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Interregional Seminar on Industrial Location
and Regional Development
Minsk, August 1968

DATA REQUIREMENTS FOR INDUSTRIAL LOCATION[1/]

by

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SUMMARY

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1. Policies aimed at effective dispersion of industries are often hindered by the lack of a comprehensive system of information on space that would give needed data on conditions in all areas throughout an entire country.

2. The urgent need of an effective system appeared first in highly industrialized countries where severe disturbances of natural, technical and economic conditions of life in general exhausted resources, contaminated the atmosphere, polluted waters, caused excessive noise and created general disequilibrium.

3. Such an unhealthy development takes place as the result of excessive concentration of industry in areas without taking into account the requirements of harmonious development. When this occurs the result is increasing investment in reconstruction of utilities in vast areas. This situation could be avoided if, in the industrial projection, spatial aspects were given proper attention.

4. The purpose of this study is to outline a system for collection and classification of data on natural, technical and economic conditions of space. This system is a graphic and tabular one. It continuously supplies information which provides background material for making decisions on the distribution of industries. The system has been recently worked out in Czechoslovakia and is known as the "General spatial project of the State".

5. In chapter I of the paper the substance of the spatial classification system is explored, individual types of projects are outlined and their relationship to the national economy is discussed. In chapter II the methods of elaboration and permanent actualization of the documentation system are describe In chapter III the possibilities and ways of applying the system are discussed. Appendices I and II include models of tables and charts that are applie in the tabular and graphic parts of the classification system.

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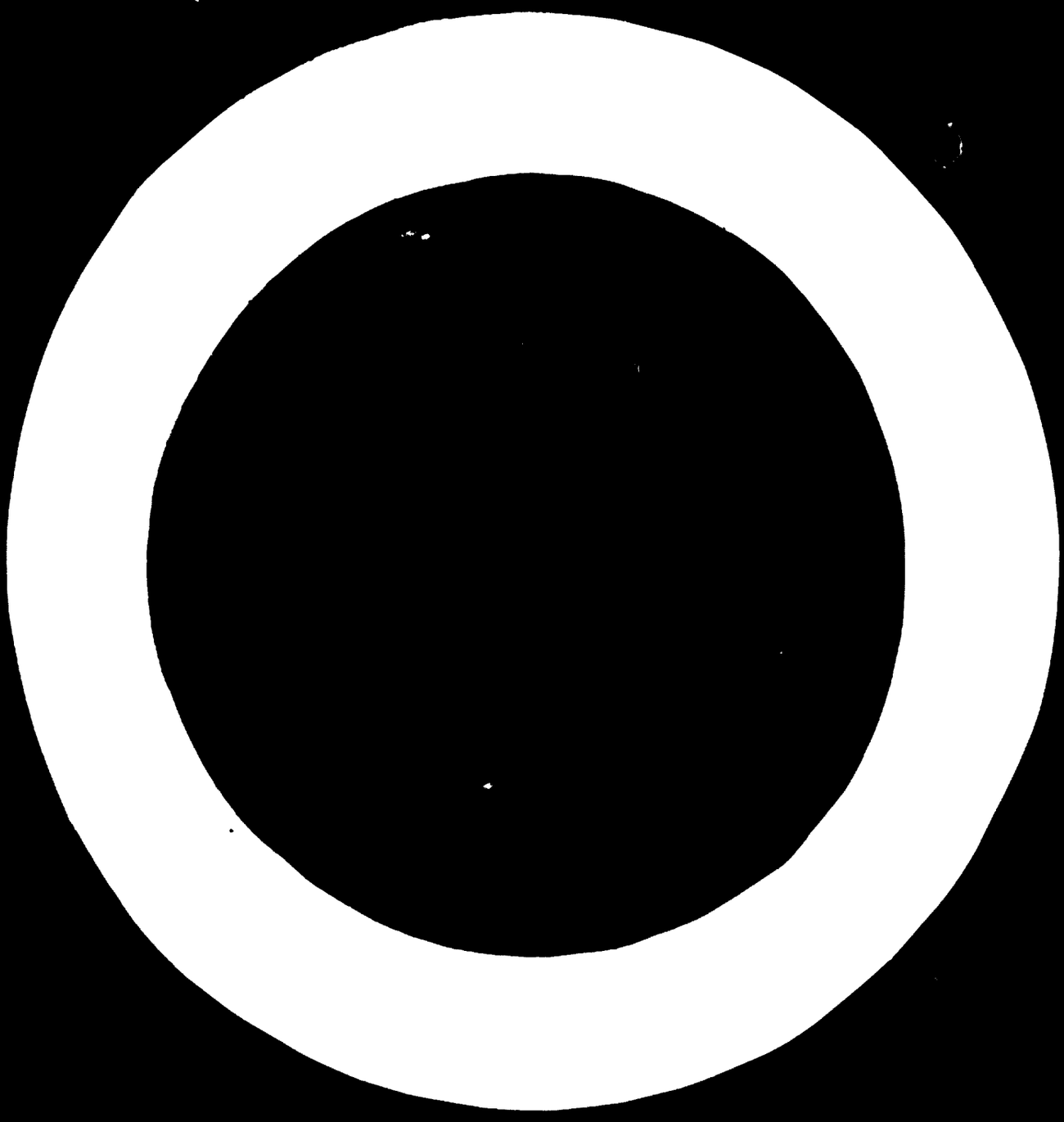


Introduction

1. One of the serious problems of locating industrial projects and planning regional development is the lack of data and information. The problem is not so much that the quantity of data is inadequate, but that the available data are often incomplete as to time, space and other required aspects. The data are not framed in a coherent system which would enable long-term evaluations to be made of spatial requirements for the advantageous and suitable distribution of industry. Moreover, the existing information is dispersed in various institutions. The result is that undue weights are sometimes attached to narrow local aspects and the application of a uniform procedure from the national point of view becomes impossible.

2. The seriousness of the lack of coherent systems of data for spatial planning has become evident in recent years when it has become urgently necessary to ensure an equilibrium of natural, technical and economic conditions for the people within a certain area.

3. Only recently have urbanization and spatial economics dealt with the question of how to remedy the damages caused by the uneven development of industry in traditional regions (e.g. exhausted resources, air and water pollution, problems of transport and excessive noise). These social costs were accepted in the name of the profitability of industry and no thought was given to the fact that space also was limited. Whenever the interests of industry clashed with the use of space, industry was exclusively favoured. At present, experts in urbanization and spatial economics seek ways and means of securing a harmonious, long-term development of an area. Even within these scientific disciplines, questions relating to prospective development and planning come to the fore. This created the need for a system of information that would gradually cover the entire area of the state - a uniform system of classification which could be continuously up-dated.

4. The question arises whether such a coherent system of information, covering the entire area of a state, is required by developing countries which do not have the problems caused by an excessive concentration of industry. At first glance it might seem that in these countries, similarly as was once true of advanced countries, the one-sided criterion of the suitability of a certain area for the

construction of industrial projects should be applied, leaving the future development of the area to chance. In this case, however, the developing countries find themselves in an advantageous position, since they may learn from the experiences of advanced countries and may thus avoid eventual losses caused by the necessary reconstruction of whole regions, the relocation of transport and communications, the regulation of waterways and the restoration of natural conditions and so on.

