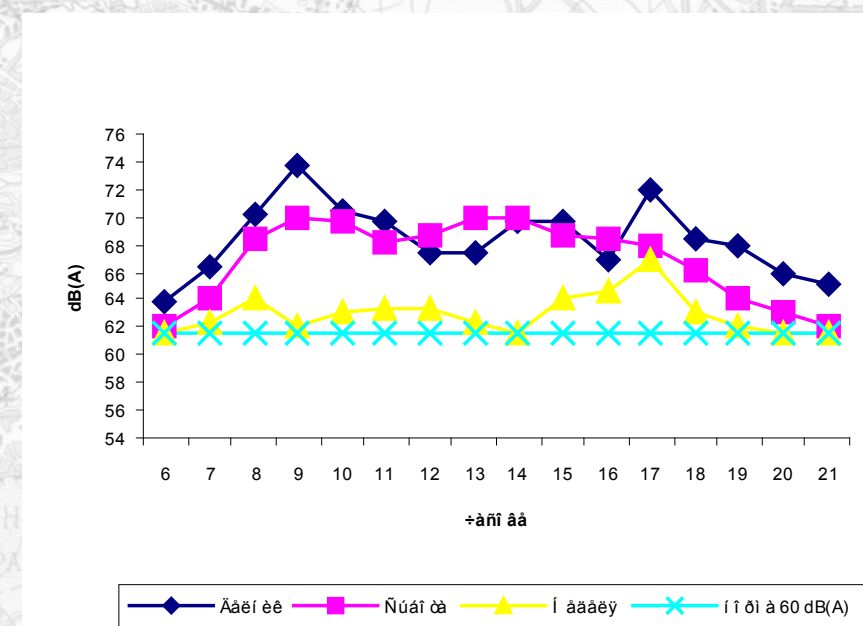


Fig. 4. Weekly, daily and hourly unevenness of acoustic loading by transport vehicles

For a number of sites with specific functions the noise loading is of particular importance. Such are hospitals and other medical facilities, schools, nurseries and kindergartens, higher educational establishments, R&D complexes. The data about the “outdoor noise” in the aspect of the acoustic environment in which some of these sites operate in Sofia show that in all the cases considerable deviations from the approved hygiene norm of 45 db(A) are reported. None of the points at medical care and educational sites fits at least in the norm for permissible noise levels in the existing urban areas.

It is obvious that in the urban environment it is practically impossible to reach the norms for permissible levels of sound pressure with respect to the plots for hospitals and other medical care facilities in so far that these sites are situated near main city arteries. Even in the case of sites, which are situated at a considerable distance from arteries with heavy traffic (Higher Medical Institute – the old buildings) the noise levels along the eastern and southern

front of the buildings vary around and above the norm. One of the reasons is that in practical terms increasing the distance of these sites from the city arteries is difficult, at least at the front of the first buildings, although at least in that respect Sofia is a good example with the 3rd City Hospital, the Medical Academy and the District Hospital, which have been built relatively far from road arteries and are located somewhat in isolation on stiller plots. At the same time it should be remembered that the norm of 45 dB(A) corresponds to the noise level from bird warbling, while talking in a low voice at a distance of 1m generates noise of approximate level of 50-60 db(A).

The second category unites points, at which noise levels close to the hygiene norms [60 dB (A)] “for existing city parts adjacent to main arteries” have been measured. Justification for approval of that norm is the fact that all the points, in which measurements are made, fall under that category.

In this group fall sites, which traditionally have lower levels of the measured noise and the measured values are the closest to the norm for one or two years. In Sofia there are only several points of this type and there the noise level is oscillating around the norm with a trend towards increase in some of them (Zone B5, *Krasno Selo* Housing Estate, *D. Chintulov* St.).

The third category unites points with measured noise levels with values above 70 dB(A). The analysis of that sample, shows that all the data exceed considerably the hygiene norms for permissible noise load in our country, including in the industrial zones. All the revealed data are for “existing urban areas adjacent to main arteries”.

The noisiest continue to be the traditional locations in Sofia – *Konstantin Velichkov* Blvd., *Tsigradsko Shosse* Blvd., and *Slivnitsa* Blvd. etc. An optimistic development is the finding that as compared to the situation of long past years (1975, 1989) some traditionally noisy arteries like *K. Velichkov* Blvd., *Slivnitsa* Blvd. and *Maria Luisa* Blvd. manifest lower noise levels. It is evident that the implemented reconstruction, the alleviating of the arteries through the construction of new ones and, above all, the use of more modern vehicles has had its impact.

In the rest of the points all the obtained values are above the hygiene norm. That, of course, does not mean that the entire city, that every point of it has noise levels above the permissible threshold norms. In the depth of the residential quarters there exist individual “islands”, where the noise levels are around the norm, but that is valid for a small portion of the territory. In addition, the norms themselves are worth some comments. Without any attempt to submit them to criticism, even less to propose raising of the permissible noise loads, since the approach is good as regards the human physiology and protection of human health, it is necessary to make certain clarifications. For instance, the notion “chief artery” is often used in the norms. This notion allows interpretation in very broad limits and in practice may be used under the most different circumstances. For the purposes of avoiding interpretations one may indicate as an example the standards for the permissible levels in Japan, which are based on functional indicators, characterizing the urban areas, and the time of the diurnal cycle. According to these standards Zone “AA” is a zone requiring calm surroundings, for instance a zone for recreation, health care etc.; Zone “A” is a residential zone; Zone “B” is a mixed-use zone with offices, trade and harmless industries, but also for residential use.

Analyzing the data under our hygiene norms it becomes clear why it is not possible to achieve the norm levels for noise loads with respect to sites from the health care sector, education, etc. The exclusively low levels of “saturation” place every site, which is situated on a street with automobile traffic, in an environment with noise above the permissible threshold norms.

ACOUSTIC LOADING OF THE ENVIRONMENT OF SOFIA AIRPORT

For modeling of the isolines of the permissible threshold norms the flows of taking off and landing airplanes have been studied and on that basis a type model of the traffic was built for a typical diurnal cycle. The isoline noise levels have been obtained after processing of the necessary input information: orography of the routes for take off and landing; distribution of the air traffic by quantity of realizations, by types of aircrafts and by flying distance; geographic and meteorological data for Sofia Airport using the FAA software, envisaged for use and approved by the Minister of Environment and Water. Different scenarios have been modeled as well: for daily flights only, for nightly flights only and for critical diurnal cycle. Because of absence of regulatory framework devoted specifically to aircraft noise in the country the permissible threshold norms for “residential zones in existing urban areas near main arteries” – 60 dB(A) during the day and 50 dB(A) at night have been used.

Sites affected by noise above the permissible threshold norms from Sofia Airport

Noise level dB(A)	Residential buildings	Industrial sites	Science, education	Medical facilities	Recreation sites
60	2 181	77	14	2	8
65	687	52	12	4	4
70	256	4			1
75	12				
Total:	3 136	133	26	13	

The taking off and landing aircrafts generate noise above the norm in *Hristo Botev* Quarter, *Suhata Reka* Quarter, *Nova Mahala* etc., where about 40 thousand people are subject to this noise burden above the norm. The new runway of the airport reduces the noise generation by about 40 per cent as compared to the situation before expansion of the airport. A number of other positive results have been achieved with the reconstruction as well, including, among other, increase of the airport capacity. With the construction of the new runway, which was shifted to the east by 540 m, reduction of the noise from aircrafts flying over the city with level of the noise from the motors above the norm was achieved, as well as reduction of the noise in the central part of the city.

Population, affected by noise above the permissible threshold level from Sofia Airport

City-district/ Quarter	Summer day			Winter night			
	60-65	65-70	70-75	50-55	55-60	60-65	95-70
Orlandovtsi	2 124						
Hadji Dimitar	19 800	660					
Suhata Reka	10 347	12 900		4 617			
Poduyane	1250						
Hristo Botev	4 067	3 082	1 230	6 159	3 005	642	55
Nova Mahala		240		1 873			
Total:	37 588	16 882	1230	12 649	3 005	642	55

The established levels of acoustic loading of the environment above the permissible threshold norms are presented through isolines. In this way the outlines of the “Noise map – Diagnosis” have been obtained and marked on the map under the same title.

ELECTROMAGNETIC FIELDS AND RADIATION

NON-IONIZING RADIATION

In recent years an enormous increase has been noted of the number and types of sources of electrical and magnetic fields (EMF) used in everyday life, for industrial, medical, commercial and other purposes. These comprise radio sets, TV sets, cell phones, PCs, different kinds of appliances, including microwave furnaces, radars etc. Scientific articles presume that the EMFs emitted by these units might have harmful impacts on human health, causing cancer, reduced fertility, memory loss, changes in children’s behaviour and development. The actual level of the health risk has not been proven yet, but it is supposed that for some types of EMFs it might be very low or negligible. Nevertheless, in many countries, including in Bulgaria, the high tension networks are built to by-pass the human settlements, the substations are localized outside the residential zones, the power distribution substations – outside the residential buildings, although these efforts have considerable economic consequences. In constructing their base stations the cell phone operators face opposition by the public because of the belief that the radio frequency emissions might cause cancer in children*.

In the practice so far, including in the assessments of the environmental aspects of the environment *vis-à-vis* human life, these sources have not been dealt with in the studies. After the massive penetration in everyday life this attitude is not to be tolerated anymore.

In reply to the increased public concerns the World Health Organization (WHO) has started since 1996 an international project under the title “Electromagnetic Fields”, in which Bulgaria is participating as well. It is expected that the project would assist the elaboration of norms for the boundaries of human exposure to the EMFs, standards for measurement and compatibility of the emissions from the various devices and appliances, as well as supply of information to the broad public concerning the possible risks from exposure to these fields.

Despite the numerous and often contradictory opinions concerning the effect of EMFs on the organisms, including on human health, in this paper these sources have also been dealt with. In view of the relatively unknown problematic they have been assigned greater attention (“out of balance” with respect to the rest of the issues).

NORM SETTING FOR EMFs

The norm-setting document, regulating thresholds for electromagnetic radiation in human settlements only in the radio frequency and micro-wave ranges in Bulgaria is Ordinance No. 9 of the Ministry of Health Care and the Ministry of Environment and Water concerning the permissible threshold levels of EMFs in human settlements and establishment of hygiene safety zones around the radiating sites. According to this norm-setting document permissible threshold norms for frequencies from 30 KHz to 30 GHz are set, accompanied by performing of preliminary sanitary control for evaluation of the hygiene protection zone assessment of the EMF is conducted as early as during the design stage and after installation of the emitting facilities through measurement of the power intensity or densities of the electromagnetic radiation.

