

ANNEX 3

SOFIA'S DEVELOPMENT AND SPATIAL STRUCTURE

1. Introduction

1. Municipal objectives have implications for Sofia's spatial structure. The objectives are by definition political. They represent priorities and trade-offs that are specific to the constituency of the elected Municipal authority. As a result, discussing the choice of objectives from a purely technical point of view makes little sense. In contrast with the selection of objectives, the design of a strategy together with its implementation tools – regulations and infrastructure investments – is a technical task that can be subjected to a critical effectiveness test.

2. The CDS needs to complement the work done by the Master plan team and to provide a framework to analyze the spatial organization of Sofia and the implications of a zoning map. First, the planning objectives implicit in the work done so far on Sofia's Master plan are taken as given. The explicit spatial implications contained in the objectives will be analyzed and compared to the current spatial distribution of people and land use. Ideally the study of the spatial organization of a city should include both population and jobs; however, no data on job location and job densities in Sofia were available at the time of this study. The map of current and projected land use will have to be taken as a proxy for the spatial distribution of jobs. The analysis presented here is therefore limited to the spatial distribution of population. The analysis of the spatial structure of a metropolitan area should also include current trends derived from the spatial distribution of land prices, rents and building permit requests. At this moment, this information is not available in Sofia. Part of the Master plan exercise should be to complete the database already collected by adding trends indicators based on the spatial distribution of market prices.

3. From an economic point of view, a city is a large labor and consumer market; the larger the size of the market and the lower the costs of transactions, the more prosperous is the economy. A deficient spatial structure might fragment labor and consumer markets into smaller less efficient markets; it would contribute also to higher transactions costs by unnecessarily increasing distances between people and places. A deficient spatial structure increases the length of the city infrastructure network and therefore increases its capital and operating costs. A deficient spatial structure can render a city economically uncompetitive. From an environmental point of view, a deficient spatial structure decreases the quality of life by increasing the time spent on transport, by increasing pollution, and by contributing to the unnecessary expansion of urbanized areas in natural sites. A poor environmental quality could also contribute to render a city economically uncompetitive.

4. A city's spatial structure is constantly evolving. Because of a lack of political consensus or a clear vision on spatial development, the combined effect of land use regulations and infrastructure investments may be inconsistent and contradict each other. It is therefore important that municipalities monitor the spatial trends of development and take regulatory remedial action if this trend contradicts municipal objectives. In market economies, municipalities can influence the shape of urban development, not through direct design, but by implementing a coherent and consistent system of land use regulations, infrastructure investments, and land related taxes. However, in the long run, the shape of a city will depend on the way the real estate market reacts to the incentives and disincentives created by these regulations, infrastructure investments and taxes. Because external economic conditions are continuously changing and are unpredictable in the long term, the planning

department of municipalities should constantly monitor the evolution the urban spatial structure, and adjust eventually the balance and nature of regulatory incentives and disincentives.

2. Municipal Development Objectives and Spatial Strategy

Municipal objectives	Sectoral policies proposed to meet objectives
<p>Economic objectives</p> <p>Increasing the competitiveness of Sofia's economy in Europe</p> <p>Maximizing employment opportunities for all residents</p> <p>Developing the service sector</p>	<p><i>Improving the functioning of real estate markets</i> <i>Reinforcing the attraction of the city center</i></p> <p><i>Avoiding a spatial fragmentation of the labor market</i> <i>Improving public transport by reducing trip time</i></p> <p><i>Allowing the renovation and conversion of existing buildings into small offices</i></p>
<p>Social objectives</p> <p>Promoting a better urban environment for the most deprived social groups</p> <p>Improving the maintenance of the housing stock</p>	<p><i>Improving maintenance and social services in targeted areas</i> <i>Improving the performance of public transport</i></p> <p><i>Testing the economic feasibility of improving panel housing in selected areas</i> <i>Reviewing the condominium legislation</i></p>
<p>Environmental and cultural objectives</p> <p>Protecting Sofia's cultural resources</p> <p>Protecting the environment</p>	<p><i>Creating a protection perimeter around the most important monuments</i> <i>Investing in renovation and maintenance of cultural monuments</i></p> <p><i>Preventing an increase in air pollution due to transport by maintaining a high use of public transport</i> <i>Preventing that street space in the center be transformed into free public parking</i> <i>Creating a protection perimeter and special land use legislation around mineral water springs</i> <i>Protecting mountain and forest areas in the periphery of the city.</i></p>

Box 1: Municipal Objectives

5. A summary of Sofia development objectives can be extracted from current Master Plan documents. Specific spatial development strategies and policies are needed to support the implementation of municipal objectives. Given the unique characteristics of Sofia's spatial structure these objectives translate into a set of strategic directions, which have been identified by the Bank CDS team. The following sections highlight the most salient characteristics of Sofia's spatial structure and identify a number of spatial conflicts and constraints to implement the municipal objectives specified in Box 1. The analysis highlights particular challenges that need to be addressed to ensure the consistency between the broader economic, social and environmental objectives and the policies that will need to be in place.