5. The present study draws attention to one such system, worked out in Czechoslovakia, by which information on natural, technical and economic conditions of individual regions and of the entire area of the economy is collected and classified. It is a graphic and tabular system of continuously up-dated information that provides background material for ascertaining advantageous conditions for the distribution of industrial and other projects and for planning the development of the area in the light of future requirements.

I. THE ESSENCE OF THE SPATIAL CLASSIFICATION SYSTEM

6. In the evaluation of industrial projects, technical, technological, economic and financial aspects must be considered from the point of view of all possible variants of a project's location. The construction and the operation of every plant will depend on the geographic and social environment in which it is to be located. On the other hand, each plant will make an impact on its environment in different ways. From this point of view, each plant is a system of technical linkages of the productive process in the area, which thus becomes the technical and economic factor of its existence.

7. It became necessary to establish a documentation system of spatial conditions which would supply information needed for ascertaining the efficiency of industrial location. First, documentation of the plant site was made, followed by documentation of the agglomeration area of regions and subregions and finally of the entire area of the economy. However, most of these modes of documentation came into being as isolated systems, in the form of physical plans of towns and villages, zones, production regions and so on.

8. A spatial project which provides a uniform method of documenting the technical parameters in the entire area of a country, and which is continuously up-dated in harmony with the dynamics of economic development, is almost unique in the world. The first steps towards undertaking such a project in Czechoslovakia were made in 1964. The first part of this general spatial projection, which was completed in 1965, contains an analysis of the prevailing spatial and technical conditions and of all relevant investment projects planned for implementation up to 1970. It includes an allowance for corrections to be made in the location and distribution of individual investment projects in the interest of national economic efficiency. Work on the second part of the national spatial projection, i.e. on the preparation of a prospective projection of settlement within the whole economy of Czechoslovakia, is currently in progress.

9. The system of spatial documentation should provide reliable information for spatial planning to facilitate the selection of the best possible location of individual plants and to ensure that the construction of plants harmonizes with the natural environment, including the living conditions of the population.

10. The documentation of all parts of a spatial projection provides information necessary for the solution of problems concerning natural, technical and economic conditions. These three groups are linked by objective interrelationships. The development of these relationships and their quantitative and qualitative changes depend primarily on the degree of the concentration of economic activity. This concentration is expressed in the production capacity, working opportunities, total population, provision of housing and services etc. within a given area.

11. Demands for technical infrastructural facilities change in proportion to the degree of concentration of economic activity in the area. These changes are of a non-linear nature. The investment and operational costs of technical facilities have a lower limit of economic feasibility, determined by the minimum concentration, and an upper limit, determined by the full technical utilization of economically feasible natural resources and by the infrastructure of the area (e.g. water, power, transport). Between these lower and upper limits, there are certain critical points for individual factors where costs for one unit of facilities begin to grow progressively. The concentration of economic activity and the costs of technical facilities within the spatial unit in question have a certain optimal relationship. The optimum is determined by the most effective economical

exploitation of an area's natural potential for a certain concentration of economic activity. The system of comprehensive documentation is intended specifically to ascertain such an optimum.

12. The relations between production and a given area, i.e. the relations between economic activity and the costs of constructing and operating the technical facilities of the area (infrastructure), are not limited by the framework of a town, residential district or any other agglomeration unit, although the weight lies within that framework. The national economy shows that these relations are projected into broader connexions of towns and residential districts, and that they become parts of the economy of a subregion, region and of the entire country. The system of relations of one town must be compared to similar systems of other towns and of places not yet inhabited.

13. The system of spatial documentation may be divided into four categories, namely:

(a) Plot construction spatial planning;

(b) Town and village (and/or other agglomeration units) spatial planning;

(c) Regional and/or subregional spatial planning;

(d) General spatial planning of an entire country.

In the graphic illustration different scales are used for individual projects, and degrees of documentation and differing quantities of detailed information are provided. The common unifying aspect of all this spatial planning is the urbanization solution, i.e. the expression of the conditions of the space in relation to the production orientation of the plant, to the size of population and their housing and service requirements, including the best possible utilization of natural conditions for the technical facilities of the area.

14. Plot construction spatial planning for plants, housing sites etc. is intended to aid in the placement of individual constructions and groups into the terrain, in the architectural composition of the dwelling area in the entire town organism and in its linkages to the system of technical facilities. A scale of 1:2000 and/or 1:1000 is used for this purpose. This type of planning corresponds to the specific nature of the solution of the synthesis of space and building which

directly determines the rational and technical standard efficiency and social quality of the utilization of space in general. This part of spatial planning belongs, in fact, to the problems to be solved in industrial plant planning and in the planning of housing and other functional constructions.

15. Town and village spatial planning represents the basic instrument for the distribution of investments, as the town constitutes the basic technical, economic and organizational unit of settlement that has gradually developed into a fully built-up area.

16. A spatial town plan provides for the integration of a town and its area into the landscape and for the internal division of the space into functional, specific tracts and technical facilities. The currently used scale of graphic part solutions is 1:5000. This scale makes it possible to delimit with sufficient precision the area of the town and its internal division into functional tracts. It also affords sufficient technical and economic background material for the location of groups of buildings.

17. Binding together the various parts of a spatial plan of a town are the setting of prospective size, relevant argumentation for the functional division of space, design schemes of technical facilities systems of transport, water and power and telecommunication networks and resources. The motivation of the funotional division of space and schemes of technical facilities are dealt with in separate technical, economic and qualitative sections. The prospective size of the town is considered from the long-term aspect. The 20- to 25-year plan is subdivided into shorter periods, usually of five years. Individual stages are harmonized with time necessary for the expansion of building plots and for the construction of utility networks for the teohnical facilities of the functional areas of the town.

18. Progressive classification methods reckon with different extents of spatial plans for towns having more than 100,000 inhabitants, for those with a population of from 30 to 100 thousand and for small towns with 10 to 30 thousand inhabitants. The differences in the extent of documentation also depend on the functions of individual towns within the system of settlement (metropolitan area, regional centres, towns). Village planning is usually the simplest.

19. The fundamental function of regional spatial planning is to provide solutions to spatial and technical relationships between two or possibly more towns, or to relationships arising from the exploitation of natural resources and from the infrastructure of the area. From this function it objectively follows that there is a certain lack of uniformity in delimiting the extent of space of the region.

20. The development of regional and/or subregional spatial planning was once determined by economic development, primarily that of industry. Spatial aspects were taken into consideration only after serious spatial problems emerged. In this way special spatial plans came into existence. For example, in Czechoslovakia most of the existing spatial plans are those for coal basins, centres of metallurgical and chemical produotion, water economy and so on. Plans to develop speoial areas as centres of manufacturing industries were rather limited.

