

**MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE**

**O. M. BEKETOV NATIONAL UNIVERSITY  
OF URBAN ECONOMY IN KHARKIV**

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**CITY PLANNING AND TRANSPORT**

A SYNOPSIS OF THE LECTURES

*(for applicants of the first (bachelor) level of higher education of  
specialty 192 – Construction and civil engineering)*



**Kharkiv**  
**O. M. Beketov NUUE**  
**2023**

**Tetiana Apatenko.** City planning and transport : a synopsis of the lectures for applicants of the first (bachelor) level of higher education of specialty 192 – Construction and civil engineering) / Tetiana Apatenko, Olena Bezlubchenko ; O. M. Beketov National University of Urban Economy in Kharkiv. – Kharkiv : O. M. Beketov NUUE, 2023. – 48 p.

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*Recommended by the Department of Urban Construction, protocol № 1 dated September 05, 2022*

Конспект лекцій передбачає розгляд питань щодо системного підходу до проектування міст, висвітлюються функціональні й структурно-територіальні тенденції та закономірності розвитку міських поселень, їх планувальна структура та функціональна організація, розглядаються основні транспортні проблеми сучасного міста, класифікація міського транспорту і вулично-дорожньої мережі. Конспект лекцій призначений для студентів будівельних спеціальностей.

A synopsis of the lectures provides consideration of issues of a systematic approach to urban design, covers functional and structural trends and patterns of urban development, their planning structure and functional organization, considers the main transport problems of the modern city, classification of urban transport and road network. The syllabus of lectures is intended for students of construction specialties.

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## INTRODACTION

Urban planning, also known as town planning, city planning, regional planning, or rural planning, is a technical and political process that is focused on the development and design of land use and the built environment, including air, water, and the infrastructure passing into and out of urban areas, such as transportation, communications, and distribution networks and their accessibility.

In theory, urban planning is a process of elaborating solutions that aim both to improve or requalify an existing urban area, as well as to create a new urbanization in a given region. As a discipline and as a method of action, urban planning deals with the processes of production, structuring and appropriation of urban space. In this sense, its main objective is to point out what measures should be taken to improve the quality of life of the inhabitants, including matters such as transport, security, access opportunities and even interaction with the natural environment.

Urban planning answers questions about how people will live, work and play in a given area and thus, guides orderly development in urban, suburban and rural areas. Although predominantly concerned with the planning of settlements and communities, urban planners are also responsible for planning the efficient transportation of goods, resources, people and waste; the distribution of basic necessities such as water and electricity; a sense of inclusion and opportunity for people of all kinds, culture and needs; economic growth or business development; improving health and conserving areas of natural environmental significance that actively contributes to reduction in CO<sub>2</sub> emissions as well as protecting heritage structures and built environments. Since most urban planning teams consist of highly educated individuals that work for city governments, recent debates focus on how to involve more community members in city planning processes.

In order to make effective urban planning decisions, it is necessary to study the peculiarities of the functioning and development of urban planning systems of various types, for example, determining the growth rates of the city, the structure of its housing stock, calculation and principles of organization of service networks, which is directly related to forecasts of the sociodemographic structure of the population, which, in turn, depends on the economic base of the city's development, its functional structure.

## CONTENT MODULE 1 BASICS OF CITY PLANNING

### Topic 1“Regularities of urban development, problems and prospects for their development”

1. Basic concepts of discipline “City Planning and transport”.
2. Basic principles of urban planning
3. History of urban planning

Urban planning, also known as town planning, *city planning*, regional planning, or rural planning, is a technical and political process that is focused on the development and design of land use and the built environment, including air, water, and the infrastructure passing into and out of urban areas, such as transportation, communications, and distribution networks and their accessibility

*Urban planning* is a technical and political process concerned with the development and use of land, planning permission, protection and use of the environment, public welfare, and the design of the urban environment, including air, water, and the infrastructure passing into and out of urban areas, such as transportation, communications, and distribution networks.

There are seven types of urban planning we discuss below: strategic urban planning, land-use planning, infrastructure planning, urban revitalization, master planning, economic development, and environmental planning.

Urban planning is closely related to:

- natural;
- social and economic conditions;
- the level of development of science, culture and production;
- national characteristics of the country.