Current spatial structure

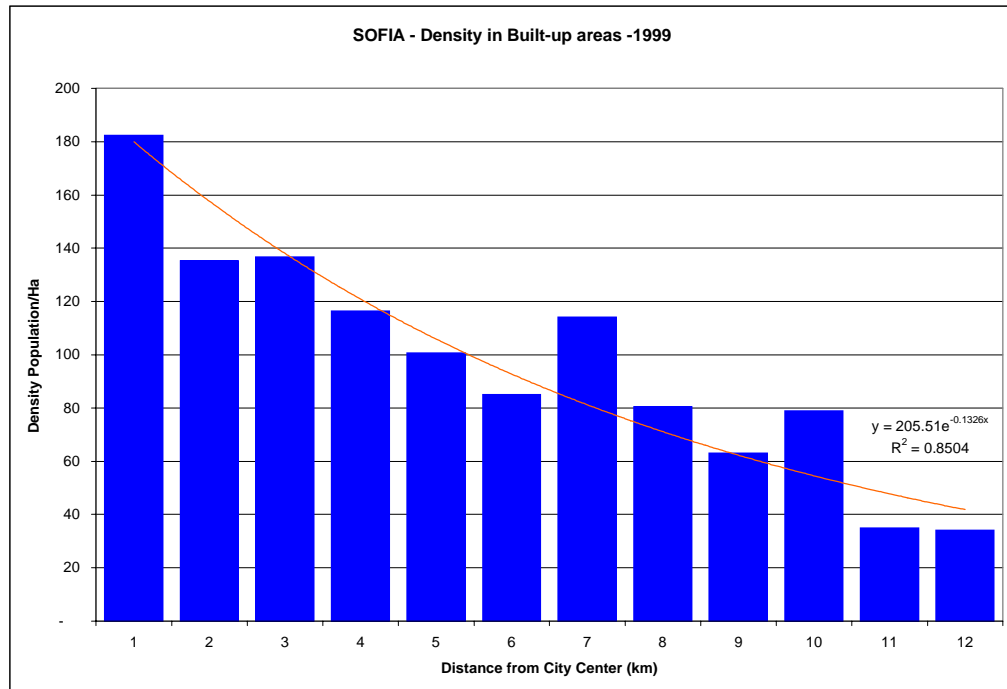
6. The spatial distribution of the population of Sofia within the metropolitan area is the most important feature of Sofia's spatial structure. The distribution of land use is the next most important feature because land use is linked to employment and daily trips. Both population distribution and land use are extremely resilient, i.e. these features change only very slowly and bear the mark of the

city's history. Some historical marks are positive – the historical monuments witness of Sofia's rich cultural heritage. Others are negative – panel housing and large obsolete industrial areas.

7. **Density and distribution of population.** The average population density in the built-up area of Sofia is about 80 persons per hectare. This is a density similar to other capital cities of central Europe. However, at 8 km from the city center, pockets of very large densities in the large high-rise residential areas of the North West (some areas above 400 people /hectare) and South West (up to 500 p/ha) contribute to the dispersion of the population. It is also anticipated that apartments located in these high density peripheral areas will progressively loose their market value because of high maintenance costs required by panel housing combined to their distant location. By contrast, individual housing or town house types will probably gain value in these peripheral areas.

Sofia – Land Use in the Built-Up Area					
		Area (Ha)	%	Area (Ha)	%
	Housing				
	Housing 3 storeys or less on individual lots	3,663	26%		
	Housing estates medium and high density	2,435	17%		
	Individual parcels with medium and low density	307	2%		
	Mixed housing in individual lots	1,177	8%		
	Summer housing and villas	962	7%		
	Total Housing			8,543	61%
	Industrial Use				
	Industrial	2,850	20%		
	Technical Infrastructure	403	3%		
	Total Industrial			3,253	23%
	CBD, Business and administration				
	Administration and Business	1,250	9%		
	City Center	248	2%		
	Total CBD, Business and administration			1,498	11%
	Transport				
	Railways	245	2%		
	Roads and Street	217	2%		
	Total Transport				
	Sports and entertainment				
	Sports and entertainment	273	2%		
	Total Sports and entertainment			273	2%
		14,029	100%	14,029	100%
Source: This land use distribution corresponds to the areas extracted from the digital map provided by Master Plan department on May 4, 2001					

8. **The profile of density** (Figure 1) measured by concentric circle of 1 km from the city center shows that in spite of the pockets of high density mentioned above, the overall profile of density is not too different from what would be expected in a city developed entirely under a market economy. The distribution of population per density shows the great majority of population of Sofia is living in high-density neighborhood (73% of population in neighborhood of more than 150 p/ha). The average distance per person to the center is 4.4 km. With a built-up area of 107 km², this give a dispersion index of 1.15, which is on the high side for a European city (see comparison with other European cities in section below). While Sofia is among the densest cities of Europe, it is not very compact for its size. This is due to the dispersion caused by the high density in some peripheral areas.