21. The delimitation of the extent of the area of a region must proceed from the assumption that, in addition to changes in the development of production, the life in a town will be much more strongly affected by other changes, among which are the impact of the construction and reconstruction of the transport system, the envisaged substantial acceleration of the existing speed of traffic, and the impaot of the ohanges in the living standard (increasing number of cars, more time for leisure) and in the way of life (more time to be spent in the open air).

22. For this reason, the methods applied so far for delimiting the area of a region do not meet the requirements. For example, Czechoslovakia is oonsidering increasing the area of a given region from the present radius of 15 to 20 kilometres by 2 to 2.5 times, depending on the size of the towns and the extent of their interrelationships. The basic scale used is 1:20,000. Such delimitation of space naturally presupposes that there will be a close link between spatial and technioal aspects of the problem. The spatial plan of a region and/or subregion provides a broader framework for town and village planning and, moreover, it is linked to the adjacent regions or subregions which in turn are delimited and oo-ordinated within a plan for the whole area of a oountry.

23. The elaboration of a ooherent system of spatial documentation of the whole area of a country oonstitutes an urgent problem both in industrially advanced as well as in developing countries. Industrially advanced countries, having a long

tradition of industrial production and construction, must undertake wide structural reconstruction of industry and agriculture in connexion with the intensification of the development of the entire economy. Structural reconstruction should facilitate the accelerated introduction of the fundamental trends of the industrial, scientific and technical revolution. The problems of structural reconstruction grow in proportion with the growth of export industries, for this growth increases the demand for flexibility and adaptability of industry to changes in foreign and domestic markets. Such an adaptability cannot be secured without certain technical reserves.

24. The concentration of industry in traditionally highly developed productive regions and towns, where at present the natural and labour resources are exhausted, considerably diminishes the operational possibilities of industry. Therefore, in the interest of accelerating structural changes in industry, the concept of urbanism must reflect signs of new basic development trends, i.e. modernization and reconstruction of existing capacities, mostly in traditional regions, and new construction in less developed areas.

25. The aim of modernizing and reconstructing industrial plants is to raise the volume and the quality of production and, simultaneously, to release a number of workers for employment in the service and construction sectors. The construction of new plants should accelerate the economic development of the less developed regions without violating the principles of housing, the development of services and the technical facilities of the area. The population must have good conditions for its work, living, education and for an all-round development of physical and mental capacities; at the same time, conditions must be adequate for economic development.

26. These development trends support the concentration of settlement in towns. The degree of urbanization of a settlement must correspond to the attained level of industrial development. A widespread network of villages and communities causes considerable dispersion of investments over the entire area of the country. Effective utilization necessitates purposeful concentration of investment in selected towns and villages.

27. The abovementioned urbanistic trends can be mastered and properly channelled, the highest possible efficiency of construction attained and the standard of housing and services secured only if these efforts follow the methodology of macro-planning based on scientific knowledge. The spatial planning of a country is one of the instruments that may facilitate the solution of these problems.

28. Spatial planning of a country is a form of documentation of the area under conditions where space is increasingly recognized as an economic factor. It changes the role and position of the whole system of spatial projection and its relationship with economic planning.

29. In Czechoslovakia physical planning of towns, villages and regions was mainly static and passive. Planning was restricted to final solutions to problems arising in the area in connexion with production targets and investments approved by the economic development plan. With frequent changes in planning, such physical plans became rapidly obsolete. Serious disproportions arose between the requirements of production units and the production opportunities offered by the area in question. Natural conditions of the area, and even the requirements of the population, were not sufficiently taken into account, partioularly in the traditional industrial centres.

30. Right from its start, over-all spatial planning now makes corrections of national development possible by taking account of actual needs, especially investment requirements, and by covering all levels of organizational management. At the same time, it creates prerequisites for an effective implementation of planned construction, mainly for the efficient functioning of new productive capacities and other constructions (such as housing, public services, schools, health and recreation facilities, tourism). Spatial planning provides new concepts and data for the up-dating of physical plans for individual towns and areas from a social point of view. In this way the spatial projection of a country enlivens the whole system of regional planning. It influences, in advance, the decisions on investment distribution, provides objective assessments of technology and economy, and harmonizes local and social interests. The active role of a spatial projection of a country develops in full scale only once its counterpart, i.e. the projection of settlement of the country, documenting the efficient concept of the urbanization of settlements, has been completed.

31. Acoording to the new concept of macro-planning, the whole system of the national economy development plans in Czechoslovakia has done away with details on technical, economic and social conditions. Attention of the central planning authority is focused on improving methods and procedures aimed at determination of the principal directions of development and of the fundamental proportions of national economy, both within industrial sectors and within the regions. The planning system is based on massive data, background information and concepts that must be documented by technical and economic studies, projections and other information. The spatial projection of a country makes it possible for the central planning authorities to view the level of various areas and towns from the standpoints of individual productive and non-productive branches and fields; it also provides information for sectoral and spatial synthesis at national level. Spatial planning is a flexible instrument for alternative and variable solutions according to the efficiency of prospective development. The concept of settlement, whioh forms part of the spatial projeotion of a country, provides one of the key systems of documentation for long-term economic development and a guide towards rendering capital construotion more effective. Spatial projection becomes a significant starting point, as well as one of the main instruments, for plaoing national economic planning, particularly its regional and investment aspeots, on a scientific basis.

32. Typical examples of technical problems that must be solved by economic reconstruction are to be found among orude oil refineries, nitrogen plants and atomic power plants. The location of these plants depends upon the solution of a number of spatial and technical problems resulting from an unbalanced distribution of industry, scattered, congested settlements, limited and unevenly located water resources and so on. For example, in Czechoslovakia when the location of refineries was considered, there were only three alternatives within the whole area of the country. A number of variants (in one case 17) had to be proposed for consideration of the location of each alternative. Complicated problems arose in planning the networks of oil and gas pipelines and product pipelines for the entire country.

33. Similar problems arise in the distribution and location of nitrogen plants, atomic power plants and larger thermal power stations. The development of a progressive power industry and of a material base gives rise to problems in the traditional fuel and ore extraction regions where many plants may have to be closed down because of exhaustion of resources or to economic inefficiency of extraction.

34. The concentration of manufacturing industries in traditional areas also poses problems for spatial planning. With regard to the engineering and consumer industries, their interests often clash with those of the key industries (fuel, metallurgical and chemical industries), particularly in the recruitment of experts, the provision of housing facilities and in demands for water and transport facilities. The distribution of chemical, metallurgical, power and manufacturing industries to new and industrially less developed regions should help to avoid this clash of interests. Such a step, however, necessitates a coherent classification of spatial and technical conditions in the entire area of the country.

35. In planning the new industrial areas and regions, Czechoslovak authorities made use of the experiences gained in the traditional regions in order to avoid negative effects of industry on the landscape and on settlements. Attention was also paid to coherent urban solutions in the framework of town planning, although construction of some plants was envisaged for the distant future. For example, areas were reserved for future water-economy constructions, for roads, gas and oil pipelines, group water mains, airports and the building of new residential quarters, for the construction of plants with high demands on space etc. This solution seems to be particularly desirable for the developing countries, as it offers them an opportunity to take advantage of experiences gained and to avoid mistakes that later may demand supplementary investments and cause unnecessary losses through inefficient construction and slowed economic development.