SOURCES OF EMFs

The sources of EMFs in Sofia are as follows:

- Broadcasting stations emitting at short, medium and long waves
- Private broadcasting stations at u.s.w.
- TV transmitters and retransmitters

- High-tension substations – indoor and outdoor
- Power transmission lines
- Power distribution substations supplying residential quarters
- Base exchanges for mobile communications –Mtel, Globul, VivaTel
- Short wave and u.s.w. systems for mobile communications for the transport, police, medical emergency systems etc..
- Radar systems of the Traffic Police, for TV and other satellite connections
- Power-driven transport – tramways, trolley buses and railway transport
- Current rectifiers for the power-driven transport vehicles
- Personal communication systems (radio-amateur transmitters)

Some of the devices for daily use may also be referred to the sources of EMFs, which may create health problems of the population, for instance:

- PC monitors
- Household electric appliances
- The electricity distribution systems in buildings
- Floor heating
- Medical equipment for diagnostics and treatment
- Cell phones, etc..

On the territory of Sofia exist hundreds of sources of EMFs, which are even not registered as such. The basic problems ensue from the variety of the operated telecommunication systems on one hand and the users – institutions, companies, private and state-owned entities – on the other hand, as well as their dynamics in functional and territorial aspect. The attempts for many years now of the control authorities responsible for the application of hygiene norms in this respect – the Regional Inspectorate on the Environment and Water and the Institute of Hygiene and Epidemiology – have practically failed.

The emitters situated closest to Sofia, in the Sofia field, are as follows:

- **Radio-transmitters**
 - Radio-transmitting centre RPTs Kostinbrod – 6 emitters with a total power output 320 kW with frequencies in the shortwave range – from 4 to 25 MHz (built in 1958);
 - Radio-transmitting station RPS Sofia-2, the city of Stolnik, power output 50 kW, frequency 828 kHz (built in 1955);
 - RPS Sofia-4 Dragoman – power output 40 kW, frequency 963 kHz (1974);
 - RPS Sofia-1 Vakarel – power output 40 kW, frequency 1161 kHz (1976);
 - RPS Sofia-3 Vakarel – power output 40 kW, frequency 773 kHz (1976);
 - RPS Sofia-5 Vakarel – power output 40 kW, frequency 963 kHz (1976).

The values measured outside the area of the technical fences of the radiotransmittance stations are as follows:

- RPS Vakarel: 2-3 V/m at the summer house zone;
- RPS Stolnik: up to 3 V/m at a bridge near the station.

In the capital these emitters have no impact because the antennae systems are located far from the city boundaries.

• **TV centres**

In Sofia and the near-by surroundings are located the following TV transmitters, on whose masts are installed u.s.w. transmitters as well:

- **KPTЦ Vitosha (Kopitoto):**

- TV-1, Channel 7, power output 10 kW (1985)
- TV-3, Channel 29, 10 kW (1985)
- “Nova TV”, Channel 48, 1 kW (1994)
- TV-7 dni, Channel 53, 1 kW (1996)
- U.s.w.-1, 69.26 MHz, 10 kW (1985)
- U.s.w.-2, 66.50 MHz, 10 kW (1985)
- U.s.w.-4, 103.00 MHz, 10 kW (1985)
- U.s.w.-5, 92.90 MHz, 1 kW (1991)
- Radio “Express”, 105.00 MHz, 1 kW (1993)

- **PPC Sofia:**

- BBC, 103.60 MHz, 250 W (1991)
- “Free Europe”, 89.10 MHz, 1 kW (1992)
- “Deutschewelle”, 95.67MHz, 250 W (1992)
- Radio “99”, 106.00 MHz, 250 W (1993)
- Radio “7 days”, 107.90 MHz, 250 W (1994)
- Radio “Signal”, 90.60 MHz, 250 W (1994)

The measured values in the vicinity of PPC Sofia (TV tower) show that the intensities of the EMFs are below 2 V/m, which is within the sensitivity boundaries of the measuring devices.

- **U.s.w. radio stations**

Part of the private radio stations are located within the city boundaries and other – on the antennae of the TV transmitter “Kopitoto” as described above. The list of u.s.w. radio stations emitting in Sofia has been presented in the Environmental Impact Assessment (2002) for the Master Plan of the city of Sofia. The described radio stations continue to transmit at the same frequencies, but a large number of them have been renamed.

The preliminary expert assessments (2002) show that the requirements concerning the hygiene protection zone, ensuring radiation at values below the permissible threshold norm (3 V/m) for the u.s.w. range have been complied with. The measurements performed afterwards by the National Centre for Protection of Public Health also prove that the population is not exposed to radiation with values exceeding the hygiene norm requirements.

- **Outdoor dissemination devices**

The outdoor dissemination devices are represented by the high-tension substations. There are many such substations of different voltage on the area of Sofia - 110 kV, 220 kV and 400 kV. They are situated near factories, but also on the area of the city (along the Ring Road, in residential quarters, etc.). The installation of the reduction and distribution facilities has been implemented in compliance with the requirements of the standards for such equipment. The technical fences limit the impact of the electrical facilities themselves and one may say that they hardly have any serious impact on the population in the vicinity of the stations. The impact of the magnetic field in the case of different levels of electricity consumption, especially during the winter season, cannot be specified, since no serious studies have been conducted in this respect.

- **High-tension power transmission lines**

The electric fields can have an impact on the health of the population living/working in immediate closeness to the high-tension power transmission lines. Frequently, in the human settlement there are construction sites, which are situated in violation of the legal provisions close to the projection of the power transmission line and might create risk situations due to the radiated electrical field as well as from the point of view of the electrical safety of the facility.

- **Power distribution substations in residential buildings**

In the city of Sofia in 2002 there were 199 power distribution substations, which were situated in residential buildings and were installed mainly before 1972, when the “Ordinance concerning the hygiene requirements for protection of human health in the human settlement environment” was promulgated in the State Gazette (Amended 25 May 1992). These power distribution substations differ in terms of design and we distinguish basement-located substations,

ground-floor located substations and outhouse-located substations. This distribution proves through the conducted measurements that the most unfavorable solutions are those featuring location of the substations on the ground floor and in certain cases also of the outhouse-located units. The non-compliance is related above all to the noise and vibrations suffered in the premises situated immediately adjacent to the substation, but also in certain cases higher values of the magnetic field have been detected.

- **Mobile communications**

In the process of working out of this study have been used the data provided by the three mobile operators, which are legalized, installed and transmit in Sofia Municipality:

- “MobilTel” - 246 sites
- “Globul” - 299 sites
- BTK (“Vivatel”) - 239 sites

The information refers to the sites, which have undergone control check up in compliance with the requirements of Ordinance No. 9/1991 for the period from January 2003 till December 2007, i.e. after the completion of the Preliminary Report on the Environmental Impact Assessment of 2002.

All base stations for mobile communication undergo two inspection phases as prescribed by Ordinance No. 9 (SG Vol. 35/1991, Amendment and Addendum SG Vol. 8/2002):

- Phase One (in 2006): “Design documentation” [Art. 9(1) of Ordinance No. 9], which consists in calculation prior to the commissioning of the site of the hygiene protection zones around the radiating facilities taking into account the size and layout of the site in the surrounding, the technical, situational and installation characteristics of the facilities as laid down in the design documentation.
- Phase Two (in 2006): “Trial operation” [Art. 9(2) of Ordinance No. 9], which consists in checking after commissioning of the site through practical measurement of the electro-magnetic radiation around the facility whether it complies with the hygiene norms set in the Ordinance.

The results from the measurements of the EMFs in the vicinity of the base stations of mobile communications reveal that in the majority of cases the measured values comply with the hygiene norms approved in Bulgaria.

The population is subjected to impact from EMFs from base stations with values above 10 $\mu\text{W}/\text{cm}^2$ only in the cases, when the requirements of the regulatory framework have not been met. In certain cases it is possible that in the cone of radiation might exist residential buildings (or only individual premises), places for permanent and temporary presence of people, like places for recreation and rest, building roofs, streets, office premises etc. and in this case the hygiene norms are exceeded.

- **Radars – locators and navigation systems**

There are data for very high values in human settlements in the event of non-compliance with the requirements for hygiene protection zones around radar installations. In Bulgaria multiple studies have been conducted at the Sofia Airport, as well as around the meteorological locator in *Mladost-1* Housing Estate, at the satellite system of *Tsigradsko Shosse* Blvd. as well as in the vicinity of military radars. Values exceeding manifold the hygiene norm requirements have been found and respectively adequate measure have been taken for safeguarding the population.

- **Other sources of EMFs**

The absence of data (and of a unified information system) does not permit deducting of scientifically justified and proven statements concerning the rate of exposure of the population to radiation by the numerous other sources of

EMFs. The most general findings may be summarized as follows:

- The number and output of the police radar systems are not known, nor those of the radio stations of the police, the emergency vehicles, the taxi vehicles.
- The radiation by the cell phones is of very high values, although for short periods of time. In many countries investigations are conducted on the influence of the electro-magnetic energy on the cerebral tissue, but as yet there is no reliable information about harmful effect of the chronic impact below threshold values directly on the brain.
- The household appliances and electricity distribution installation pose a problem, which has not been studied yet. In the scientific literature it is considered that the magnetic field emitted in everyday life is a probable cancerogenic stimulator.
- The exposure to EMFs from medical sources because of their specifics may have very high values, much exceeding the permissible threshold norms.

WASTE TREATMENT

Waste has direct or indirect influence on each of the components of the environment and human health provided no measures have been taken beforehand for curtailing of that influence. Sofia is faced by a grave and as yet not resolved problem with waste disposal. Because of the suspension of the operation of the existing landfill it has been resorted to packing the solid urban waste in bales as a kind of temporary solution of the problem, which in turn has led to the creation of sites for packaging and storage of the bales, as well as follow-up action on the part of Sofia Municipality after exhaustion of the capacity of the allocated sites.

A number of studies have been conducted for overcoming of the problem, but to date (2008) no final solution has been found. In the approved Master Plan (2002) two dumpsites in the framework of Sofia Municipality have been proposed, having in mind only the solid urban waste – expansion of the Suhodol landfill and Kremikovtzi (former mine). Additionally, several opportunities for construction of sanitary dumpsites for solid urban waste have been indicated outside the administrative boundaries of Great Sofia Municipality. That might be realized through construction of regional dumpsites jointly with neighboring municipalities from Sofia District. Plots considered to be suitable for that purpose have also been indicated – in Elin Pelin Municipality (deserted pits in Chukurovo mines), in Dragoman Municipality (deserted pits in Bolshevik mines) and in Kostinbrod Municipality.