9. **Land use.** Sofia is well provided with large parks well distributed within the built-up areas (Figure 2). The existence of these parks makes the high density more acceptable. However the industrial areas (20% of the built-up area) are abnormally large compared to other European cities (average between 5 to 8%). In addition, a large amount of industrial land is located close to the city center: 34% of the developed land is industrial at 4km from the city center. Large areas devoted to industries are typical of socialist economies. In market economies, the high price of land in large cities tends to push industries in far away suburbs or in secondary cities. This large amount of industrial area in key location is both a liability and an opportunity. It is a liability because redevelopment of large industrial area is costly and requires government intervention and investment in infrastructure. It is also an opportunity because, after reconversion, it allows a redistribution of land use responding to current demand for office, commercial and residential space.

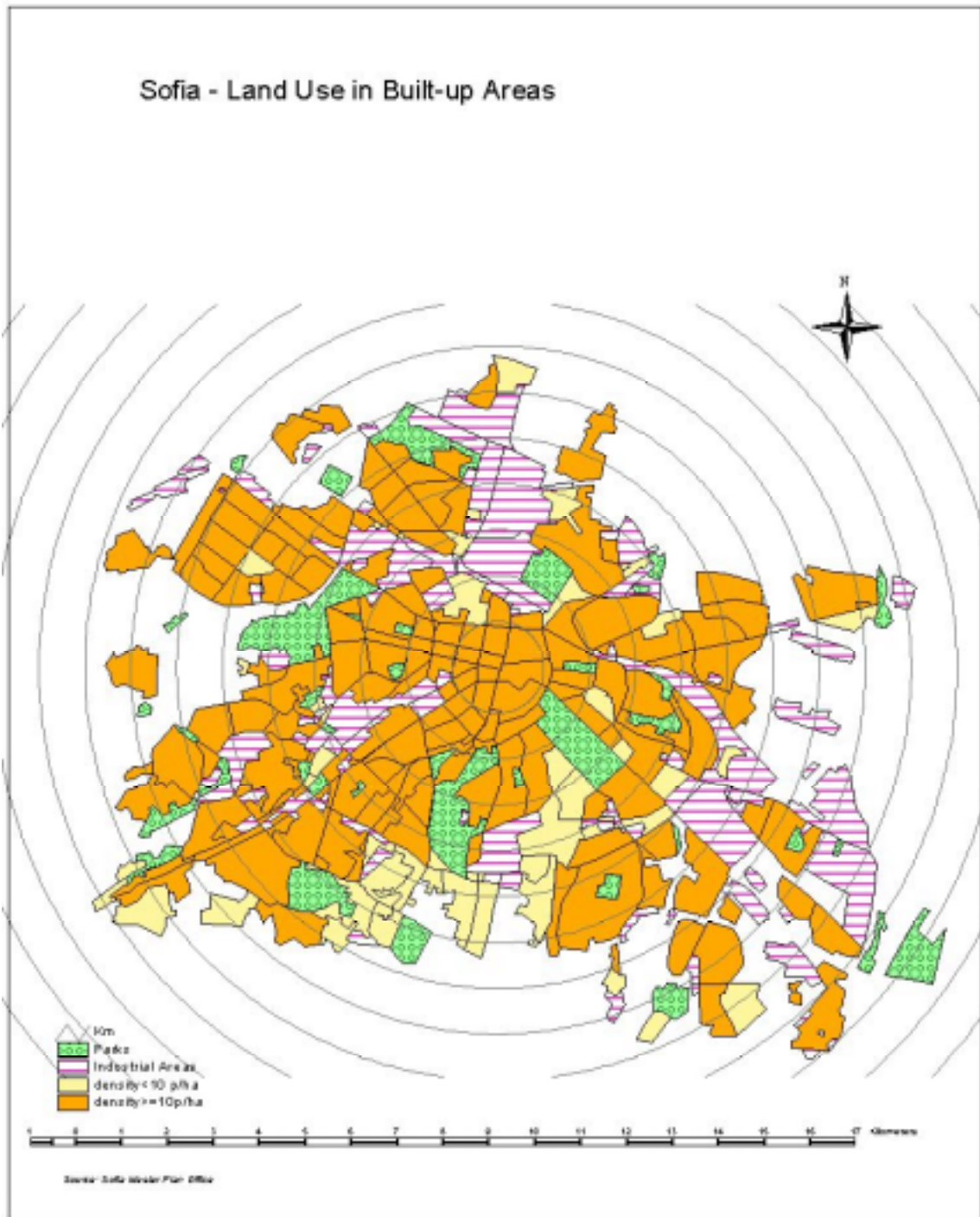


Figure 2: Land Use

10. **Transport time.** A study commissioned by the Master Plan department of Sofia in 1998, 1999 and 2000 evaluated the distribution of transport time per trip to work. However, because of differences in sampling techniques it is difficult to identify with certainty the trend in mode split and mean commuting time. Trips with public transport represent about 65% of all trips of which only 3.3% are with the metro. The objective of the municipality is to maintain a very high public transport usage in order to maximize air pollution and to maintain the cultural preeminence of the city centre. While the percentage of trips with public transport has decreased to some extent, the median commuting time to work is 30 minutes by public transport and 27 minutes by car. This suggests that public transport maintains some competitiveness. Car ownership in Sofia is getting close to one per household. As incomes grow, more households will find it convenient to commute by car, for this reason the performance of public transport needs to be monitored on a regular basis and its performance enhanced.