36. Already during the preparatory and drafting stage of the spatial projection of Czechoslovakia it became necessary to find practical solutions for some of the problems that had received varied theoretical interpretations. This applied mainly to the concept of coherence of investments and basic funds, and the concept of methods applied in the spatial projection system. The principles of the dynamic and coherent concept of investments and basic funds and the principle of continuous up-dating of the entire system of documentation of space were formulated, and their correctness was confirmed by the actual draft of the first part of the spatial projection of the country.

37. It was found that the preferential treatment of the construction of industrial capacities in some towns, at the expense of housing and utility facilities, had a negative effect on the utilization of the productive capacities and on living conditions. In some regions, heavy concentrations of industry caused

water and air pollution and upset the natural biological equilibrium, thus making excessive supplementary investments necessary.

38. It has likewise been confirmed that when investments are allocated to coherent housing construction, the knowledge of specific conditions of the area and the possibilities for utilities in individual towns are of fundamental importance. Experience has shown that a small number of high-quality, fully equipped flats is much more valuable, both socially and economically, than a large number of flats without these amenities.

39. The conclusions drawn from the elaboration of the projection underline the necessity of respecting the criterion of the dynamic development of towns and villages. Capital construction must simultaneously take care of the reconstruction of towns and villages. One-sided orientation towards the construction of housing on virgin sites at the boundaries of towns causes the lagging behind of older housing areas and may cause a disharmony of appearance and function between the "old" and the "new" town. In addition, construction on new plots means increasing the demand for additional land and investments in the infrastructural utilities. The relation between construction and reconstruction depends primarily on the development rate of a town, on the urgency of the housing problem, and on investment demands for new construction compared to those for reconstruction.

40. The data collected confirm the tendency towards structural reconstruction of areas. The prospective division of space follows the trend of the formation of functional groups within the built-up area (for housing, production, utilities). In town planning, areas are reserved for the construction of recreation facilities to serve as social and cultural centres to the population of the town and of the adjacent areas. The above trends in the spatial and technical solutions should help to overcome the historic administrative boundaries of towns which, especially when town development is not understood as a dynamic process, often impede progressive and effective urbanization solutions.

41. An integrated approach in any urbanization plan is generally valid for and applicable even to developing countries and regions. Urbanization schemes must be all-embracing, even in cases where investment funds are limited and part of the planned construction must be postponed. In these cases, the purpose of integrated urbanization schemes is to organize space in such a way as to reserve areas for future construction. Should these areas be built up haphazardly, extra

expenditure connected with the demolition of constructions built at unsuitable or ill-considered locations will become necessary. These conclusions hold true both for the delimitation of industrial and housing sites and for the determination of sites and tracks of lands for engineering networks, mainly transport ways and water-economy installations.

42. Changes that are continuously taking place, and those that are planned beforehand, must be projected in the whole system of spatial documentation through continuous up-dating. Background material can thus be obtained for the delimitation of the area to serve the modernization and reconstruction of basic funds and sanitary conditions, and the purposeful preparation of the area for new construction.

43. The Czechoslovak authorities gradually prepared the organizational prerequisites for carrying out the general spatial projection of the country. A number of country-wide technical and economic projects and other documents were prepared which applied uniform methods for working out the natural, technical and economic development potentialities of individual areas and regions. The most significant of these may serve as examples.

44. The Czechoslovak Central Institute for Geology made a systematic assessment of a geological survey of deposits of raw materials and of hydrological, seismic and landslip zones. The state hydro-meteorological service and state as well as regional sanitation experts worked out documents on climatic conditions, air pollution, purity of watercourses and main sources of water. The Ministry of Agriculture and Forestry, in co-operation with national committees and the administrative bodies of communities, districts and regions, worked out a nation-wide zoning plan for agricultural production according to produotion regions, including specifications for irrigation and drainage. Data for the balance-sheets of the land and forest fund were also specified. At the request of the State Planning Commission, the State Institute for Regional Planning worked out a national balance-sheet of labour according to districts and selected village settlements earmarked for development, and drafted technical and economic maps for the spatial distribution of industry. The Institute also established a spatial soheme for the tourist industry. From the periodical censuses the Central Commission of People's Control and Statistics collected data on the number of inhabitants, flats and houses (housing fund) and made a demographic

projection of the development of the population, its economic activities and age composition within spatial divisions. National bodies in charge of technical amenities for the whole country accumulated data on the national transport and resource systems (selected network of roads, railway network, airports, power-circuit network, state water-economy plan etc.).

45. Most of these documents were elaborated as government schemes with the co-operation of sectoral research planning institutes and other specialized bodies. These documents represent a systematic collection and classification of data and background material corresponding to the various aspects of natural, technical, economic and social conditions, processes of economic and social development and to the possibilities for their exploitation in view of the changing requirements of modern society.

46. However, this collection provided no analysis of mutual technical and economic linkage and no synthesis of general social aspects. The missing links were provided by the general spatial projection. The projection was elaborated by state authorities, dealing with regional planning, in collaboration with urbanization centres established in the regional planning institutes.

47. During the ten years of their existence, the state institutes for regional planning in Prague and Bratislava worked out more than 70 spatial projections and studies, and several nation-wide spatio-technical documents on selected productive and non-productive branches. Individual planning institutes worked out spatial master plans for most of the towns and villages within their own region. The establishment of urbanization centres as parts of the regional planning institutes constituted organizational and financial prerequisites for gaining qualified architects and engineers, specialized in urbanization, to work out maps on the spatio-technical conditions of the individual regions. In addition to these expert groups, boards of architects were established in the capitals of Bohemia and Slovakia (Prague and Bratislava) and in some other towns and important centres of tourism (Brno, Ostrava, Košice, Plzeň, Ústí, Karlovy Vary, Vysoké Tatry). This highly organized professional machinery completed the set work within eighteen months. The short time needed to complete the task, and the professional and technical standard of work, confirmed not only the correct selection of experts working on the project, but also the suitability of the chosen organizational procedures. The main merits of this set-up lie particularly in the fact that it ensures continuous up-dating of the whole system of documentation and data.

II. SCOPE, FORMULATION AND UP-DATING OF THE CLASSIFICATION SYSTEM

48. The general spatial projection of a country oonsists of three basic parts, namely descriptive text, tables and graphs. Each of these parts provides information on natural, technical and economic-social oonditions.

49. Similarly, as these three groups of conditions create the prerequisites for any eoonomic and social activity, the text, the tables and graphs of the spatial projection form an interrelated system of documentation of the whole area of the country. Thus the remarks on the system of documentation start with the olassification of oonditions into types and elements and prooeed in three interrelated parts of documentation.

Natural oonditions

50. The group of natural conditions of an area in the documentation system oovers five main oategories: geology, land fund, olimatology, hygiene and biology. The oriteria determining the ohoice of faotors in these categories are parameters that characterize them from the point of view of the requirements of the population and the suitability or non-suitability of the area for building purposes. Simultaneously, documentation is made of the characteristios of the area according to its suitability for the development of primary production (extraotion industry, agrioultural and forest production).