The Master Plan contains also a proposed alternative for decontamination of solid urban waste, namely a waste treatment plant. Two possible sites have been proposed for situation of the plant – next to the Kubratovo waste water treatment plant and a site situated to the northeast of the tailing reservoir at the village of Dolni Bogrov.

After all the studies on the problem with waste in the city of Sofia and Sofia Municipality it turned out that part of these sites, laid down in the Master Plan, do not comply with some of the requirements put forward by the local authority or cannot be used for location of waste treatment facilities. For this reason other possibilities were considered as well and five potential sites for location of waste treatment facilities were approved. These sites are marked in the Amendment to the Plan. The studies show that there are no non-compliances with the norm requirements and that they comply with the criteria related to construction of a facility for treatment of non-hazardous waste:

- Site at Khan Bogrov
- Site at Kremikovtzi 3CK

- Site at the village of Yana – “Sadinata”
- Site at the village of Yana – “Pasishteto (the Pasture)”
- Site at the urban wastewater treatment plant - Kubratovo

The site at Kubratovo has been selected for specific study in connection with the construction of a treatment plant for non-hazardous waste. It has been issued a positive position paper No. SO-02-1/2008 by the Regional Inspectorate on Environment and Water Sofia on the basis of the prepared Environmental Impact Assessment subject to strict implementation of all the prescribed measures for prevention, minimizing or, if possible, complete removal of the supposed unfavorable consequences from the implementation of the Plan, as well as measures for monitoring and control.

The results from the conducted evaluation in a feasibility study and the accompanying documents for a project under the title “Management of urban waste in Sofia Municipality” show that the criteria and indicators formulated by the local authority concerning the applicability of the sites at maximum possible number of scores 100, the complex evaluation has singled out as appropriate “Khan Bogrov” (for construction of a treatment plan for non-hazardous waste) and the site “the village of Yana – Sadinata Locality” (for construction of a dumpsite for non-hazardous waste or construction of treatment plant and a dumpsite of smaller capacity). It is recommended to conduct follow-up studies of these sites during the next phases.

Taking due account of the already conducted studies of the five approved potential sites and the conclusions made from them, it is necessary to note that the problems with waste of the city of Sofia and Sofia Municipality should be considered and resolved for the longest possible time horizon. For this reason we would suggest that the future actions should be oriented towards opening the due procedures for the two probable locations.

The implementation of the prescribed measures together with the management decisions of the administration of Sofia Municipality related to collection, storage and disposal of solid urban waste, closure of old unorganized landfills, cleaning of past contamination of the plots of industrial enterprises, which plan to move to new locations, etc., will create conditions for minimizing the harmful effect of waste on the environment and human health as a result of the implementation of the draft-Amendment to the Master Plan on the area of the city of Sofia and Sofia Municipality.

RADIATION SITUATION

Eight points have been set up with the respective subsystem of the HACEM with the Ministry of Environment and Water for control of the radiation situation in the country. Since 1997 an automated system for permanent control of the radiation Gamma-background (гама-фон) in the country has been introduced. The system is equipped with the most modern devices, hardware and the appropriate software, allowing registration of any deviation from the norms. The system has points for monitoring of the *natural and technogenic situation* in immediate vicinity to the sites, which are considered to be potential pollutants (uranium mining). Two of the sites controlled by the system are in the village of Buhovo, Sofia Municipality: “Underground construction” SP plc and “Rare metals” SP plc. The results from the measurements, general analysis and findings are reported on a daily basis in a special bulletin – “State of the environment in the Republic of Bulgaria”, Subsystem “Radiation situation”.

To date the published information and analyses in the yearbooks prove that for the city of Sofia the radiation Gamma-фон is within the limits of the typical (natural) фонови values.

Sofia is covered by the system for control of atmospheric radioactivity. The

published information shows that by this indicator, which is characterized through the фонови concentrations of Cs-137 and the космогенен Be-7, the aerosole samples for Sofia are identical with those for the country as a whole.

Sofia is part of the system for monitoring of the natural and technogenic radionuclides in soils. The published information shows that no values about the specific activeness of the natural radionuclides above the фоновите values have been found for Sofia.

Sofia is included in the system for monitoring of the radiologic characteristics of waters. Since 1997 the monitoring extends to the rivers on the area of the municipality – Iskar, Gradska, Lesnovska, Kakach and Blato, and since 1998 – to the *Iskar* Dam as well.

The potential sources of radioactive pollution in Sofia Municipality are “Rare Metals” SP plc and “Underground Construction” SP plc in Buhovo. The performed analyses of water in the village of Seslavtsi, “Chuka” section (canal after the sorption installation of the section – site of “Underground Construction”) in 1996 show that the uranium content does not exceed the permissible threshold concentration and that there are no traces of total Beta radioactivity. The result from the investigated river Eleshnitsa water (“Rare Metals” SP plc) is the same.

In the “Chora” section, however, the total beta radioactivity is 14 times higher than the permissible threshold concentration and the uranium content in the soils (Uranium 238 and Radium 22) is 3 times above the permissible threshold concentration. The waters discharged from the tailing reservoir (“Rare metals”) feature total beta radioactivity 6 times above the permissible threshold concentration. The river Eleshnitsa water after the influx of drainage water show no values above the permissible threshold concentration, i.e. the contamination is local, whereat in the bottom-level sediments the characteristics exceed 8 times the permissible threshold concentration. The samples from the dumpsite “Shtolnite” and “Brezov Vrah” quarry of “Iskra” site (Underground construction) exceed the фоновите values of uranium 238 5 times and of radium and lead – 30 times; at the “Rare Metals” site Buhovo the total beta radioactivity is 2 times above the permissible threshold concentration. “Underground Construction” SP plc has been invoted to perform technical liquidation of section “Mine 5”, technical and biological recultivation of all sites and to set in place a permanent monitoring network covering all the sites.

COMPLEX ECOLOGICAL FORECAST

The complex ecological map offers a “cumulative” illustration of all the ecological indicators and outlines the ecological forecast. Marked on it is the following:

- The territories with bioclimatic conditions classified according to the degree of favorability (A1÷ A4)
- The territories with air, water and soil pollution classified according to the degree of favorability (B1 ÷ B5)
- The territories with acoustic loading of the environment by the transport vehicles, classified according to the degree of favorability (C1÷ C4)
- The territories of EMFs, classified according to the degree of favorability (E1÷ E4)

The resultant combinations of unfavorable ecological impacts outline the forecast picture of the estimated environmental conditions in ecological aspect with respect to the implementation of the forecasts of the Amendment to the Master Plan of Sofia Municipality.

The following conclusions may be made as a summary from the conducted expert ecological projections:

The conditions of the natural environment will as a whole not change and will remain to be not particularly favorable. A considerable share of the weather will in ecological aspect be characterized by discomfort manifestations – discomfort-causing overheating and discomfort-causing cooling. The reasons for that are both the geographical location of the city and human activity, which demonstrates underestimation of these conditions and failure to take them into due consideration. More than 80 per cent of the territory features deteriorated conditions for hosting building foundations – low bearing capacity of the soils and ground waters, which although not aggressive, are very high. The city is located on a territory of 7th degree of seismic risk.

With respect to the anthropogenic conditions, in the Amendment a relative improvement of the positions of Sofia as compared to other cities in the country is laid down. Large-scale industrial polluters of the atmosphere, water and soils are evacuated from the urban territory. With the transformation of purely industrial zone into mixed-functional zones the violations of the MX33 by the enterprises and the industrial zones become also, with minor exceptions, conventional. The major problems, connected with atmospheric air pollution, will continue to be motor vehicles and the residential sector. A problem of a “particular” nature is the dust from the poorly cleaned and not adequately paved streets, the solid urban waste and the low culture of user behaviour.

No substantial improvement of the acoustic loading of the environment by the transport means may be expected. Despite the envisaged highways and by-pass routes for evacuation of the transit traffic flows beyond the compact city, the typical for the capital high intensity of the transport flows will persist. A certain reduction of the high noise levels might be achieved as a result of the improvement of the state of the primary street network, the pavements and the traffic organization, but a solution should finally be found for the problem with the total neglect of the “noise” factor in the process of build-up of the territories. Sources of considerable noise pollution of the environment are the airport and the railway areal. The raising living standard and the related rate of use of private motor vehicles would hardly contribute to reduction of the noise levels. The renewed to a significant extent automobile fleet and the striking of the almost upper limit for motorization, however, allow us to presume that further increase of the noise levels is unrealistic.

Electromagnetic radiation and fields do represent a problem for the city. On the urbanized territory operate a multitude of broadcasting station, TV-re-transmitters, the cells of the mobile phone operators, an unknown number of civil and military radio stations, locators, radars, and the rampantly localized power transmission lines cover with electromagnetic fields a large portion of the territory.

An important issue for the entire territory is that of resolving the problem with waste through introduction of an appropriate environmentally-friendly waste treatment technology.

IMPACT ON THE NATURE COMPONENTS

For improvement of the local nature conditions the Amendment to the Master Plan proposes setting in place of a unified Green System, whereat the concept for its “design” is not based on some sort of “area norms” (m²/inhabitant) but rather the objective “needs” of the territory with due consideration of all existing circumstances and conditions as a complex. In general, this concept may be reduced to the following:

Sofia is situated in a hollow, surrounded and “protected” by the massifs of Vitosha Mountains, the Balkan Mountain Range, Lyulin Mountains and Ikhtiman Sredna Gora Mountains. At this configuration the large percentage

of time with weak winds and stillness is quite natural. That is the substance of one of the biggest problems with the weather of Sofia.

The combination of absence of ventilation with the large percentage of sunny weather (180 days/year) and the big concentration of massifs of artificial coverings (industrial sites, housing, streets and squares etc.), which accumulate, store and respectively emit the accumulated heat (long-wave radiation) long after the “solar attack”, till late in the evening, is the source of discomfort-causing overheating of the environment with all the ensuing consequences – economic (air-conditioners, reduced work capacity etc.), social etc.

As a consequence of heating heat chimneys emerge above the overheated surfaces, the heated air rises up (entraining a considerable portion of the harmful substances diluted in it). It is replaced by cooler air from the adjacent, less heated areas. In this way a “specific, proprietary” local natural wind system is generated. The question is reduced to “from where” does cooler air come and “what type” of cooler air is that. It is obvious that if that air came from the adjacent green massif it would be considerably cooler (i.e. stronger ventilation), more humid (thus meeting the physiological demand; 15 per cent increase of the relative humidity = temperature drop by 3.5°C) and cleaner. The studies show that under such “wind system” the influence of the green areas extends up to 300 – 600 m depending on the type of the massif (the plants in it) and its size. The bigger the massif and the larger the share of high-stem tree species, the higher its impact.