Urban planning covers a set of the following problems:

- compositional (architectural and spatial);
- functional;
- aesthetic (architectural and artistic);
- transport.

Basic principles of urban planning are:

- zoning of urban areas;
- district planning of the city road system;
- typology of cities (garden city, satellite city, etc.);
- allocation of structural elements of the city (residential areas and microdistricts).

The main tasks of modern urban planning – the creation of cities and towns with individual appearance, solving urban environmental problems, overcoming the monotony of typical buildings, preservation and scientifically sound reconstruction of

old urban centers, careful preservation and restoration of cultural monuments, the combination with modern buildings.

Evidence of planning has been unearthed in the ruins of cities in China, India, Egypt, Asia Minor, the Mediterranean world, and South and Central America. Early examples of efforts toward planned urban development include orderly street systems that are rectilinear and sometimes radial; division of a city into specialized functional quarters; development of commanding central sites for palaces, temples, and civic buildings; and advanced systems of fortification, water supply, and drainage.

For several centuries during the Middle Ages, there was little building of cities in Europe. Eventually towns grew up as centers of church or feudal authority, of marketing or trade. The physical form of medieval and Renaissance towns and cities followed the pattern of the village, spreading along a street or a crossroads in circular patterns or in irregular shapes, though rectangular patterns tended to characterize some of the newer towns.

Conscious attempts to plan cities reemerged in Europe during the Renaissance. Although these efforts partly aimed at improving circulation and providing military defense, their prime objective was often the glorification of a ruler or a state. From the 16th century to the end of the 18th, many cities were laid out and built with monumental splendor. The result may have pleased and inspired the citizens, but it rarely contributed to their health, to the comfort of their homes, or to efficiency in manufacturing, distribution, and marketing.

The New World absorbed the planning concepts of European absolutism to only a limited degree. Concern for the appearance of the city had long been manifest in Europe, in the imperial tradition of court and palace and in the central plazas and great buildings of church and state. In Paris during the Second Empire (1852–70), Georges-Eugène, Baron Haussmann, became the greatest of the planners on a grand scale, advocating straight arterial boulevards, advantageous vistas, and a symmetry of squares and radiating roads. The resulting urban form was widely emulated throughout the rest of continental Europe.

Haussmann's methods provided a template by which urban redevelopment programs would operate in Europe and the United States until nearly the end of the 20th century, and they would extend their influence in much of the developing world after that.

Test questions on the topic:

1. What is the role of urban planning?
2. What are the principles of urban planning?
3. What is the historical background of city planning?
4. What is the history of urban planning theory?

## Topic 2” Definition of the concept of settlement”

1. Classification of settlements.
2. Basic formatting principles, types and forms.
3. Agglomerations. Transformation of rural settlement.

The function of a settlement helps to identify the economic and social development of a place and can show its main activity. Most large settlements have more than one function though in the past one function was maybe the most important in defining the success and growth in importance of the settlement.

A settlement is a place where people live. But it also includes the people who live there, the buildings, the roads, streets and pathways which link up the buildings in the settlement and through which the people communicate.

### Human Settlement Factors:

1. Body of water (transportation routes, water for drinking and farming)
2. Flat land (easy to build)
3. Fertile soil (for crops)
4. Forests (timber and housing)

### Classification of settlements

Settlement are primarily classified according to their *pattern*, *size* and *housing density*. They can also be classified according to the functions they perform.

### Classification according to pattern

There are 5 types of settlement classified according to their *pattern* (fig. 1), these are, isolated, dispersed, nucleated, and linear.