51. With regard to geology and land fund, the choioe of parameters is made by the elimination method. Maps are made of the looation of deposits (fuels, ores, minerals, peat, other raw materials), seismic and landslip zones, water resources and mineral and thermal springs. All these specified areas are eliminated from the fund of building sites for general oonstruotion; they may even fall under a speoial land protection scheme. They may, however, provide looations for plants oonnected with the extraction and exploitation of deposits only. The documentation of the land and forest fund is made in a similar way. Reoords are kept on the characteristic features of the natural conditions of produotion regions and specialized areas, the irrigation and drainage systems, the balanoe-sheet of land fund according to background materials used in the zoning of agri-oultural production. The working out of background materials ooncentrates mainly on the proteotion of the land fund against expanding building aotivities and on the

possibilities of utilizing the land fund for agricultural production. The choice of parameters documenting other branches of the group of natural conditions, such as climatology, hygiene and biology, is determined mainly by their influence on the set-up and use of building sites. Among the climatic parameters, the most important ones are the movements of winds and inverse positions. Directions and velocity of prevailing winds are compiled in tables and, for characteristic areas, marked by wind roses.

52. Important data on spatial hygiene are those concerning the purity of atmosphere, watercourses and water resources, main sources and types of pollution, affecting mainly towns and their neighbourhoods. Pollution is mainly caused by combustion processes of solid fuels (ashes, oxide, sulphur and arsenic), basic chemical plants, cellulose and paper industries, fuel and ore processing plants, health facilities (hospitals, facilities for treatment of infectious diseases), effluent from municipal sewerage and so on.

53. Biology is of importance as a factor balancing the negative impacts of human activities on hygiene. By means of active protection of selected areas (special forests, nature reserves, national parks, historical beauty spots etc.) and the recultivation of devastated regions, biology provides an active approach to the creation of prerequisites for the equilibrium of natural surroundings and productive activities.

Technical conditions and utilities

54. The utilities of an area represent the core of the problem which has to be solved in planning industrial location and the location of other functional establishments. They cover four categories of resources, equipment and networks, namely: water, power, communications transport and telecommunications.

55. The factors to be studied and to be included on the spatial projection maps must be characteristic of the natural resources of the relevant area and the level of their technical exploitation. This arrangement provides data on natural resource reserves and technical reserves and/or the overburdening of specific types and elements of engineering networks and sources. Areas still having unutilized resources are marked and sites are reserved for future use, including housing and plant installations.

56. In Czechoslovakia - the watershed of Central Europe - water resources in the river basins of the main watercourses are of key importance to technical conditions. The clarification system includes data on their minimum rates of flow for 364 and 355 days and flood rates of flow (for 1, 20 and 100 years). Specifications are made of: supply of water to and consumption of water by the population, irrigation systems, agriculture and industry; sources of water pollution; classification plants; system of water mains and sewers; reservoirs and dams. These estimates are used for establishing water balance-sheets for 37 river basins. Underground sources of water and protection of land against contaminated water are also recorded.

57. Balance-sheets of water according to river basins and specifications of current and future spatially bound supplies (for drinking purposes, for irrigation etc.) make it possible to obtain figures on water resources for industry. Mapping is done of water resources conditioned by investments (potential construction of reservoirs and dams) along with specifications of investment costs.

58. The significance of the transport system increases with progress of the present scientific and technical revolution and its impact on production and on society. The complex system of transport under prevailing conditions (distance between working place and residence) has assumed a new economic and social role. For the majority of the population and the industrial sectors an efficient network of roads and streets is of key importance. The mapping covers constructional and technical conditions of the network with regard to transport, its capacity, utilization and prospective development based on various studies. The degree of motorization, the intensity and structure of road transport, and public facilities for personal and freight traffic are also assessed.

59. For railway transport, the significant factors for spatial documentation are the network, shunting stations, centres for the loading and unloading of freight cars, efficiency and degree of utilization of trackage. Mapping of civilian airports contains their technical data, their degree of utilization and the specially protected zones. In the case of shipping traffic, mapping is done of ports, navigable waterways, shipping tracks and channels. The general development of shipping traffic is covered by separate studies. Maps on the network of long-distance conduit systems include markings of tracks according to dimensions of media, and of control centres and stations.

60. With regard to power utility of the area, data are collected on the various types of power, i.e. electrical, thermal and gas. The characteristics proceed from the concept of central heat deliveries for housing and production zones of towns based on the development of the basic structure. As to electrical power, information is collected on current and future supply and consumption patterns. Maps are made recording the location of thermal power stations and thermal stations, the condition of the power transmission systems and the condition of important distributing stations and major supplies exceeding one million kWh per year. The data provide a survey of the distribution, size and utilization of thermal stations and the mapping likewise covers the system of basic heat-conduit networks. Data on the gas supplies of individual areas cover the situation in the resources of coking, crude oil, carbon and generator gas, tracks of high-pressure pipelines, consumption and short-term prospects. The telecommunications network is marked according to individual types of equipment (wireless, television, telephone exchange and cables).

61. Data concerning transport and power industry are classified so as to provide background information on technical reserves of basic resources in individual areas, both of the current and the expected development conditioned by investments. Such data are important for the construction and development of industrial plants and for housing construction and the development of services, i.e. for the development of towns as balanced organisms.

Socio-economic conditions

62. These contain information on the current situation and the possible development of the population in relation to the current situation in basic funds. They provide documentation of basic data on industrial plants, housing, services and so on. The system of settlement is characterized in general. Towns and villages are classified into three groups, namely, typically town settlements, settlements suitable for village population, and other settlements.

63. Industrial intensity is analysed according to individual centres (above 500 employees). For these centres, the spatial documentation lists data on characteristics of plants, location and types of plants according to their prospects for further development (plants capable of future expansion, stabilized and viable plants and those earmarked for liquidation), utility requirements, possible expansion of industrial development, and the negative effects of industry on

settlements. The synthesis is made on the basis of value, age structure of basic funds and the number of jobs in general and specifically for women.

64. A relatively more detailed documentation is made of the housing fund and the population. In these cases it is necessary to proceed from the assumption that the location and distribution of housing construction and public amenities should reflect the active role of spatial projection and its impact on the location and distribution of industry.

65. With regard to demographic development, attention must be paid to those elements that substantially influence the location of flats and service facilities and also to data on the present employment structure which is important for the location of industry and services. Documentation should include population figures in general and broken down according to sex, age structure; the development of the number and structure of households requiring housing; and facilities necessary for personal and public services. The data covering the development of the population and households form the basis for determining the fundamental relationships to be considered in the location of production and other investments as a uniform whole within the area of individual towns and villages. Attention must also be paid to the development of housing and service facilities for the population.

66. In addition to current data on the number of houses, flats, density of built-up areas and the structure of the housing fund according to the nature of communities, the qualitative aspects of and relations to the number of inhabitants and households should also be analysed.