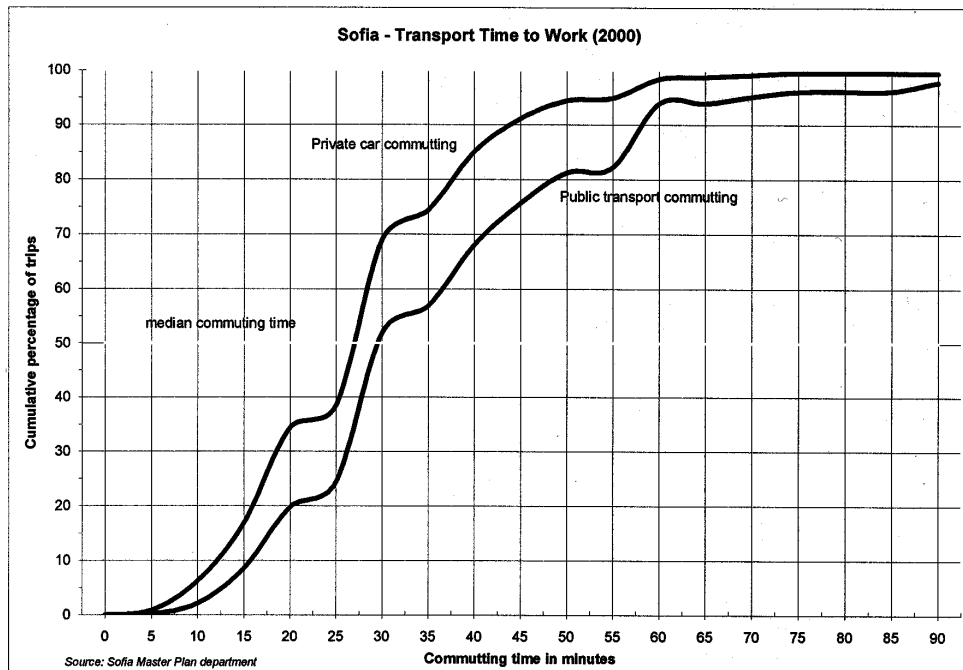
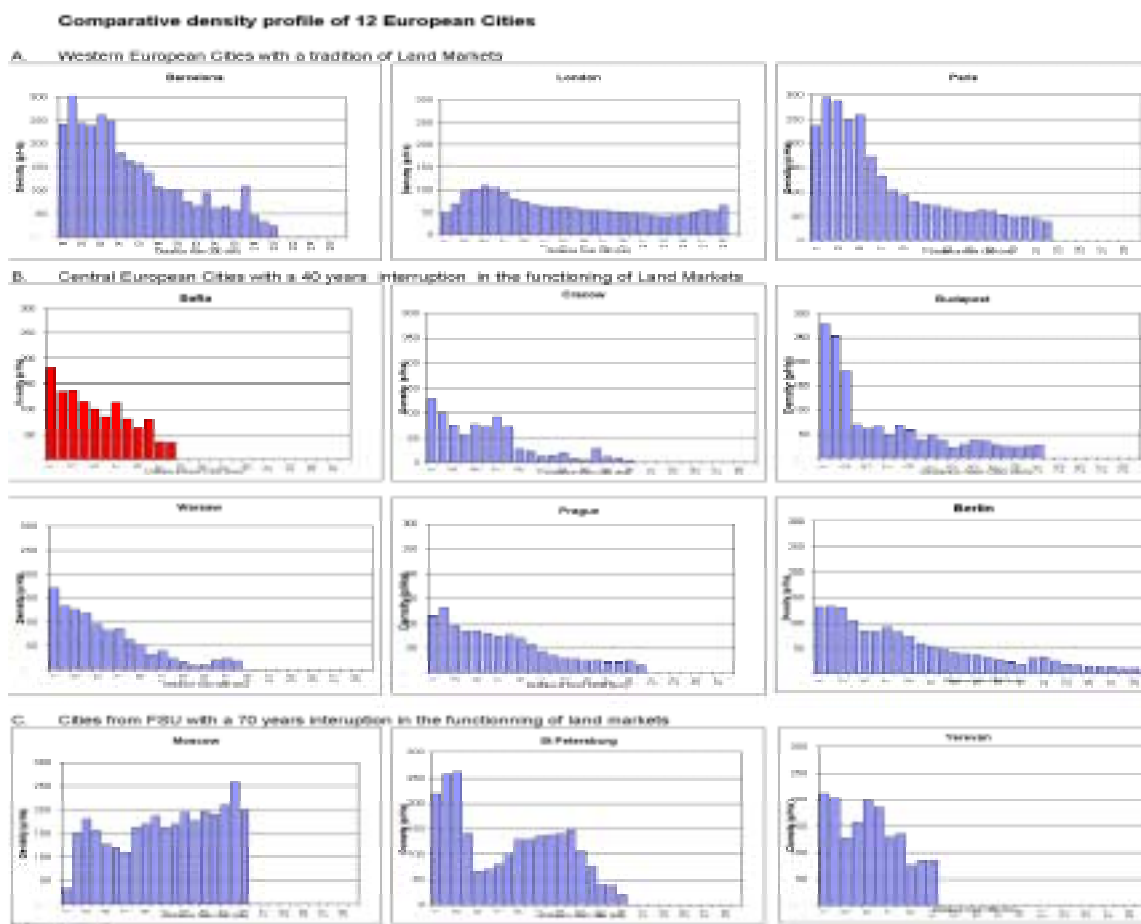


Figure 3: Sofia – Commuting time per mode of travel

Sofia's spatial indicators in comparative perspective

11. **Average density.** The average density in the built-up area of Sofia is similar to the average of Warsaw, Paris and Prague. As in other European cities, Sofia's density is likely to further decrease in the future. The transformation of apartments into office space, a desirable trend in the city centre, will further decrease the density in the future and therefore add to the dispersion.