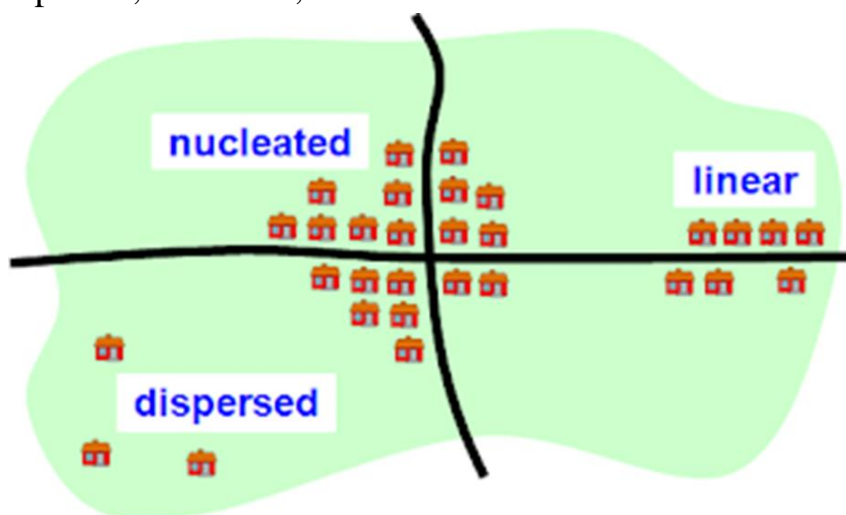


Figure 1 – Classification according to pattern

An isolated settlement consists of a single farm or house very remote from any other one, usually found in farming or hunting rural communities.

A dispersed settlement is made up of several houses, scattered or dispersed (as the name implies). One house may be up to one or more kilometers from the next. This type of settlement is common in the Sahel.

In a nucleated or compact settlement, the buildings are clustered, linked by roads, and the settlement itself may have a nearly circular or irregular shape. Such settlements can be either cultural or urban, depending on the size and the functions they perform.

A linear or elongated settlement forms a straight or curved line, following a line of movement, such as a road, river, coastline or the foot of an elongated escarpment. This type of settlement is found in rural area, but linear developments may constitute extensions of towns on their outskirts.

Finally, the integrated nucleated and linear settlements combines the characteristics of both types of settlement, and they are star-like. They often occur at junctions, and a number of them in urban settlements.

### Classification according to size and housing density

Size and housing density are used together with settlement functions to classify settlements into major categories i.e. rural and urban (fig. 2).

Rural settlements are often small in size and have low housing and population densities.

Urban settlements are larger in size and have many houses built close together.

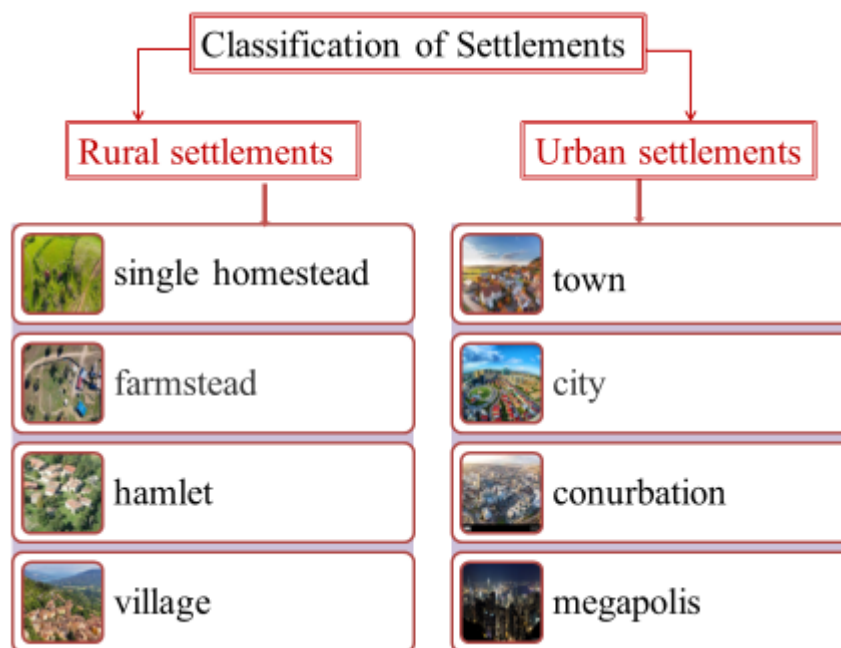


Figure 2 – Classification according to size and housing density

Rural settlements can further be broken down into these four grades on the basis of size.

A *single homestead* has just one compound, usually isolated and owned by a family, and one may be many kilometers from the next.



A *farmstead* consists of two or more homesteads, usually dispersed in a farmland and occupied by up to fifty individuals.