67. For the qualitative indices, analyses are made particularly of the housing standard, the average number of rooms per flat, the age structure of houses and flats, and the types of material used for construction and equipment of basic fittings. The relation between the number of flats and the number of households during the last twenty years is documented by the final number of households having no flat or their own according to types of apartment houses.

68. In harmony with the trend towards solving adequately the housing problem, documentation is made of the current situation in public amenities covering the following sectors:

Educational facilities (universities, secondary schools, schools of general education, secondary vocational schools)

Cultural facilities (theatres, cultural establishments)

Medical care (hospitals, maternity hospitals, policlinics, facilities for specialized treatment)

Services (establishments where several types of services are concentrated, laundries and dry-cleaning, wholesale warehouses)

Sport (open-air and winter stadia, gymnasiums, swimming pools)

Social welfare (homes for retired people).

The facilities under documentation represent a set of amenities exceeding local scale. They are analysed according to sectors and areas. Synthetical assessment is made of their location from the point of view of the concentration of settlements and regional distribution.

69. In recent years Czechoslovakia has increasingly come to regard recreation as an independent economic sector. This is why the documentation of this sector follows and supports this trend. Three phenomena are under observation, i.e. recreation, tourism and spas. Suitable areas are marked and divided into appropriate sections according to their characteristics. Areas suitable for tourism and the development of spas are analysed in greater detail. According to the degree of their attraction and their importance, they are classified into local, regional, national and international categories.

Classification of documentation and methodology of its up-dating

70. The whole system of documentation of the general spatial projection of the entire country has three basic parts - text, tables and graphs. As the projection is a document in which spatio-technical data are compiled, the emphasis is on the graphic and tabular parts.

71. The descriptive part outlines the objectives and significance of documentation and the process of elaboration. It lists the co-operating organizations and the applied materials and documents. Explanations are also given on the division of the tabular and graphic parts of spatial documentation and methods and indices applied.

72. The graphic part forms the basis of the whole documentation. Its main component is a set of maps on a scale of 1:50,000. The whole area of the country is divided into a number of sections; in the case of Czechoslovakia there are 454 sections. Each map covers one section of the area and contains all factors under observation that can be expressed graphically according to a uniform key. Each sectional map provides an analysis of all characteristic factors as far as they are found in the area in question. Thus a synthesis is provided of all these conditions for the area represented by the map which gives a realistic picture of the degree of coherence and disproportions. If appropriate maps are combined, they give a picture of individual regions. They may be used for composing the picture of the entire country, a picture of selected spatial entities within the framework of the country, and also within regions. Annex 2 gives an example of such a map.

73. The country-wide synthesis of individual sections and types of spatio-technical conditions and their analytic distribution into administrative units (regions, districts) are documented in maps on a scale of 1:500,000. Each of these maps covers the whole area of the country and indicates certain types and factors of natural, technical and economic conditions. For example, natural conditions are represented graphically in twelve maps, of which five deal with the land fund, two with hygienic conditions and three with geology (mineral reserves, hydro-geologic zones, seismic and landslip areas). Economic conditions are included in eighteen maps, e.g. the characteristics of the housing fund in seven maps and the demographic development of the population in five maps. Moreover, the housing fund is depicted qualitatively in twelve charts and the demographic development in fourteen charts.

74. Details of selected data are given in maps on a scale of 1:200,000. These include relationships between population and housing facilities broken down by towns and villages, the quality of the land fund according to local land registers, and information on basic water-economy according to river basins.

75. The documentation of the factors under observation in maps and charts on a scale of 1:500,000 and the more detailed documentation of selected factors in maps on a scale of 1:200,000 serve primarily as tools for orientation. They express the degree of the difference in the types and factors of conditions between individual areas. They provide a good basis for assessing the distribution of the factors and facilities over the entire country, signal the newly

emerging disproportions in spatial units and the absolute and relative differences between them (in per capita relation).

76. The tabular part complements the system of graphic documentation. It contains basic spatio-technical data on the quantitative and qualitative factors under observation. These data permit an analytic as well as a synthetic numerical survey of individual elements and their groups. They provide information for alternative and variable distribution of industries, housing facilities etc., according to individual areas, for total, vertical and horizontal analyses of the current situation and also for current and future solutions of spatial problems. Models of such tables are given in Annex 1.

77. The problem of continuous up-dating of the whole system of spatial documentation has various organizational and technical aspects. As far as the organization is concerned, the up-dating is entrusted to the responsible bodies for spatial projections (State Institute for Regional Planning or the town planning centres in regions). All investors are legally obliged to have approved the individual stages of project documentation of the envisaged construction in co-operation with urbanization centres. They are obliged to ask the respective national committees for permission to put the construction into operation. Thus data on constructions needed for the up-dating of the spatial documentation are systematically and continuously acquired.

78. The technical aspect of up-dating is solved by a system of watermarks attached to the original maps. The watermarks register data on the actual development and on the development of economy and investment, and are placed on background materials of individual stages of approved documentation of buildings. Corresponding tables are supplemented along with graphic registration. It is planned that after a certain period of time (four to five years) the whole set of maps and tables will be reprinted and the old ones will be deposited in the archives to be kept there as important documents of their time.

III. POSSIBILITIES AND WAYS OF USING THE DOCUMENTATION

79. An advantage of general spatial projection is that it provides an all-embracing system of documentation on the characteristics of the country, classified according to branches (vertically) and regions (horizontally); it contains data on the factors and spatial units under observation and is continuously up-dated. The uniformity of the system, its classification and continuous up-dating, provide ample opportunities for the use of such a documentation both in theory and in practice.

80. The flexibility of adjusting the system of documentation to the conditions and development of any country having differing conditions does not lie in the changes of the system, but primarily in the results it yields. For example, in the documentation of developing countries, the system will mostly cover data on natural conditions, the distribution of these data within characteristic areas and zones, data on the population and its distribution according to regions, and data on the systems of settlement. The methodical documentation of these data within a uniform system of tables and maps is of great importance. It provides government authorities, both national and local, with a uniform system of information on current and prospective activities within the framework of their investment policies. Whenever decisions have to be taken on any important investment project, this system makes it possible to assess the suitability of its location in the light of national considerations, and specifically, to formulate the technical and economic problems to be solved in choosing the location in question.