Figure 4: Comparative Density Profile



12. **Comparative density profile.** Sofia population density profile is not too different from the other cities of Central Europe with the exception of Budapest, where the density in the downtown area is more than double the density of Sofia (Figure 4). However densities stay high in the suburbs compared to other cities, this reflects the predominance of high-rise apartments in the housing stock.

13. **Cumulative population by distance to center.** The total number of people living within 5km from the center of Sofia is about 700,000 people. London, Berlin, and Warsaw have about the same number. Sofia fares well, therefore, in terms of immediate accessibility to the city center.

14. **Dispersion index.** With a dispersion index of 1.15 Sofia is in the high range of dispersion, which indicates an inefficient land use. Nevertheless, some cities of central Europe –Cracow, Ljubljana, and Prague – are in the same range (Figure 5). This dispersion is caused by high-density residential neighborhoods in far away suburbs.

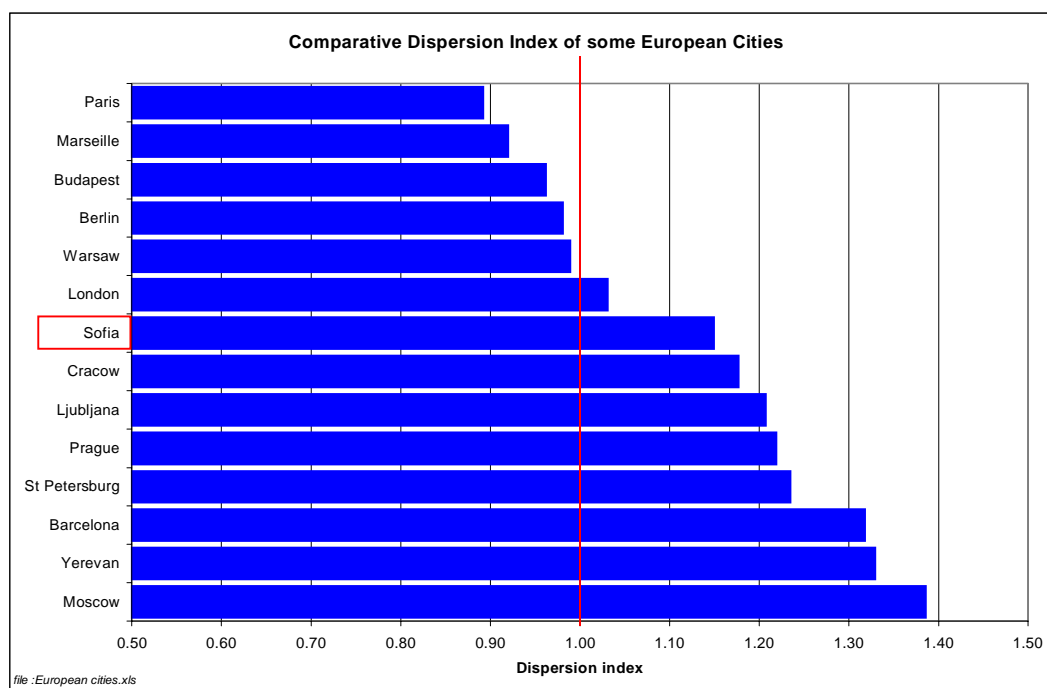


Figure 5: Comparative Dispersion Index

3. Major Spatial Issues to be Addressed

15. To improve the efficiency of Sofia's spatial structure the urban planning component of the CDS needs to address a wide range of issues that are analyzed in the following section.

16. **Inefficient real estate markets.** There is some anecdotal evidence that the difficulties involved in renewing and redeveloping land in the center city contribute to push business activities toward the periphery. For instance, while the city center is well served by public transport, it is the final destination of only 18% of all work trips. This suggests that land in the city center is underutilized and that employment is dispersed, weakening the economic role of the center city. The transformation of land use in the center city in particular, and in the entire city in general, should be one of the main aims of the planning strategy. Land ownership pattern in the city might be an obstacle to the functioning of real estate markets, either because land titles are uncertain, or because land belongs to the government and is therefore not on the market, whether it is in use or not.

17. The government should consider the sale of that land over time, particularly if it is not used for a legitimate government function. Using rents on government real estate property as means to generate revenues in lieu of taxes is usually counterproductive. The yield of commercially leased government property is usually small because rents are subject to political pressure by various interest groups. Government involvement in direct real estate operation is always suspected of corruption. The private sector is more likely to use land at its highest and best use, therefore generating a flow of business and property taxes higher than the flow generated by properties directly leased by government. Finally, the private sector will be able to optimize the use of land in the city only if transaction costs are low enough to justify financially the change of use.