A *hamlet* is made up of several dispersed, nucleated or linear homesteads generally with shops, schools or other service centers and occupied by some hundreds of persons who are engaged in primary activities like farming, hunting and fishing.

A *village*, like a hamlet, may be dispersed, nucleated or both nucleated or linear, but the village has more homesteads and the population may be up to several thousands. The people engage in primary occupations, but there may also be craft and cottage industries, and service centers like schools, post offices, health centers and markets.

Urban settlements can equally be graded into four, according to size. These are towns, cities, conurbations and megapolis.

*Towns* are urban settlements of up to several thousand persons. Houses are built together and the emphasis is more on secondary and tertiary rather than on primary occupation. Usually, a town has large chain stores, and many other social and commercial facilities.

*Cities* are the major towns of a country, like the major state capitals which have administrative functions. The old concept of a city being a walled town is no longer tenable as cities are no longer walled these days. They are generally larger than towns.

A *conurbation* grows when two or more towns or parts have grown and joined together to form a large urban area of 1 million persons or thereabouts. The boundary between original towns becomes blurred, just like we have in Lagos (Ikeja) and Accra (Tema).

*Megapolis* are several cities or conurbations which have grown over the years and have joined together to form a massive sprawling urban settlements. Such settlements stretch over several square kilometers and, as conurbations, it is difficult to know where one original city ends and the other begins. Megapolis is the highest in the hierarchy of urban settlements. Examples are New York-Boston-Philadelphia and Greater Los Angeles (USA), Tokyo (Japan), Greater London (Britain), Mexico City (Central America), and Dusseldorf-Duisburg-Essen-Dortmund, in the Ruhr manufacturing region of Germany.

The structure of the regional system is formed by group systems of settlements, agglomerations of cities, oasis (center) and rural settlements. The formation of regional systems establishes a path to the integration of urban and rural settlement, to the formation of equally comfortable working, service, living and recreation conditions for both urban and rural populations.

In modern urban planning there are other approaches to the structure of regional systems. The proposals of the Ukrainian urban planning school are to distinguish three levels of settlement: regional systems, zonal systems, urbanized core of agglomerated systems. In many developed industrial and agricultural countries, there are new ways

to transform rural settlements – the formation of mutually agreed groups of rural settlements, which, in turn, form a hierarchy of higher groups in areas of influence of medium, large and the largest cities and agglomerations. Within these local groups there is a process of differentiation, as a result of which rural settlements are formed, different in size and functional purpose – local, industrial, economic and cultural centers.

In the theory and practice of urban planning, three types of small settlement systems are identified: district – groups of rural settlements around a small town; inter-farm (bush) – around small towns, villages or large villages; domestic – around urban-type settlements. Thus, small settlement systems of the rural population are the primary link in the hierarchical structure of group and regional systems and an intermediate link in the territorial location of these systems.

Urbanization of large economic areas is a process of merging cities of different sizes and the formation on this basis of agglomerations and conurbations of cities. This settlement process is managed by the formation of mutually agreed systems of regional, group and local settlement. Thus, a hierarchical structure of settlement of the country is formed, which consists of regional and group systems, as well as the system of rural settlement. The choice of a rational organization of settlement is decided in projects and schemes of district planning.

Test questions on the topic:

1. What is the concept and meaning of settlement?
2. Why is settlement important?
3. What are the factors of settlement?
4. What are the 5 types of settlement?
5. Describe the difference between group systems of settlements, regional systems and agglomerations
6. What is the concept of urban and urbanization?

### **Topic 3” Typology and classification of cities”**

1. Cities defining and categorized.
2. Typology and classification of cities.
3. The city profiles.

Major characteristics of cities include having downtown areas, buildings, highways, and other transportation networks. Businesses, a large population, and a unique cultural landscape identify a city, whereas urban locations include non-rural areas like the city and suburbs.

A city is a human settlement of notable size. It can be defined as a permanent and densely settled place with administratively defined boundaries whose members

work primarily on non-agricultural tasks. Cities generally have extensive systems for housing, transportation, sanitation, utilities, land use, production of goods, and communication. Their density facilitates interaction between people, government organizations and businesses, sometimes benefiting different parties in the process, such as improving efficiency of goods and service distribution.