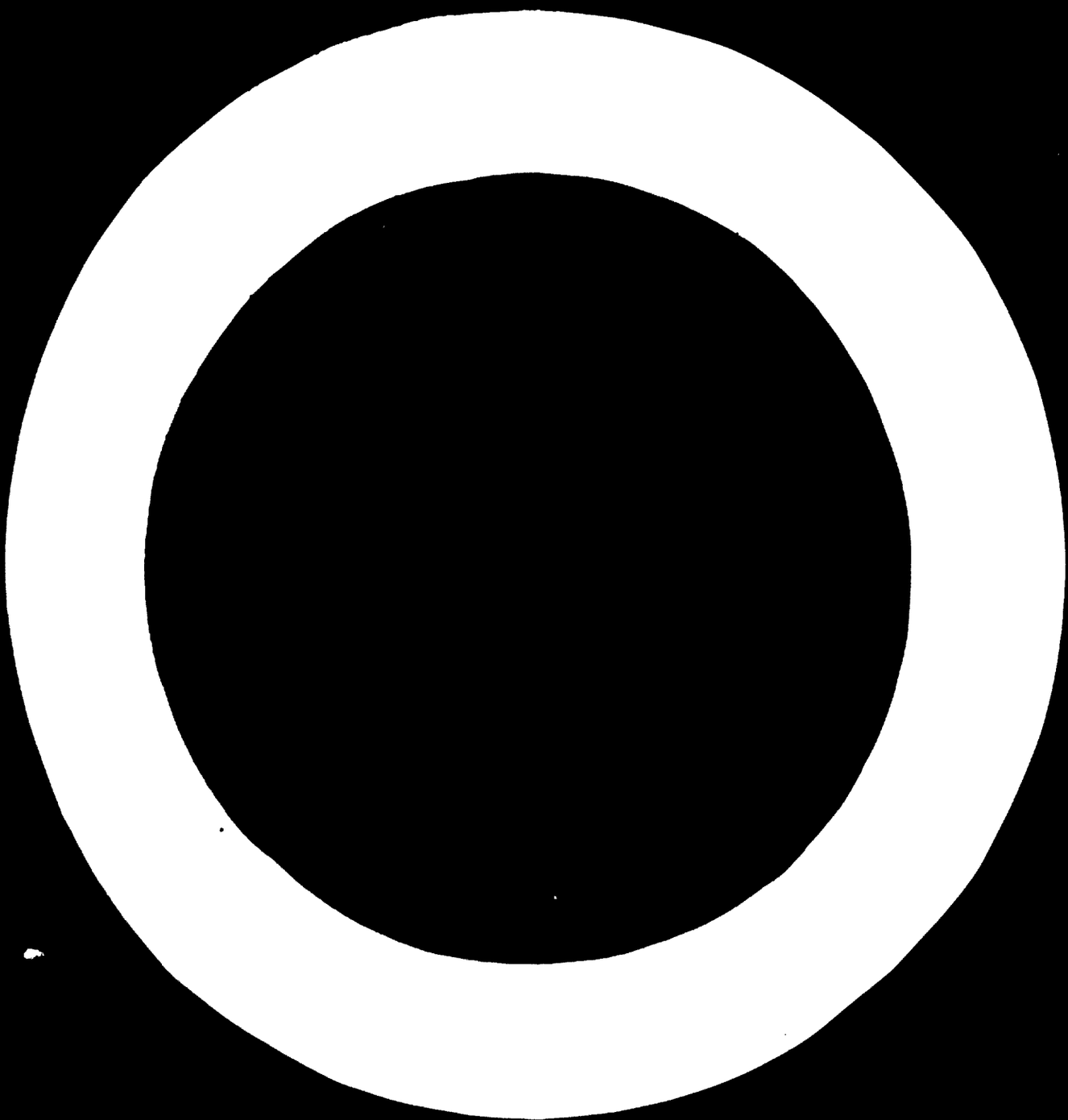
81. It represents a system of data and technical documents for the formulation of future construction of engineering networks, transport systems (roads, railways, airports, ports), water economy networks, networks of power supply and their trackings in view of the needs of the national economy as well as of individual areas.

82. The system provides important background material for the introduction of economic and financial measures by the state and the local administration (e.g. contributions of enterprises towards the construction of engineering facilities, charges for their use, assessment of building sites. It offers concepts for the elaboration of partial spatial projects (towns, regions), and/or for their up-dating. At the same time, it provides an objective view of technical, urban and economic problems awaiting solution within these spatial projects.

83. This classification system in the hands of the government bodies and local administration authorities can become an effective tool for locating productive, as well as non-productive, investments and for manifesting a social interest in all such investments.

84. The classification system provides industry with technical and economic information necessary for the optimum location and the establishment of new plants with regard to the country as a whole. At the same time, industries must, in their investment intentions, fully respect social and public interests and take into consideration the possibilities of utilizing the resources and technical amenities of the area subject to the investment plan.

85. The above possibilities for using the classification system of documentation of space indicate its potential applicability to countries with different stages of industrial development, particularly when spatial dispersion in the regions and the entire country is uneven. In the least developed regions documentation will be made particularly of natural conditions, technical possibilities and their current utilization according to completed technical documentation (schemes) and development projects (power networks, networks of water economy constructions, roads, railways, ports etc.) and population data. In regions with industrial centres, data on technical and economic conditions of areas will start taking predominance. Documentation will primarily concentrate on the types and capacities of the existing and projected engineering constructions, the size and location of production capacities, the size of towns and villages and their development according to their spatial plans and so on. At this stage it is the co-ordinating function of the classification system that steps into the foreground. There is the need to co-ordinate the timing in technical linkages between production engineering constructions and the building of housing facilities. Naturally, the regions with intensive development of industry require, in addition to the above documentation, spatial planning of towns and villages and spatial planning of broader areas of common interest which specify and provide binding solutions to the urbanization concept and thus insure the consistency of a purposeful solution and stage-by-stage development.



Annex 1

MODELS OF SELECTED TABLES

Utilities

Water economy

Sources:	natural rates of flow	– table 1
	underground water resources	– table 2 and 3
Supplies:	agricultural irrigation	– table 4
	industry	– table 5
	drinking water	– table 6
Water economy balance-sheets		– table 7
Reservoirs		– table 8
Clarification plants		– table 9

The tables cover a set of spatio-technical factors under observation and their interrelationships. The general spatial plan of Czechoslovakia includes tables on 34 river basins. These tables contain data on water resources, the degree of utilization and the pollution of water courses. They make it possible to express numerically the reserves of water outside the water courses and underground sources, and sources requiring investments (possible construction of reservoirs, their preliminary technical and economic parameters).

The system of indicators is graphically expressed in maps on a scale of 1:500.000. These maps also show the basic network of water mains and sewers.

Table 1

Natural rates of flow

River basin	Watercourse	Profile	Q 355 [a]	Q 364 [a]	Q 1 [b]	Q 20 [b]	Q 100 [b]
			m^3/s				

a/ Q 355, Q 364 = minimum rates of flow during 355 and 364 days respectively.

b/ Q 1, Q 20, Q 100 = flood rates of flow in one, 20, 100 years.

Table 2

Underground water resources (under observation)

No.	Sub-river basin	Watercourse	Location	Capacity l/s		Remarks
				min.	max.	
1	2	3	4	5	6	7

Table 3

Underground water resources (utilized above 5 l/s)

No.	Sub-river basin	Watercourse	Location	Capacity l/s	Remarks

Table 4

Agricultural irrigation (current and planned)

No.	Course	Location	Acreage in hectars	Consumption			Remarks
				mil. m^3/r	m^3/s		
					average	max.	