The Green System of Sofia is building on that natural process. It takes the best advantage of all the existing factors – the existing parks, the free and loosely built-up neighboring plots – expanding in the direction of the mountains (Vitosha, Lyulin and the Balkan Mountain Range to the north), penetrating like a wedge as far as possible in the most densely built-up quarters in the Central City Area. There are great expectations connected with the plots relieved from industrial activities in the existing industrial zones (approximately 10 per cent according to the conducted investigations) It is relied also on the street and house-yard greenery, especially in the envisaged new expansion of these areas, called not by chance “parks”.

Enormous awareness raising activity will be necessary for realization of the so indispensable for Sofia green system – both in terms of governance and among all the public systems. Amendment of the regulatory framework will be necessary as well. The essence of such amendment shall be the requirement that the Detailed Regulation Plans and the investment projects should in addition to the till now traditional ПСД contain also projects for greenery, as well as provisions for mandatory implementation of these projects to be certified during the acceptance of the sites and their commissioning (the costs for such implementation account on the average for approximately 2-3 per cent of the construction costs). The latter is specifically emphasized because there exist numerous, relatively simple means, whose application in concrete projects and implementation would produce high environmental effect. As already mentioned, some of these means are the ratio of the build-up of the quarters along the periphery, the break-throughs in the build-up plan, the ratio of the building dimensions (height / depth / length), the indenting of façades, their colour, the vertical greenery, the layout of the green areas, etc.

Last but not least, appropriate work is needed in raising the “environmental awareness” of the management, design and executive personnel.

IMPACTS ON THE ANTHROPOGENIC COMPONENTS

For improvement of the anthropogenic ecological parameters of the environment the Amendment to the Master Plan proposes also a set of

actions aimed at curtailing and hampering those activities, which cause the gravest burden on the ecological balance:

- Atmospheric pollution as a result of industrial and everyday activities of recognized local sources and automobile transport.
- Acoustic loading of the environment by the transport means and the operation of the Sofia Airport;
- Loading of the environment by electromagnetic radiation.

For resolution of the spatial planning problems of Sofia and Sofia Municipality in the draft-Amendment of the Master Plan is proposed restructuring of the industrial activities and, from ecological considerations, evacuation of the polluting industries, construction of adequate treatment facilities, clustering of enterprises in isolated zones on the basis of similarity of activities with common manufacturing and ecological infrastructure. Non-complying manufactures and violations of the MX33 envisaged by the law will not be tolerated.

The Amendment proposes building of non-formal branch associations in specifically set apart zones, in which the means of ecological infrastructure will be united and in which social and economic effect will be sought in addition to the purely ecological effect. In such a zone the unbuilt even at present 10-30 per cent of the territory are subject to greenery and public works. The industrial activities are localized in a mosaic form, linked with a common manufacturing and common ecological infrastructure (treatment facilities, public works and greenery). “In front of” the approaches to the zone are constructed warehousing yards and a specialized hypermarket, which offers finished products of local make as well as materials and raw materials required by the similar types of industries. This representative “approach” is equipped with the necessary annexes – conference halls, negotiation offices etc., as well as, wherever possible, with the respective business and management services etc. and shapes the “image” of the zone.

One of the most future-oriented directions for general reduction of atmospheric pollution as a result of the action of the significant in terms of capacity local sources – the district heating plants – is the use of solar energy for meeting part of the energy demand of households and industries. At the face of 180 sunny days in Sofia it is strange that solar batteries are as yet a sporadic phenomenon.

The facility burdening the most gravely the ecological balance – the metallurgical giant *Kremikovtsi*. If it happens to survive, it should construct the respective treatment facilities – a “counteracting plant” – for the purposes of limiting the negative consequences from its activity. Since there is no available information about concrete actions, during the follow-up phases it would be necessary to outline through mathematical models the real radii of pollution, including its components, the sedimentation mode etc. and taking into due consideration the respective risk situations (temperature inversions, smogs etc.) and gulp pollution connected with the technology cycles, averages, etc.

The necessary software exists and in the event of input of the required data it may help maintain a “permanent duty ecological map”.

The problems with the acoustic loading of the environment by the transport means are resolved to a large extent by the proposed new configuration of the primary street network. The most intensive transport flows are concentrated along the tangential routes, where the respective measures for protection against noise are undertaken as well – earth embankments with greenery, where the earth masses from digging works are made good use of, partition advertising billboards for protection against noise, transparent screens against noise etc. Special attention is paid to the build-up adjacent to the primary street network. In it are concentrated service activities, before the

quarters are built barriers of lower buildings, in which public activities, multi-storey garages and parking areas are localized. For minimizing the noise levels are harnessed also all the available types of actions related to the organization of traffic, the traffic lights duty cycles, green waves, green fields etc. aimed to minimize the waiting times, standstill duration and rush drive of the transport flows, which cause emitting of the highest amounts of harmful emissions and noise.

Particular attention should be paid to the actions for protection against noise and the rest of the environmental protection activities in the process of construction of the “Euro-tangent” in the northern end of the urban organism. The design and implementation of that artery of utmost importance for the city should proceed under respect for and use of all the known actions for environmental protection.

With respect to the acoustic loading of the plots adjacent to the airport, which fall under its “noise shadow”, nothing more can be done besides the building and structural activities, which are defined and respectively limited in their importance and impact. The rapid development of the civil aviation, the growing passenger and cargo flows, require ever bigger and ever more powerful aircrafts (whose development is already underway), and hence despite the measures already implemented and being implemented for minimizing the noise level it continues to increase. Under these circumstances the only alternative is evacuation of the airport to another plot and utilization of the existing infrastructure for the indispensable needs of an airport designated for processing of private flights by small private aircrafts and helicopters.

The loading of the environment with electromagnetic radiation, as already noted, is the so far least developed ecological problem. Until recently this type of environmental pollution was marked by the stamp “confidential” and data about these types of radiation were not publicly accessible. Presently in the city operate private broadcasting stations, which transmit in the 89.9 ÷ 109.7 MHz range, TV re-transmitters, cells of Mobiltel, Globul and Vivatel (900 and 1800 MHz) and an unknown number of military and civil radio and locator stations. The majority of the known transmitters is situated on the urban area and emits 24 hours a day, in densely populated residential and public zones.

The harmful effect of radiation on human organism is long-term and with delayed impact. In synergy with the other harmful factors the health risk increases significantly.

A more detailed study, clarification of the list of transmitters, power substations, high-voltage power transmission lines, their location, power output etc. are needed for due reflection in the documents during the next planning phases.

The conclusions from the urbanistic ecological analysis, the discovered causes for emergence of the ecological situation and the extent of distortion of the ecological balance, the outlined ways, directions and content of the proposed measures for its recovery, by means of the feedback, of the expected changes in the quality of the environment as a result of the activities envisaged in the plan and the extent to which they come closer to the matric-criteria, serve as an output of the effectiveness of the design solution and outline the ecological forecast.

As a result of the ecological measures envisaged in the Amendment to the Master Plan – the green system layout, the changed conditions of build-up – under favorable from the point of view of the ecological requirements urban planning indicators, qualitative changes in the general indicators of the natural environment may be expected.

Although not to a high extent, but the balance between the comfort and

discomfort bioclimatic manifestations may be changed in the direction of increase of comfort. The balance, relative weight and the boundaries of the most favorable and favorable zones with respect to the natural conditions may also be changed in the direction of their expansion. Upon implementation of the envisaged actions it is expected that the most unfavorable zone A4 will “shrink”, although insignificantly, and in terms of its indicators part of it will move to the next one – A3.

As regards the ecological indicators, which are the result of anthropogenic activities, in the MX33 are not envisaged residence and other incompatible activities, the activity of polluting enterprises is evacuated or discontinued, and where they continue to operate the respective treatment facilities should be set in place. In this way the pollution zones “B1- B5” are transformed up to “B1-B3” , whereat in the most polluted ones there is a ban on residence and service activities.

The zones with acoustic loading of the environment by the transport means also undergo a certain change. As a result of the implemented measures – improved organization, new primary street network with significantly improved spatial parameters – general limitation and lowering of the noise loading is expected.

In this way the formulated objectives of the urbanistic-ecological analysis and synthesis are achieved – not just to unveil the reasons for degradation of the environment, but also to indicate the roads for its recovery and optimization. For this reason in the process of urbanistic investigations parallel to the public and utilitarian needs of man an equitable, balancing role is assigned to the ecological unity in the concept of spatial and functional organization of the environment for the purposes of the Sofia Master Plan.

CONCLUSION

The increased requirements with respect to the conditions of the urban environment, the incurred irreversible changes as a result of human activity and the global scope of these changes require that in the urbanistic investigations, forecasts and plans these issues should be assigned their deserved place and weight, because the city, the urban environment in general should, while meeting the utilitarian and public needs of man, provide for meeting his/her natural requirements as a biological being.

Many of the aspects of human development give grounds for serious concern:

- In the first place, a matter of concern is the discrepancy between the demographic growth and the global resources of the planet. Mankind is on the verge of exhausting the capacity of the arable land, the ore and mineral resources and especially the energy resources.
- In the second place, the waste produced by human activity pollutes the air, water and soils, destroys the flora and fauna and deteriorates the living conditions for the people. The worked out forecasts with respect to global climate change as a result of pollution for the time horizon by the end of the 21st century are to the experts' surprise already a fact.
- In the third place, last but not least, the constantly increasing within the life span of a single generation volume of information, the irresistible introduction of standards related to consumption and cultural life, cause enormous losses of nervous energy and finally to impoverishment of the emotional life of man.

All these developments pose new problems before society (generated by it, therefore subject to be resolved by it), destroy traditions, changes long ago established relationships and stereotypes, but also something in man himself.

Irrespective of all the achievements of progress, man has almost not changed in a number of aspects since ancient times – unchangeable generation after generation remain not only the human body, man’s mental capacity, but also numerous manifestations of his spiritual life, which may be assigned to the intrinsic cultural and moral-ethical values.

For that reason the thought that many traditional, long-established spatial stereotypes should now and in the future find their adequate place in the structure of the living environment. It is only in this way – in the dialectic unity, contained in the concept for matching the constantly changing elements with the steadily fixed ones – that the foundation for highlighting of the structure of human needs and building of a true-to-fact model of man’s spatial surroundings may be realistically laid.

The factors determining human development may be classified as follows:

- On one hand the “biological characteristics, which have served as the basis for the emergence of the fully developed human being, possessing consciousness”, coded in his/her hereditary structures and forming the essence of the “genetic programme” of his/her development; and
- On the other hand, the conscious activity of people, transferred from generation to generation, through education and upbringing, i.e. along the road of the “social heritage programmes”.