18. **Constrained development in the city center.** All European capitals have a strong multifunctional city center where business, retail, culture, and entertainment coexist and reinforce

each other. Many cities also have high residential densities and a high accessibility to the city center. For instance, Sofia has about 700,000 people living within 5 km from the city center, a number similar to Berlin, Budapest, London, and Warsaw. Centers of European capital cities are the object of constant changes and transformation; they are the country's showcase for design, innovation, art, culture and fashion. This is possible by maintaining a delicate balance between preserving the historical patrimony and allowing changes to display what is the most innovative in the country. However, because of the absence of a land market for half a century, many cities of Central Europe pose administrative and legal hurdles when confronted with increasing new demand for office building and retail space. Consequently, many of the most prestigious activities move to the suburbs where they can develop more easily on former agricultural land. While it is normal for large cities to become polycentric over time, the role of suburban sub-centers should be to receive businesses that are overflowing from the city center, but not to substitute for the business functions of the center.

19. In Sofia, there is a real danger that if redevelopment of land in the center was to become increasingly more difficult, most modern retail activity and modern office building will move to the periphery, not because this location is better for their operation but because it is the only location available for modern facilities. The functioning of the city center is affected by recent growth in car ownership. The lack of parking fees along city streets constitutes a subsidy to private car use in the city center and therefore contradicts the municipal objective to maintain a high ratio of public transport use. Further, the lack of clear parking policy paralyzes both car and pedestrian traffic and discourages private solutions for off-street parking.

20. **Fragmentation in the labour market.** The attraction of Sofia for international investors is the size and quality of its labor market. The larger the size of the market the more attractive is the location. However, the size of the labor force is not necessarily equivalent to the size of the labor market. The possibility for the labor force to reach any location of the metropolitan area in less than an hour is usually a rule of thumb to evaluate the effective size of the labor market. If public transport and communication between different parts of the city is difficult or too expensive, the labor market becomes fragmented into smaller geographical submarkets. For the same size of the total labor force, the return on investments in a fragmented labor force is smaller than for a unified one.

21. **Lack of office space.** In Sofia, the emerging service sector has problems finding suitable space. Small firms requiring rental of office units often below 100 m² constitute the majority of demand for office space in this sector. As there were practically no office buildings offering such small units before 1990, it is often difficult for these firms to find accommodations. This slows the growth of employment in the sector. The possibility of transforming apartments into office building should not be hindered by regulations or by the difficulty of the process itself. It is true that eventually the transformation of apartments into office building will decrease density in the central area of the city, but the benefit of creating new employment and new economic activity outweigh the cost of losing apartment units. As most households own their apartment in Sofia, there is no fear that households will be displaced without compensation. On the contrary, higher rents paid by offices could easily finance an expansion or a renovation of the existing housing stock.

22. **Urban decline.** Some areas in Sofia experience a process of rapid urban decline and social deprivation. For example, a large area located to the north of the railway station and railway yards are deteriorating rapidly due to its proximity to industrial zones and railway yards. Its poor quality housing has made it particularly unattractive to investors. There have been practically no real estate transactions in this part of the city. Despite its proximity to the city center, accessibility is poor. Removing the physical barriers formed by the railway yards and the industries, and integrating the neighborhood with the rest of the city would require heavy investment in infrastructure, which are

beyond the means of the municipality at this moment. Renovation of individual buildings is probably not economically feasible either because the market price might well be below the cost of the renovation. The redevelopment of the industrial areas will be feasible only when rents and land value in the center will have reached a much higher level than at present. The proximity of the northern district from the center will then make it feasible to remove and redevelop some industrial area. Meanwhile the municipality should concentrate in helping the population living in the northern district through an increase in the quality of social services.

23. **Deteriorating housing stock.** A large number of households are living in high-rise panel housing. The maintenance of this type of housing is particularly expensive. At the same time the quality of life of the inhabitants is more sensitive to deterioration in the maintenance of panel housing than in other sort of housing. Because of a large part of the housing stock is constituted by panel housing it is not possible at this time to progressively phase them out (as it is being done in western Europe for public housing using a similar technology and built in the sixties). It is therefore important to find an economically feasible solution, which would improve the comfort of panel housing during the next decade or so, before they can be phased out. In addition, large residential buildings suffer from a lack of maintenance. Normally, the maintenance is the responsibility of apartment owners. Because of the lack of traditions of managing condominium associations in Bulgaria, maintenance is often poor or non-existent.

4. Policy Directions for Planning and Spatial Development

The urban component of Sofia City Development Strategy

24. The analysis of Sofia's spatial structure has identified major problems in the city, as well as conflicts between the municipal objectives guiding the preparation of the Master Plan and future spatial development. The urban component of Sofia's City Development Strategy needs to address these challenges through new land use regulations, infrastructure investments and improved performance in the delivery of public services. The sections that follow discuss specific policies that need to become an integral part of the Sofia's CDS so that the municipal objectives specified in Box 1 could be efficiently implemented.