Table 5

Industry - Supply situation

No.	Course	Location	Plant	Requirement	Consumption	Remarks
				m^3/s		
1	2	3	4	5	6	7

Table 6

Drinking water supplies

No.	Course	Place of supply	Supply in l/s	Remarks

Table 7

Water economy balance-sheet - Current situation

No.	Course	Profile	Requirement m^3/s	Consumption m^3/s	Q 355 m^3/s	Q 355 Cons. m^3/s 6 - 5	Q 364 m^3/s	Qn m^3/s	Difference m^3/s 9 - 5 + 6	Qn - Cons. 9 - 5
1	2	3	4	5	6	7	8	9	10	11

Table 8

Reservoirs

Course	Reservoir	Current rate of flow		Purpose of reservoir	Elevation of water level above sea-level	m Level of dike	Flooded area	Capacity of reservoir		Effect of reservoir improvement Qn	Reduction	Investment cost		Operation cost per year	Investment cost of improvement		Price of water	Remarks
		Q 355	Q 100 years		max. serv.			protective	serv. total	total Qn total Q 355	Q 100	total	induced		total	above Q 355		
		m^3/s			m	m	km	mil. m^3		$m^3/sec.$	m^3/s							

Table 9

Clarification plants (current and planned)

No.	Settlement	No. of inhabitants		Quantity of effluent		Inflow Q 355	Index of purity (5:7)	Clarification plant		Utilization of plant		Remarks
		total	with access to sewer facilities	total	of which industry			type	capacity	current (5:10)	1970	
				m^3/day		m^3/s	%	M[a] MB[b]	m^3/day	%	%	
1	2	3	4	5	6	7	8	9	10	11	12	13

a/ Mechanical system.

b/ Mechanical and biological system.

Economic conditions

Industrial plants

Table 10 includes a set of factors which have to be currently checked in industrial plants with more than ten workers. Plants are observed and documented according to individual districts for which population and labour balance-sheets are made as well. A complete regional set of tables covers all the districts that are parts of the region in question. The set of factors on individual plants do not contain water supplies. These are covered by tables concerning water economy (see table 4). The supplies and resources of power are observed by a similar method.

Fund of houses and flats

Table 11 contains a set of housing and settlement factors. The tables are worked out also according to districts and form a part of separate sets covering individual regions. By their classification according to items, they are closely linked with the system of industrial labour balance-sheets industry.

Table 10

Industrial plants

1	2	3	4	5	6	7	8	9	10

Key:
1 - name of administrative community
2 - name of plant
3 - number of plant
4 - sector to which it belongs
5 - category of industrial plants according to the classification of sector
R - plant capable of future expansion
S - stabilized plant
L - earmarked for liquidation
J - plant proposed for other use
6 - location of industrial
x - within the built-up area of a settlement
- - outside the built-up area of a settlement
7 - area of industrial plant in hectares, and/or other operation grounds outside railing
8 - number of employees
x - pre-1963 data; not marked = data for 1963 and 1964
9 - access by railway
x - link to free track
- - link to station
10 - remarks

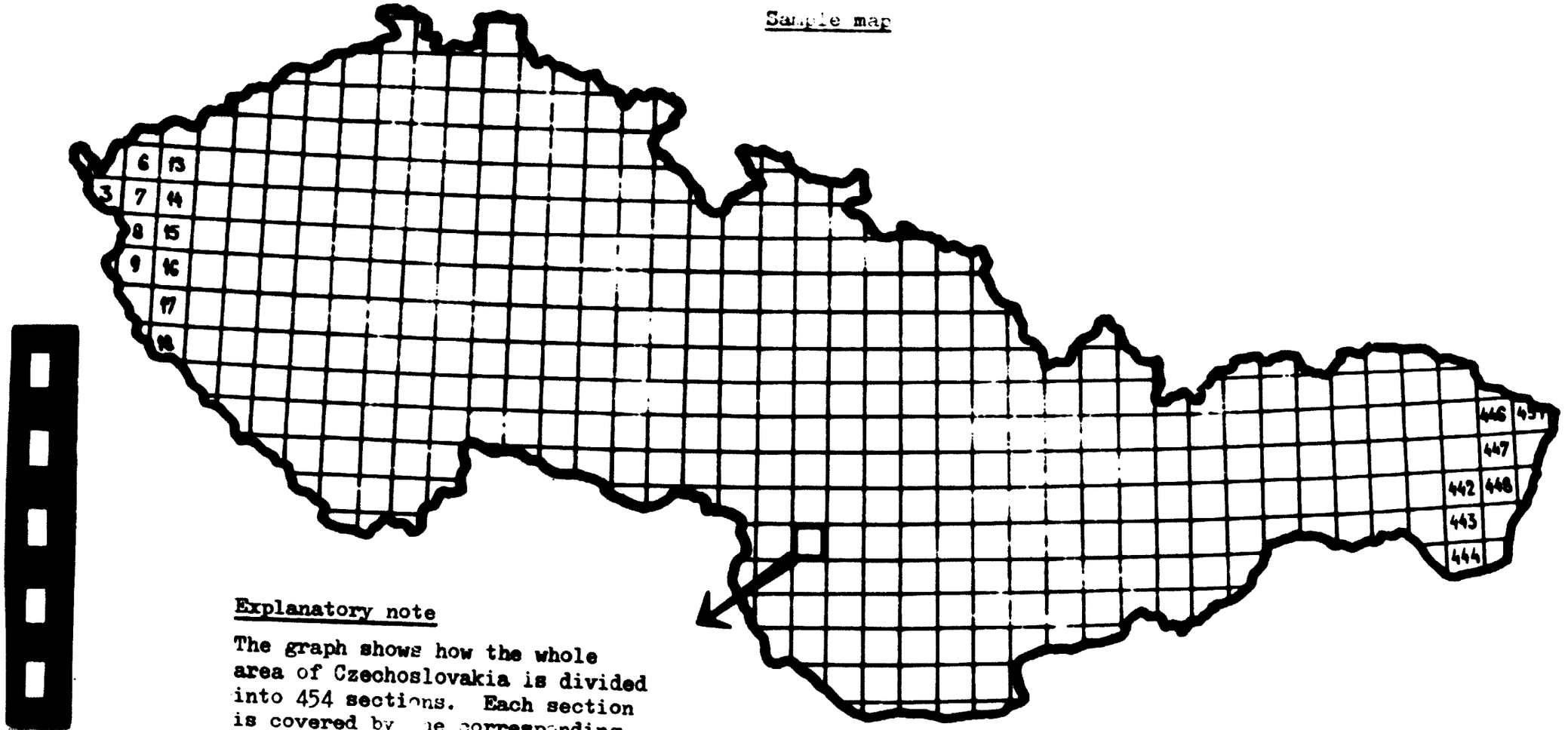
Table 11

Fund of houses and flats - basic data (as of March 1961)

Area	Number of						Total number of houses		Total number of flats	
	houses	flats	rooms for living	living area in m^2	households covered by census	inhabitants	in towns	in villages	in towns	in villages
1	2	3	4	5	6	7	8	9	10	11

ANNEX 2

Sample map



Explanatory note

The graph shows how the whole area of Czechoslovakia is divided into 454 sections. Each section is covered by the corresponding section-map (scale 1:50.000). Each section-map contains basic information on natural conditions, facilities and economic conditions expressed in a uniform key which is valid for the whole system of the general spatial projection of the country.

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