Contrasting the slow course of genetic evolution to the rapid process of changing of man’s spiritual life, fixed in the social programme, one comes to the important conclusion that man’s development as a reasonable being depends entirely on the growth of the qualitative and quantitative contents of the social heritage, since the genetic programme will be preserved entirely in the same form for further thousands of years.

Under these conditions one should pay the most particular attention to the genetic programme of mankind with the aim to safeguard it from harmful mutagenic factors. A task to create a new, genetically improved human species is not on the agenda.

Therefore the air, humidity and temperature characteristics of the environment, the sensor and motor reactions inherent to man, man’s regimes of sleep and eating, his general physiology, may be viewed as practically unchanging factors. As impressing as the changes in the man’s lifestyle, in his way of rationing may seem, one should not underestimate the time-related stability of these fundamental factors, which influence the spatial organization of the environment both directly and indirectly, exercising a certain stabilizing impact on the spiritual culture of man and the human mind.

The sustainable in the time traditional factors, which should be taken into consideration during analysis and forecasting of the environment, are not limited to the genetic programme alone. The changes in the spiritual content of the human being triggered by the globalization process not only renovate the structure of his/her demands, but also require certain inertia of that structure. This inertia is manifested in strengthening of the specific “stabilizing” needs, guaranteeing the necessary succession in the development of the programme for social inheritance, excluding the possibilities for missing the point and degeneration in the transfer of the accumulated experience.

The accelerated trends of mobility and changeability push to the top of the agenda the issue of adaptation, man’s capacity to adapt to the changing surrounding. The information flow, the intensive life in a complex integrated spatial environment, lead to the need of periodical “switching off” of man from the extremely intensive daily rhythm. Such ‘switching off’ presumes on one

hand effective insulation in the dwelling and, on the other hand, ensuring of the necessary diversification in the environment for free communication with other people.

As evident, the development of man’s spiritual life and his material environment evolves in a constant struggle between the trends of renewal and succession. The core of the issue is the form of realization of this link, which marks the boundary between changeability and sustainability, between standard and uniqueness, between man and machine in the process of formation of man’s spatial surrounding.

The existence of the two sides of an unbreakable unity is of particular importance and is imbedded in the primary principle of the approach towards resolution of the problems of the living environment, which are not “purely ecological”, but in their entirety rather “socio-ecological”. That is, therefore, the object of the conducted studies, in which an attempt was made to make typical “forecast cross-sections” of the living environment and in this way to obtain more or less overall idea about the future of the city in the “urbanistic-ecological” aspect of its development.

7. BALANCE OF THE TERRITORY

BALANCE OF THE TERRITORY – AMENDMENT TO THE MASTER PLAN

	TYPES OF AREAS	Sofia Municipality		City of Sofia – compact city		Surrounding area		Long-term prospective areas	
		ha	%	ha	%	ha	%	ha	%
1	Residential zones	15857.7	11.8%	8155.1	38.9%	7702.6	6.8%	2049.0	31.0%
	<i>Including summer-house (villa) zones</i>	2160.9	1.6%	0.0	0.0%	2160.8	1.9%		
2	Zones for public services	2609.7	1.9%	1482.3	7.1%	1127.4	1.0%	23.5	0.4%
3	Industrial zones	4740.2	3.5%	1608.7	7.7%	3131.5	2.8%	208.8	3.2%
	<i>Including zones for mining and quarries</i>	694.3	0.5%	70.2	0.3%	624.2	0.6%		
4	Mixed multi-functional zones	4920.7	3.7%	2943.2	14.0%	1977.5	1.7%	2689.2	40.6%
	<i>Including city centre zones</i>	447.7	0.3%	447.7	2.1%	0.0	0.0%		
5	Zones for utility facilities, including landfills	757.4	0.6%	2.7	0.0%	754.7	0.7%		
6	Zones for transport and technical infrastructure, including service yards, facilities and depots	5209.3	3.9%	2348.0	11.2%	2861.3	2.5%		
	<i>Including main road and street networks</i>	4136.0	3.1%	1784.4	8.5%	2351.6	2.1%		
	<i>Railway lines and areals</i>	658.3	0.5%	339.1	1.6%	319.3	0.3%		
7	Green areas, including green strips, gullies, servitudes, canals	10269.8	7.7%	3661.7	17.5%	6608.1	5.8%	1104.4	16.7%
8	Zones for sports and entertainment	1167.0	0.9%	414.9	2.0%	752.1	0.7%	545.5	8.2%
9	Special-use zones	1077.1	0.8%	214.3	1.0%	862.8	0.8%		
10	Rivers and open water areas	3066.4	2.3%	42.7	0.2%	3023.7	2.7%		
11	Agricultural areas	36112.5	26.9%	72.7	0.3%	36039.8	31.8%		
	<i>Including areas with permission for construction</i>	375.6	0.3%	0.0	0.0%	375.6	0.3%		
12	Forest areas	48397.2	36.1%	10.1	0.0%	48387.2	42.7%		
	<i>Including nature reservations</i>	2101.8	1.6%	0.0	0.0%	2101.8	1.9%		
TOTAL		134185.0	100.0%	20956.3	100.0%	113228.7	100.0%	6620.3	100.0%

A balance of the territory of the currently enforced Master Plan and this amendment to it has been drawn in compliance with the construction boundary of the city of Sofia, proposed by virtue of the amendment. In this way a comparative analysis can be reasonably made of the changes in the different types of zones inside the city and its surrounding area.

The comparative analysis of the balance of the territory between the 2003 Master Plan and this Amendment to the Master Plan shows that the urbanized areas have increased from 33.7% to 34.7% of the total area of the municipality. This increase is at the expense of the agricultural areas, which have diminished from 28.0% to 26.9% of the total area of the municipality. All in all the area of the zones for utility facilities and the mixed multi-functional zones increases from 4.9% to 5.6% of the area of the municipality and that increase is manifested the strongest in the compact city, where these areas grow from 18.2% to 21.1%. That increase is due to a significant extent to the diminishing of the area of industrial zones – from 10.1% to 7.7% in the compact city. In this way the share of the industrial zones in the city makes Sofia compatible with the other European capitals. In the surrounding area industrial zones also diminish from 2.9% to 2.8% and for the municipality total the reduction is from 4.0% to 3.5%.

	TYPES OF AREAS	Sofia Municipality		City of Sofia – compact city		Surrounding area		Long-term prospective areas	
		ha	%	ha	%	ha	%	ha	%
1	Residential zones	15412.4	11.5%	8260.6	39.4%	7151.8	6.3%	372.4	16.6%
	<i>Including summer-house (villa) zones</i>	1998.1	1.5%	0.2	0.0%	1997.8	1.8%		
2	Zones for public services	2830.0	2.1%	1529.3	7.3%	1300.7	1.1%	45.8	2.0%
3	Производствени територии	5377.6	4.0%	2115.3	10.1%	3262.3	2.9%	180.9	8.1%
	<i>Including zones for mining and quarries</i>	722.8	0.5%	71.2	0.3%	651.6	0.6%		
4	Mixed multi-functional zones	3696.4	2.8%	2288.7	10.9%	1407.7	1.2%	428.0	19.1%
	<i>Including city centre zones</i>	483.0	0.4%	483.0	2.3%	0.0	0.0%		
5	Zones for utility facilities, including landfills	646.1	0.5%	7.9	0.0%	638.2	0.6%		
6	Zones for transport and technical infrastructure, including service yards, facilities and depots	5012.6	3.7%	2384.7	11.4%	2627.9	2.3%		
	<i>Including main road and street networks</i>	3914.2	2.9%	1790.4	8.5%	2123.8	1.9%		
	<i>Railway lines and areals</i>	708.7	0.5%	372.3	1.8%	336.4	0.3%		
7	Green areas, including green strips, gullies, servitudes, canals	9945.7	7.4%	3570.4	17.0%	6375.3	5.6%	981.0	43.8%
8	Zones for sports and entertainment	1089.9	0.8%	408.6	1.9%	681.3	0.6%	229.6	10.3%
9	Special-use zones	1182.9	0.9%	232.4	1.1%	950.5	0.8%		
10	Rivers and open water areas	2991.7	2.2%	42.5	0.2%	2949.2	2.6%		
11	Agricultural areas	37565.8	28.0%	106.3	0.5%	37459.5	33.1%		
	<i>Including areas with permission for construction</i>	521.0	0.4%	0.0	0.0%	521.0	0.5%		
12	Forest areas	48433.8	36.1%	9.6	0.0%	48424.2	42.8%		
	<i>Including nature reservations</i>	2101.8	1.6%	0.0	0.0%	2101.8	1.9%		
TOTAL		134185.0	100.0%	20956.3	100.0%	113228.7	100.0%	2237.7	100.0%

Residential zones as a whole manifest a negligible increase (from 11.5% to 11.8% of the total area of the municipality), but that increase is more significant in the surrounding area (from 6.3% to 6.8%)q while in the compact city a drop from 39.4% to 38.9% has been noted. The increase of the green areas for the municipality total is about 320 ha, including some 90 ha in the compact city and approximately 230 ha in the surrounding area. In this way the share of the green areas demonstrates an increase from 17.0% to 17.5% in the compact city and from 5.6% to 5.8% in the surrounding area or from 7.4% to 7.7% for the municipality total. The zones for sports and entertainment have increased by some 6 ha in the compact city and by about 71 ha in the surrounding area or a total of 77 ha for the entire municipality. The special-use zones have diminished by a total of about 106 ha, including by approximately 18 ha in the compact city and by approximately 88 ha in the surrounding area. There is no change in the share of the forest and protected areas.

In addition, a total of approximately 6620 ha is envisaged in the Master Plan Amendment for long-term prospective development. These are mainly mixed multi-functional zones (about 2690 ha), residential zones (about 2050 ha), green areas, zones for sports and entertainment (1650 ha) etc.

DIRECTIONS FOR DETAILED PLANS TERRITORIES IN NEED OF ELABORATION OF COMPREHENSIVE DETAILED REGULATION PLANS, PARTICULARLY INVOLVING APPLICATION OF ARTICLE 16 OF THE LAW ON REGULATION AND BUILD-UP OF THE TERRITORY

As an integral part of the Amendment to the Master Plan of Sofia Municipality a specialized scheme is proposed of regulation and urban planning units (localities), for which entirely new comprehensive Regulation and Build up Detailed Plans (ПРЗ) should be designed and processed. They form parts of different planning zones covered by the Master Plan, but in the majority of cases the matter is related to peripheral expansions of the construction boundaries of the city of Sofia and other settlements within the scope of the municipality. Some of these units do not as yet have well established names and for that reason the design team had taken the liberty to assign them provisional names. The territories subject to strict application of Article 16 of the Law on Regulation and Build-up of the Territory have been specifically marked.