Policies to implement economic, social and environmental development objectives

With respect to ***increasing the competitiveness of Sofia's economy*** in Europe three aspects are critical: i) improving the functioning of real estate markets, ii) reinforcing the attraction of the city center, and iii) improving access to employment opportunities for all residents.

25. **Improving the functioning of real estate markets.** Most of the land use changes, which will be required to make Sofia economically competitive with other capitals of Europe, will be made by the private sector, not by blue prints developed by the government. Because the real estate market will be the main engine of change, the government has a key role to play in facilitating its efficient operation through adequate land use regulations, efficient tenure transfer procedures and supportive municipal services and infrastructure. Due to relatively moderate demographic growth in the future, most of the land use change in Sofia will have to occur within the existing built-up area rather than through large development of new green field areas. The main role of the municipal government will be to facilitate this demand driven transformation of land use. Allowing and facilitating the recycling of already developed land should be the main theme of the spatial municipal strategy. Some extension of low-density residential areas will of course be needed in suburban areas, but they should

be limited and should receive a lower priority than the transformation of land use in the current built-up area.

26. The real estate strategy of the municipal government should increase the number of transactions, and make every effort to reduce transaction costs. This includes reviewing of: (i) the process and fees applied to register property sale, (ii) the building permit and land subdivision and assembly process, and (iii) the taxes levied on real estate capital gains.

27. **Increasing the vitality and attractiveness of the city center.** Some of the measure to allow more efficient operation of real estate markets will have a positive impact on the city center. However, the municipality will have to undertake some additional actions such as policies that deal with parking, as well as policies that promote a new more active role for the maintenance and the activities of its cultural monuments. Sofia Municipality should also try to instill new life in public monuments by opening them to alternative uses or by using their prestigious architectural space for concerts or exhibitions. The city of Prague has been particularly innovative in this domain. The National Historical Museum in Sofia for instance is particularly well located to fill this role. Temporary exhibitions could also increase the revenue of these institutions.

28. Redesigned sidewalks and pedestrian space combined with to off-street public parking, municipal or privately operated, would contribute to higher economic activity in the city center. A number of experiments with this reallocation of public space have been conducted with some success in Warsaw¹, Budapest and Prague. The value of redesigned space affects real estate prices of properties along streets and plazas.

29. These policies converge towards one aim: providing new life and prestige to the city center. This will prevent the dispersion of jobs and cultural activities into suburban areas, which are outside the reach of the public transport network. The revitalization and intensification of the city center meets in fact several objectives: it makes Sofia economically more competitive among European capital cities and improves the quality of the urban environment by reducing pollution due to transport.

30. **Maximizing access to employment opportunities for Sofia residents.** Better and more efficient public transport can counteract the existing spatial fragmentation in Sofia's labour market. Improved sector performance should have as a major goal reduction in the median public transport trip time below the present level of 42 minutes. This will simultaneously (i) improve employment opportunities and productivity of the population using public transport and (ii) increase the competitiveness of public transport as opposed to private transportation, which reduces traffic congestion and environmental pollution.

31. With respect to the **social municipal objectives** two aspects are important: i) promoting a better environment for the most deprived social groups through improved social services in targeted areas, and ii) improving the maintenance of the housing stock through pilot projects that test the economic feasibility to rehabilitate panel housing.

32. **Promoting a better urban environment for the most deprived social groups.** This objective can be achieved through improvement of maintenance and social services in targeted areas. A survey is under way to determine the extent of the problem in areas inhabited by the poorest social group in Sofia and to identify deficiencies in housing and service standards. The result of the survey

¹ The redesign of Nowy Swiat in Warsaw has resulted in an increase in the value of commercial leases comparable to the most prestigious streets of capital cities in Western Europe. Well-conceived property taxes can rapidly recover the cost of investment.

will allow developing an action plan and programs to deal with these issues in a participatory manner.

33. **Improving the maintenance of the existing housing stock.** The first step is to explore technical, financial and organizational alternatives to carry out routine maintenance and minor repairs. The economic feasibility of improving panel housing in selected areas through energy retrofits needs to be examined and tested through pilot projects.

34. **Protecting Sofia cultural resources** – policies need to focus on the following aspects:

- ❑ *Creating a protection perimeter around the most important monuments.* This could specify clearly the type of structure, type of use and intensity of use allowed. It will have the double effect of protecting Sofia historical past and clarifying property rights.
- ❑ *Invest in renovation and maintenance of cultural monuments.* The enhancement of monuments will reinforce the image of Sofia and will improve the environment and attraction of the city center.

35. **Protecting Sofia's environment** – policies could focus on:

- ❑ *Creating special land use legislation for areas around mineral water springs.* Sofia metropolitan area is surrounded by mineral springs which require special land use legislation to be preserved. It should be done as part of the overall zoning plan of Sofia.
- ❑ *Protecting the urban forest and the natural habitat in the periphery of the city.* While land use should be demand driven in most areas of the city, it is important to establish quickly as part of the zoning plan the perimeter of natural areas such as mountains and forest, which should be protected from urbanization.