Other specific cases are those of the existing urbanized territories, which have been built up long time ago without adequate regulation, as well as areas featuring “island-type” detailed Regulation Plans for individual real estates or groups of real estates. In order to provide for their sustainable development in the future it is necessary to work out at least comprehensive overall regulation plans.

The practice that had set in after 1990 was to work out and process detailed regulation plans as “piecework” depending on the investment initiative of the individual plot owners has manifested too many shortcomings. This had led in a number of cases to impossibility to ensure normal density and profile of the street network, respectively of the engineering infrastructure networks, and even less to leave room for new social infrastructure facilities or public greenery. The result was situations, under which it was entirely impossible to provide for not only sewerage network, but event transport accessibility. This is particularly evident in territories, which according to the Master Plan provisions have been envisaged for urbanization, but the ownership rights have been reinstated “in real boundaries” by virtue of a land division plan and there are no municipal agricultural cart-roads in situ. Even when such roads did exist and the agricultural land has been parceled out, that does not automatically outline the skeleton of an urban street network, since the development of any settlement area should follows quite a different structuring logic. For these reasons in recent years it has become obvious that all the new territories envisaged for urbanization should be provided with comprehensive Regulation and Build-up Plans, envisaging not only real estate plots under regulation for residential functions or market-type facilities (industrial, commercial, warehousing etc.), but also the entire remaining set of norm requirements and elements related in principle to public investments – transport network, engineering and social infrastructure and the respective greenery.

The lack of adequate municipal financial means and possibilities for reimbursement by other real estates in the event of application of the detailed plans under the general provisions of the Law on Regulation and Build up of the Territory “within the previous real estate boundaries” led to considerable difficulties as to the application of certain already enforced Regulation and Build up Detailed Plans (ПРЗ), for instance in *Manastirski Livadi* East etc. As far as the regulation is concerned, the best opportunities are provided by Article 16 of the Law on Regulation and Build up of the Territory – the so-called “urban parceling out”. According to its texts if not

all, but at least the majority of the plots designated by the Regulation and Build up Detailed Plans (ПРЗ) for public functions within the scope of a given regulation and urban planning unit composed of several quarters (conventionally called “locality” – micro-district, summer house zone or industrial zone etc.) become municipal property immediately after the enforcement of the Regulation and Build up Detailed Plans (ПРЗ). In this way the complications related to the need of expropriation and indemnification are avoided and the time limits for implementation of the public engineering and social infrastructure are significantly accelerated, whereat municipal investments are reduced in practical terms to investments in construction only. Therefore, under these arrangements the municipality, the state, the operating enterprises, other public institutions and also private associations may get directly involved in the urbanization process and share the benefits of it. This practice leads to creation of prerequisites for facilitation and promotion of private investments as well in the individual real estates under regulation. The new urbanized parts obtain an optimal street networks possessing correct geometry and optimal (depending on the functions) neighborhood and plot structure as a result of the regulation of the plots after reduction and re-grouping. The aspect mandatory taken into account is not the real boundaries of the plots but rather their dimensions and the investment intentions of the owners. All these aspects act as prerequisites for achieving an environment of a better quality and higher esthetic properties as a whole, which is one of the major objectives of urban development.

It would be feasible to work out more detailed rule for the urban parceling out of Sofia Municipality, which would take due account of the specifics of the territories that are the object of such plans. It would be beneficial to compile a range of additional criteria for determining the bonitet coefficients in order to avoid harming the interest of some owners. It is not one and the same thing whether the plot used as a starting point is big or there are several small plots at different locations, whether the plot borders on a main street or there is no access to it at all, whether there is certain existing elementary infrastructure or not – all these specific characteristics influence the market prices and should have adequate expression in the newly conceived real estate under regulation. The calculation show that for areas with Kint values above 2 the currently allowed maximum 25 per cent for reduction of the plots in the vent of regulation are not sufficient to cover the norm requirements for areas for public functions – street network, inherent social infrastructure, local sports facilities and green plots. Evidently, at low Kint the population density is lower and the greenery rate inside the real estate under regulation is higher. In such cases the necessary area of the plots for social infrastructure is also relatively low. And vice versa, at high Kint the density of habitation increases significantly, the street network traffic requires broader profiles and hence the necessary plots for social infrastructure and greenery should be bigger, which can hardly fit into the permitted maximum 25 per cent. It is necessary to note that in the practice of a number of other countries this percentage may reach much higher values. In Germany, for instance, it is 30 per cent, in Turkey – 35 per cent. Sofia with its residential densities, which are high above those of the majorities of cities in Bulgaria, should respectively create and apply its own specific detailed rules for urban parceling out.

**Annex
ZONES AND PLOTS FOR APPLICATION OF SPECIFIC RULES AND NORMS AS DEVIATION FROM THE GENERAL ONES LAID DOWN IN THE MASTER PLAN**

With the Amendment to the Master Plan an additional study was conducted, aimed at alignment of the parameters for development of a number of areas characterized by specific factors of local significance, such as:

1. Environmental factors – protection of the environment
 - Vitosha Nature Park
 - Nature 2000 network and habitats
 - Protected areas of different status
 - Sanitary-protection zone of *Iskar* Dam
 - Sanitary-protection zone of thermal mineral water deposits and springs
 - Zone A of national resort locations (Bankya, Ovcha Kupel)
 - Existence of valuable vegetation without specific status
2. Engineering-geological factors
3. Inherited built-up environment with specific characteristics and problems
 - Socio-economic and demographic (disadvantaged neighborhoods)
 - Small-size real estates, narrow streets, non-existent infrastructure at zones for temporary habitation – recreation – set up in the past
 - Existing facilities, for which hygiene-protection zones cannot be provided
 - Existing cultural-and-historical heritage and completed ensemble nature of the milieu
 - Detailed specific rules and norms currently in force
4. New territories for urbanization, in which the necessary infrastructure is not available

As a result of the conducted studies these territories have been marked by an additional asterisk to the letter index of the planning zone in the fundamental drawing of the Master Plan – the map of functional designation and planning regimes of the area of the city of Sofia and Sofia Municipality. For higher clarity a specialized scheme was designed for all these zones and plots, including specification of the additional requirements concerning application of the Master Plan through detailed regulation plans. A table with more precise formulation of the parameters is provided as an annex to the scheme.

SOFIA MUNICIPALITY – total area 134 168 ha; permanent population - 1 485 617 inhabitants				
№	ZONING PLAN PARAMETERS	Area (ha)	% greenery	Green areas (ha)
Sectoral balance of the green system				
Residential zones				
1	Residential zone with high-rise build-up	450.82	20	90.16
2	Residential zone with high-rise build-up *	80.67	20	16.13
3	Residential zone with complex build-up	2536.11	40	1014.44
4	Residential zone with complex build-up *	20.43	40	8.17
5	Residential zone with medium-rise build-up	847.65	40	339.06
6	Residential zone with medium-rise build-up *	46.11	40	18.44
7	Residential zone with low-rise build-up	5115.91	40	2046.36
8	Residential zone with low-rise build-up *	229.7	40	91.88
9	Residential zone with low-rise build-up in natural environment	908.3	70	635.81
10	Residential zone with low-rise build-up in natural environment *	81	70	56.7
11	Residential zone with low-rise build-up under specific additional requirements	2285.91	60	1371.55
12	Residential zone with low-rise build-up under specific additional requirements *	62.38	60	37.43
13	Residential zones with low-rise build-up in zones for preservation of the environment	571.45	80	457.16
14	Residential zones with low-rise build-up in zones for preservation of the environment *	319.69	80	255.75
15	Summer-house zones	2115.68	60	1269.41
16	Summer-house zones *	4.52	60	2.71
RESIDENTIAL AREAS TOTAL		15676.33		7711.16
Green areas average for residence areas - 52 m²/inhabitant				

Mixed zones for residence and services		Area (ha)	% greenery	Green areas (ha)
1	City centre zone 1	55.24	15	8.29
2	City centre zone 2	266.28	30	79.88
3	City centre zone 3	136.31	40	54.52
4	Mixed multi-functional zone	1704.79	40	681.92
5	Mixed multi-functional zone 1	684.18	40	273.67
6	Mixed multi-functional zone 2	2187.76	40	875.1
7	Mixed multi-functional zone 2 *	39.23	40	15.69
MIXED ZONES FOR RESIDENCE AND SERVICES TOTAL		5073.8		1989.07
Green areas average for Oo - 13.38 m²/inhabitant				

Areas for public services		Area (ha)	% greenery	Green areas (ha)
1	Public services zone	1344.15	40	537.66
2	Public services zone*	2.27	40	0.91
3	Public services activities and greenery zone 1	658.47	50	329.23
4	Public services activities and greenery zone 1 *	4.03	50	2.02
5	Public services activities and greenery zone 2	584.76	60	350.86
6	Public services activities and greenery zone 2 *	46.89	60	28.13
AREAS FOR PUBLIC SERVICES TOTAL		2640.57		1248.81
Green areas average for O3 - 8.40 m²/inhabitant				

Industrial areas		Area (ha)	% greenery	Green areas (ha)
1	Industrial zone	1247.58	25	311.895
2	Mixed industrial zone	1214.26	30	364.28

3	Zone for SMEs	1283.67	35	449.284
4	Zone for high-tech industries	272.71	40	109.08
5	Zone for high-tech industries *	34.4	40	13.76
6	Plots for quarries and ore mining	648.93		
	INDUSTRIAL AREAS TOTAL	4701.55		1248.299
	Green areas average for industrial zones - 8.40 m²/inhabitant			

	Plots for utility yards and technical infrastructure	Area (ha)	% greenery	Green areas (ha)
1	Plots for service yards of the green system	88.73		
2	Plots for transport infrastructure	1043.17		
3	Plots for railway transport infrastructure	659.54		
4	Plots for transport yards and depots	123.07		
5	Plots for area sites of power supply	63.45		
6	Plots for area sites of the water supply and sewerage system	177.28		
7	Plots for area sites of petrol, gas and heat pipelines	53.08		
8	Plots for landfills	670.66		
	PLOTS FOR UTILITY YARDS AND TECHNICAL INFRASTRUCTURE TOTAL	2878.98		
	Not subject to norm setting			

	Green areas and plots	Area (ha)	% greenery	Vegetation areas
1	Zone of city parks and gardens	4377.52	85	3720.89
2	Zone for city parks and gardens *	79.48	80	63.58
3	Plots for local gardens and greenery	470.25	60	282.15
4	Plots for green strips and greenery along streets, rivers banks and gullies, and open canals	4667.53		
5	Plots for special-use green areas	290.57		
6	Plots for cemeteries	373.42		
7	Plots for cemeteries *	4.15		
8	Plots for decorative plant nurseries	2.35		
	GREEN AREAS AND PLOTS TOTAL	10265.26		4066.62
	Greenery areas average - 6.91 m²/inhabitant; areas for cemeteries - 2.54 m²/inhabitant			
	The indicator has been extracted on the basis of 10 265 ha			

	Areas for sports and entertainment	Area (ha)	% greenery	Green areas (ha)
1	Zone for sports and entertainment 1	168.04	40	67.22
2	Zone for sports and entertainment 2	17.54	40	7.02
3	Zone for sports and entertainment 2 *	576.91	50	288.46
4	Plots specifically designated for sports and entertainment	401.01	40	160.4
	AREAS FOR SPORTS AND ENTERTAINMENT TOTAL	1163.51		523.1
	average in plots for sports activities - 7.83 m²/inhabitant			

	Special-use plots	Area (ha)	% greenery	Green areas (ha)
1	Special-use plots	1028.97		
	SPECIAL-USE PLOTS TOTAL	1028.97		
	Not subject to norm setting			
	Rivers and open water areas	Area (ha)	% O3	Green areas (ha)
1	Plots for rivers and miscellaneous open water areas	2999.51		
	RIVERS AND OPEN WATER AREAS TOTAL	2999.51		
	Not subject to norm setting			

	Agricultural areas	Area (ha)	% greenery	Green areas (ha)
1	Agricultural zone with permissible construction	365.52		
2	Agricultural zone with restriction on construction	28199.45		
3	Agricultural zone under specific regulation	5378.43	20	1075.69
4	Agricultural zone under specific regulation and specific rules and norms	1921.49	20	384.29
5	Agricultural zone for perennial plantations, plant nurseries etc.	309.4		
6	Plots for experimental agriculture (with R&D institutes)	69.96		
	AGRICULTURAL AREAS TOTAL	36244.25		1459.98
	Agricultural areas - 9.8 m²/inhabitant			

	Forest areas	Area (ha)	% greenery	Green areas (ha)
1	Protected forests and plots	31.1		
2	Recreation forests and plots – green zone	31637.67		
3	Recreation forests and plots – green zone *	64.06		
4	Forest parks	1165.3		
5	State game reservation	3365.16		
6	Plots for forest vegetation nurseries	8.6		
	FOREST AREAS TOTAL	36271.89		36271.89
	Forest areas - 22 m²/inhabitant			

	Areas for protection of nature	Area (ha)	% greenery	Green areas (ha)
1	Protected localities, nature landmarks etc.	246.91		
2	Nature parks	10026.73		
3	Nature reservations	1854.91		
	AREAS FOR PROTECTION OF NATURE	12128.55		
	Areas for protection of nature - 6.9 m²/inhabitant			
	The dimensioning excludes the area of the nature reservations			

	Long-term prospective areas	Area (ha)	% greenery	Green areas (ha)
1	Zone for city parks and gardens	997.1	85	847.54
2	Zone for sports and recreation	543.8	40	217.52
	LONG-TERM PROSPECTIVE AREAS	1540.9		1065.06
	Long-term prospective areas - 10.37 m²/inhabitant			

SOFIA-CITY: total area - 20 914 ha; permanent population - 1 377 690 inhabitants				
№	PLANNING REGIMES УСТРОЙСТВЕНИ РЕЖИМИ	Area (ha)	% greenery	Green areas (ha)
	Sectoral balance of the green system Секторен баланс на зелената система			
	Residential areas			
1	Residential zone with high-rise build-up	450.82	20	90.16
2	Residential zone with high-rise build-up *	80.67	20	16.13
3	Residential zone with complex build-up	2479.11	40	991.64
4	Residential zone with complex build-up *	20.43	40	8.17
5	Residential zone with medium-rise build-up	771.15	35	269.9
6	Residential zone with medium-rise build-up *	46.11	35	16.138
7	Residential zone with low-rise build-up	1534.84	40	613.94
8	Residential zone with low-rise build-up *	214.05	40	85.62
9	Residential zone with low-rise build-up in nature environment	254.62	70	178.23
10	Residential zone with low-rise build-up in nature environment *	77.23	70	54.06

Annex No. 2

11	Residential zone with low-rise build-up under specific additional requirements	1551.93	60	931.16
12	Residential zone with low-rise build-up under specific additional requirements *	25.24	60	15.14
13	Residential zone with low-rise build-up in zones for preservation of the environment	335.74	80	268.59
14	Residential zone with low-rise build-up in zones for preservation of the environment *	234.16	80	187.33
15	Sumer-house zones	0.02	60	0.01
	RESIDENTIAL AREAS TOTAL	8076.12		3726.218
	Green areas norm for residence - 27 m²/inhabitant			

	Mixed zones for residence and services Смесени зони за обитаване и обслужване	Area (ha)	% greenery	Green areas (ha)
1	City centre zone 1	55.24	15	8.29
2	City centre zone 2	266.28	30	79.88
3	City centre zone 3	136.31	40	54.52
4	Mixed multi-functional zone	1694.49	40	677.79
5	Mixed multi-functional zone 1	651.74	40	260.69
6	Mixed multi-functional zone 2	246.1	40	98.44
	MIXED ZONES FOR RESIDENCE AND SERVICES	3050.16		1179.61
	Green areas norm for Oo- 8.56 m²/inhabitant			

	Areas for public services	Area (ha)	% greenery	Green areas (ha)
1	Public services zone	994.39	30	298.32
2	Public services activities and greenery zone 1	311.36	50	155.68
3	Public services activities and greenery zone 1 *	4.03	50	2.02
4	Public services activities and greenery zone 2	173.5	60	104.1
5	Public services activities and greenery zone 2 *	20.13	60	12.08
	AREAS FOR PUBLIC SERVICES TOTAL	1503.41		572.2
	Green areas norm for O3 - 4.15 m²/inhabitant			

	Industrial areas	Area (ha)	% greenery	Green areas (ha)
1	Planning zone for industrial production устройствена зона за индустриални производства	80.64	25	20.16
2	Mixed production planning zone смесена производствена устройствена зона	869.8	30	260.94
3	Planning zone for production in small and medium-size enterprises	398.72	35	139.55
4	Planning zone for high-tech industries	155.33	40	62.13
5	Planning zone for high-tech industries *	34.4	40	13.76
6	Plots for ore mining and quarries	70.09		
	INDUSTRIAL AREAS TOTAL	1608.99		496.54
	Green areas norm for industrial zones - 3.60 m²/inhabitant			

	Plots for utility yards and technical infrastructure	Area (ha)	% greenery	Green areas (ha)
1	Plots for service yards of the green system	2		
2	Plots for transport infrastructure	6.72		
3	Plots for railway transport infrastructure	339.72		
4	Plots for transport yards and depots	123.07		
5	Plots for area sites of power supply facilities	30.8		
6	Plots for area sites of the water supply and sewerage system	37.69		
7	Plots for area sites of petrol, gas and heat pipelines	35.91		

	PLOTS FOR UTILITY YARDS AND TECHNICAL INFRASTRUCTURE	575.91		
	Not subject to norm setting			

	Green areas and plots	Area (ha)	% greenery	Vegetation areas
1	Zone for city parks and gardens	2464.3	85	2094.66
2	Plots for local gardens and greenery	254.14	80	203.31
3	Plots for green strips and greenery along of streets, rivers and gullies and open canals	528.27		
4	Plots for special-use green areas	163.61	60	98.17
5	Plots for cemeteries	208.11		
6	Plots for cemeteries *	1.52		
7	Plots for decorative plant nurseries	2.35		
	GREEN AREAS AND PLOTS TOTAL	3622.29		2396.14
	Green areas - 26.3 m²/inhabitant; including areas for cemeteries - 1.5 m²/inhabitant			

	Areas for sports and entertainment	Area (ha)	% greenery	Green areas (ha)
1	Zone for sports and entertainment 1	153.2	40	61.28
2	Zone for sports and entertainment 2	213.68	50	106.84
3	Plots specifically designated for sports and entertainment	43.56	40	17.42
	AREAS FOR SPORTS AND ENTERTAINMENT TOTAL	410.44		185.54
	Sports areas - 2.98 m²/inhabitant, including green areas 1.34 m²/inhabitant			

	Special-use plots	Area (ha)	% greenery	Green areas (ha)
1	Special-use plots	172.1		
	SPECIAL-USE PLOTS TOTAL	172.1		
	Not subject to norms setting			

	Rivers and open water areas	Area (ha)	% greenery	Green areas (ha)
1	Rivers and miscellaneous open water areas	42.74		
	RIVERS AND OPEN WATER AREAS TOTAL	42.74		
	Agricultural areas	Area (ha)	% O3	Green areas (ha)
1	Agricultural zone with permissible construction	0		
2	Agricultural zone with restriction on construction	58.62		
3	Agricultural zone under specific regime and specific rules and norms	0	20	
	AGRICULTURAL AREAS TOTAL	58.62		
	Agricultural areas - 0.42 m²/inhabitant			

	Forest areas	Area (ha)	% greenery	Green areas (ha)
1	Recreation forests and plots – green zone	0.37		
2	Recreation forests and plots – green zone *	9.01		
	FOREST AREAS TOTAL	9.38		
	Forest areas - 0.07 m²/inhabitant			

	Areas for protection of nature	Area (ha)	% greenery	Green areas (ha)
1	Nature parks	0.67		
	AREAS FOR PROTECTION OF NATURE	0.67		

	PLANNING CATEGORIES – City of SOFIA (building boundaries)	Total area 20 955 ha	Total area 20 0914 ha	
		Population - 1 150 000 inh.	Population - 1 377 690 inh.	
	Comparative analysis of green areas			
№	Residential areas	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Residential zone with high-rise build-up	443.13	450.82	-7.69
2	Residential zone with high-rise build-up *		80.67	
3	Residential zone with complex build-up	2516.39	2479.11	-37.28
4	Residential zone with complex build-up *		20.43	
5	Residential zone with medium-rise build-up	966.46	771.15	-195.31
6	Residential zone with medium-rise build-up *		46.11	
7	Residential zone with low-rise build-up	1827.08	1534.84	-292.24
8	Residential zone with low-rise build-up *		214.05	
9	Residential zone with low-rise build-up in nature environment	359.35	254.62	-104.73
10	Residential zone with low-rise build-up in nature environment *		77.23	
11	Residential zone with low-rise build-up under specific additional requirements	1410.48	1551.93	141.45
12	Residential zone with low-rise build-up under specific additional requirements *		25.24	
13	Residential zone with low-rise build-up in zones for preservation of the environment	508.8	335.74	173.06
14	Residential planning zone with low-rise build-up in zones for preservation of the environment *		234.16	
15	Summer-house zones	0.24	0.02	-0.22
	RESIDENTIAL AREAS TOTAL	8031.93	8076.12	44.19