Planning tools to assist the implementation process

36. The municipality of Sofia has only 2 tools at its disposal to modify current spatial structure and to assist the implementation of policies discussed above -- land use regulations (zoning) and primary infrastructure investments. The preparation of the zoning plan and the identification of infrastructure investments are part of the ongoing Master plan process. We are only providing here some methodological guidelines to insure consistency between the municipal objectives and the spatial component of Sofia CDS.

37. **Land use regulatory framework (zoning plan).** The zoning plan has 2 objectives: the first is to reinforce property rights and to improve the operations of markets by making explicit the right to built attached to every parcel of land in Sofia; the second is to protect public goods, i.e. to show the limit of property rights in clearly identified and limited areas in order to preserve valuable environmental or historical sites.

Box 2: The Zoning Plan

The design of the zoning map should include the following steps:

1. Building of a spatial model of the current and future distribution of population and type of land use in the metropolitan area, using municipal objective and the strategy described above. (A simplified version of such a model is presented on Figure 8)
2. Drawing the boundaries around all the sites to be protected for environmental or cultural reasons.
3. Formulating the regulations restricting property rights within these boundaries.
4. Drawing of boundaries around all special zones: polluting industries, airport and land reserves for expansion, noise nuisances, railway yards, utilities, water bodies not already included in 2.
5. Spatial analysis of the land use restrictions imposed so far on all the land parcels within municipal boundaries, comparison with the model prepared in 1.
6. Definition of land use rights in all the areas that have not been included into boundaries 2. or 4. Land use rights in these areas should be guided by discernable market trends. The intensity of use allowed should be higher than the one already used to provide flexibility.
7. Calculation of land use distribution and densities following the maximum building intensity allowed within each zone.
8. Iteration of the model prepared in 1. to verify that the land use type and intensity of development allowed by the zoning is consistent with the objectives.
9. Preparation of a detailed zoning map at scale 1/1000.

38. **Infrastructure investments.** The master plan team will identify infrastructure investments that are the most consistent with the municipal objectives. The team will try to anticipate the effect of the proposed investments on land prices and rents. It will also check the consistency between the type and intensity of use allowed by zoning and the optimum use of infrastructure investments.

39. **Indicators, projection and monitoring tasks.** Indicators should be prepared, ideally for each level of urban boundaries: built-up area (compact city), municipal boundary, and oblast. In some cases, one level could be omitted, or the level of accuracy could be different depending on the boundary level. A number of indicators prepared in the economic component will be used as input in the spatial indicators (households' income distribution, Sofia GDP growth rate, municipal investment budget, etc). The indicators will be used to: (i) identify recent trends, (ii) project realistic target values for the future, and (iii) monitor change and modify targets accordingly.

40. The Bank CDS team recommends the following sets of indicators to be developed to monitor the implementation of the CDS (Box 3): The value of the indicators should be periodically updated and published to allow the public to participate in a debate over the development of the city.

Direction taken by spatial indicators indicating that Municipal Objectives are being met

This table should be completed when the strategy has been adopted

		Trend in indicator value to meet Municipal Objectives		
		in city center	at 5km from center	in City periphery
1) Real estate market indicators	o Land price map, land price gradient			
	o Rent map, disaggregated by type (residential, office, commercial, etc)			
	o Area of land owned by the government or municipality not used for government function.			
	o Area of vacant land ready for development by distance to city center.			
	o Number of residential unit transaction per year			
	o Vacancy rate, housing, offices, retail.			
	o Average dwelling size, m2 of floor per person			
	o Average rent/m2			
	o Average price to income ratio			
	o Households income distribution, median household income			
	o Cost of construction/m2			
	o Spatial distribution of building permits, occupancy permits.			
	2) Land use indicators	o Size of built-up area, % per type of use		
o Land use distribution per distance to city center				
o Average density in built up area				
3) Spatial indicators	o Density gradient			
	o Average distance per person to CBD			
	o Population dispersion index			
	o Spatial land use model: density, developable land and population by distance from city center			
4) Transport indicators	o Average and median trip time for various mode of transport			
	o Average length of trips			
	o Isochrones from city center for public transport and private car trips,			
	o Number of persons within isochrones.			

Box 3: Spatial Indicators

41. The simple land use model in Figure 6 illustrates how municipal objectives can be translated into a spatial policy that can be monitored by indicators. The graphs and tables are showing the land use and spatial distribution of population in 1999 and in 2015. On the graph, blue bars show the 1999, while a red line shows the projection for 2015. The first graph shows the density change; the second shows the land use changes and the third the distribution of population by distance to the city center. In the scenario used in the model, it has been assumed that Sofia population increase by 10% over 15 years, industrial land decreases by 25%, Sofia built-up area increases only by 3%. These figures are used for illustration purpose and do not represent a recommendation. Under this scenario, population density decreases in the center because of the development of new office and commercial space; however density increases between 2nd and 5th km from the center because of residential redevelopment in brownfield industrial areas. Finally, about 4 km² of currently vacant land is developed in the suburbs into low-density housing. The average distance per person decreases by about 4% in spite of the increase in population and developed area. This scenario, one among many, would be consistent with an intensive use of public transport and a city staying strongly monocentric.

Figure 6: Modeling Future Densities and Land Uses