№	Mixed areas for residence and services	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	City centre zone 1	15.49	55.24	39.75
2	City centre zone 2	319.32	266.28	-53.04
3	City centre zone 3	148.19	136.31	-11.88
4	Mixed multi-functional zone	849.45	1694.49	845.04
5	Mixed multi-functional zone 1	762.22	651.74	-110.48
6	Mixed multi-functional zone 2	192.61	246.1	53.49
	MIXED ZONES FOR RESIDENCE AND SERVICES TOTAL	2287.28	3050.16	762.88
№	Areas for public services	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Public services zone	856.01	994.39	138.38
2	Public services activities and greenery zone 1	581.91	311.36	-270.55
3	Public services activities and greenery zone 1 *		4.03	
4	Public services activities and greenery zone 2	95.49	173.5	78.01
5	Public services activities and greenery zone 2 *		20.13	
	AREAS FOR PUBLIC SERVICES TOTAL	1533.41	1503.41	-30.00

№	Industrial areas	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Industrial zone	17.08	80.64	63.56
2	Mixed industrial zone	1233.85	869.8	-364.05
3	Zone for SMEs	558.4	398.72	-159.68
4	Zone for high-tech industries	234.75	155.33	-79.42
5	Zone for high-tech industries *		34.4	
6	Zone for ore mining and quarries	71.18	70.09	-1.09
	INDUSTRIAL AREAS TOTAL	2115.26	1608.99	-506.27

№	Areas for utility yards and technical infrastructure	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Plots for service yards of the green system	7.9	2	-5.90
2	Plots for transport infrastructure	55.38	6.72	-48.66
3	Plots for railway transport infrastructure	364.66	339.72	-24.94
4	Plots for transport yards and depots	111.73	123.07	11.34
5	Plots for area sites of power supply	34.53	30.8	-3.73
6	Plots for area sites of the water supply and sewerage system	37.47	37.69	0.22
7	Plots for area sites of petrol, gas and heat pipelines	38.31	35.91	-2.40
	AREAS FOR UTILITY YARDS AND TECHNICAL INFRASTRUCTURE TOTAL	649.98	575.91	-74.07

№	Green areas and plots	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Zone for city parks and gardens	2481.58	2464.3	-17.28
2	Plots for local gardens and greenery	201.26	254.14	52.88
3	Plots for green strips and greenery along streets, rivers and gullies and open canals	539.67	528.27	-11.40
4	Plots for special-use green areas	162.76	163.61	0.85
5	Plots for cemeteries	187.98	208.11	20.13
6	Plots for cemeteries *		1.52	
7	Plots for decorative plant nurseries		2.35	
	GREEN AREAS AND PLOTS TOTAL	3573.25	3622.29	49.04

№	Areas for sports and entertainment	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Zone for sports and entertainment 1	88.98	153.2	64.22
2	Zone for sports and entertainment 2	273.68	213.68	-60.00
3	Plots specifically designated for sports and entertainment	45.09	43.56	-1.53
	AREAS FOR SPORTS AND ENTERTAINMENT TOTAL	407.75	410.44	2.69

№	Special-use plots	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Special-use plots	232.4	172.1	-60.30
	SPECIAL USE PLOTS TOTAL		172.1	

№	Rivers and open water areas	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Rivers and open water areas	42.49	42.74	0.25
	RIVERS AND OPEN WATER AREAS TOTAL	42.49	42.74	0.25

№	Agricultural areas	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Agricultural areas with permitted construction		0	
2	Agricultural areas with restriction on construction		58.62	
3	Agricultural areas under specific regulation and specific rules and norms	19.35	0	-19.35
	AGRICULTURAL AREAS TOTAL	19.35	58.62	39.27

№	Forest areas	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Recreation forests and land – green zone		0.37	
2	Recreation forests and land – green zone *		9.01	
	FOREST AREAS TOTAL	9.6	9.38	-0.22

№	Areas for protection of nature sites	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Nature parks	0	0.67	0.67
	AREAS FOR PROTECTION OF NATURE SITES TOTAL		0.67	0.67

	PLANNING CATEGORIES – Sofia Municipality	Total area 134 168 ha	Total area 134 168 ha	
		Population -1 300 000 inh.	Population - 1 485 617inh.	
	Comparative analysis of the green areas			
	Residential areas	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Residential zone with high-rise build-up	443.13	450.82	7.69
2	Residential zone with high-rise build-up *		80.67	
3	Residential zone with complex build-up	2573.74	2536.11	-37.63
4	Residential zone with complex build-up *		20.43	
5	Residential zone with medium-rise build-up	1054.47	847.65	-206.82
6	Residential zone with medium-rise build-up *		46.11	
7	Residential zone with low-rise build-up	5380.47	5115.91	-264.56
8	Residential zone with low-rise build-up *		229.7	
9	Residential zone with low-rise build-up in natural environment	985.06	908.3	-76.76
10	Residential zone with low-rise build-up in natural environment *		81	
11	Residential zone with low-rise build-up under specific additional requirements	2134.11	2285.91	151.8
12	Residential zone with low-rise build-up under specific additional requirements *		62.38	
13	Residential zone with low-rise build-up in zones for preservation of the environment	641.54	571.45	-70.09
14	Residential zone with low-rise build-up in zones for preservation of the environment *		319.69	
15	Summer-house zones	1998.05	2115.68	117.63
16	Summer-house zones *		4.52	
	RESIDENTIAL AREAS TOTAL	15210.57	15676.33	465.76

	Mixed areas for residence and services	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	City centre zone 1	15.49	55.24	39.75
2	City centre zone 2	319.32	266.28	-53.04
3	City centre zone 3	148.19	136.31	-11.88
4	Mixed multi-functional zone	849.45	1704.79	855.34
5	Mixed multi-functional zone 1	762.22	684.18	-78.04
6	Mixed multi-functional zone 2	1601.75	2187.76	
7	Mixed multi-functional zone 2 *		39.23	
	MIXED AREAS FOR RESIDENCE AND SERVICES TOTAL	3696.42	5073.8	1377.38
	Aras for public services	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Public services zone	1299.99	1344.15	44.16
2	Public services zone *		2.27	
3	Public services activities and greenery zone 1	1218.6	658.47	-560.13
4	Public services activities and greenery zone 1 *		4.03	
5	Public services activities and greenery zone 2	2518.59	584.76	-1933.83
6	Public services activities and greenery zone 2 *		46.89	
	AREAS FOR PUBLIC SERVICES TOTAL	5037.18	2640.57	-2396.61

	Industrial areas	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Industrial zone	924.42	1247.58	323.16
2	Mixed industrial zone	1778.24	1214.26	-563.98
3	Zone for SMEs	1580.35	1283.67	-296.68
4	Zone for high-tech industries	371.8	272.71	-99.09
5	Zone for high-tech industries *		34.4	
6	Plots for ore mining and quarries	722.79	648.93	-73.86
	INDUSTRIAL AREAS TOTAL	5377.6	4701.55	-676.05

	Plots for utility yards and technical infrastructure	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Plots for service yards of the green system	93.16	88.73	-4.43
2	Plots for transport infrastructure		1043.17	
3	Plots for railway transport infrastructure		659.54	
4	Plots for transport yards and depots		123.07	
5	Plots for area sites of power supply		63.45	
6	Plots for area sites of the water supply and sewerage system		177.28	
7	Plots for area sites of petrol, gas and heat pipelines		53.08	
8	Plots for landfills	552.96	670.66	117.7
	PLOTS FOR UTILITY YARDS AND TECHNICAL INFRASTRUCTURE TOTAL	646.12	2878.98	2232.86

	Green areas and plots	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Zone for city parks and gardens	4655.22	4377.52	-277.7
2	Zone for city parks and gardens *		79.48	
3	Zone for local gardens and greenery	446.63	470.25	23.62
4	Zones for green strips and greenery along streets, rivers and gullies, and open canals	4177.27	4667.53	490.26
5	Plots for special-use green areas	367.15	290.57	-76.58
6	Plots for cemeteries	293.91	373.42	79.51
7	Plots for cemeteries *	0.78	4.15	3.37
8	Plots for decorative plant nurseries	4.47	2.35	-2.12
	GREEN AREAS AND PLOTS TOTAL	9945.43	10265.26	319.83

	Areas for sports and entertainment	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Zone for sports and entertainment 1	121.75	168.04	46.29
2	Zone for sports and entertainment 2		17.54	
3	Zone for sports and entertainment 2 *	575.9	576.91	1.01
4	Plots specifically designated for sports and entertainment	392.26	401.01	8.75
	AREAS FOR SPORTS AND ENTERTAINMENT TOTAL	1089.91	1163.51	73.6

	Special-use plots	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Special-use plots		1028.97	
	SPECIAL UZE AREAS TOTAL		1028.97	

	Rivers and open water areas	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Rivers and open water areas		2999.51	
	RIVERS AND OPEN WATER AREAS TOTAL		2999.51	

	Agricultural areas	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Agricultural zone with permissible construction		365.52	
2	Agricultural zone with ban on construction		28199.45	
3	Agricultural zone under special regulation	5591.16	5378.43	-212.73
4	Agricultural zone under special regulation and specific rules and norms	2034.45	1921.49	-112.96
5	Agricultural zone for perennial plantations, plant nurseries etc..	349.66	309.4	-40.26
6	Plots for experimental agriculture (with R&D institutes)	57.33	69.96	12.63
	ОБЩО ЗЕМЕДЕЛСКИ ТЕРИТОРИИ	8032.6	36244.25	28211.65

	Forest areas	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Protected forests and land	31.16	31.1	-0.06
2	Recreation forests and land – green zone	31719.57	31637.67	-81.9
3	Recreation forests and land – green zone *		64.06	
4	Forest parks	1169.5	1165.3	-4.2
5	State game reservation	3371.64	3365.16	-6.48
6	Plots for plant nurseries	14.15	8.6	-5.55
	FOREST AREAS TOTAL	36306.02	36271.89	-34.13

	Areas for protection of nature sites	Current Master Plan (ha)	Master Plan Amendment (ha)	Difference (ha)
1	Protected localities, nature landmarks, etc.	264,9	246,91	-17,99
2	Nature parks	10026,03	10026,73	0,7
3	Nature reservations	1854,87	1854,91	0,04
	AREAS FOR PROTECTION OF NATURE SITES	12145,8	12128,55	-17,25