There are a range of different definitions and ways of categorizing cities depending on the data-analyzing organization, census records or country. Cities can be determined by the number of inhabitants, the role they play within a larger political context, the role they play as a hub for the larger surrounding area and so on.

*Megalopolis* – a group of conurbations, consisting of more than ten million people each.

*Conurbation* – a group of large cities and their suburbs, consisting of three to ten million people.

*Metropolis* – a large city and its suburbs consisting of multiple cities and towns. The population is usually one to three million.

*Large city* – a city with a large population and many services. The population is more 1 million people but over 300 000 people.

*City* – a city would have abundant services, but not as many as a large city. The population of a city is between 100,000 and 300,000 people.

*Large town* – a large town has a population of 20 000 to 100,000.

*Town* – a town has a population of 1 000 to 20 000.

*Village* – a village is a human settlement or community that is larger than a hamlet but, smaller than a town. A village generally does not have many services, most likely a church or only a small shop or post office. The population of a village varies however; the average population can range from hundreds to thousands.

*Hamlet* – a hamlet has a tiny population (more 100) and very few (if any) services, and few buildings.

*Isolated dwelling* – an isolated dwelling would only have 1 or 2 buildings or families in it. It would have negligible services, if any.

Each city is a complex, functional and planning object. The harmonious functioning and development of the city and its components is ensured by taking into account the category of the city by population.

The following cities are distinguished by population:

small – up to 50 thousand inhabitants;

medium – 50–100 thousand inhabitants;

large – 100–500 thousand inhabitants;

big – 500–1000 thousand inhabitants;

very big – more than 1 000 thousand inhabitants.

A city's economic value can be broken down into industries and clusters that make up the city's industrial composition, which ultimately compose its economic identity.

The criteria formation of a city are as follows. First, political, religious and cultural centers are formed in the region. Second, emerge of settlements that military defense functions have been strengthened, and many of which are marked by the construction of city walls. Third is the formation of the state and civilization.

The city profiles into four broad categories: capital, knowledge, mobility, and pleasure (fig. 3).

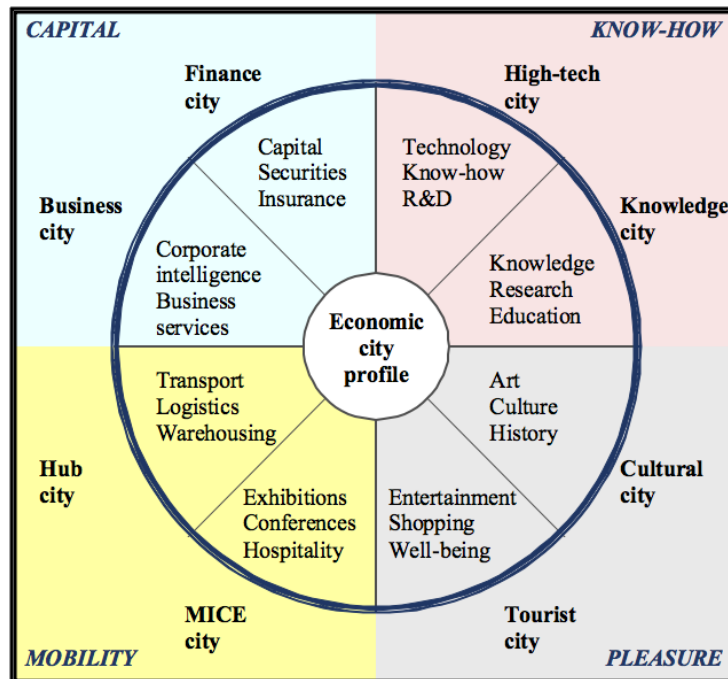


Figure 3 – These categories form a field of post-industrial activities that add high value to a city

As various types of industrial cities, science cities, economic cities, university cities, satellite cities, comprehensive development zones, special economic zones, and other new urban spaces continue to spring up, the planning and construction of new towns has attracted extensive and continuous attention from the circles of geography, planning, economics and sociology, and there have been a large number of high-quality research.

According to the administrative and political significance, the following cities are distinguished:

- capital;
- centers of regions, region;
- centers of lower administrative districts.

*Port cities* are located on the seas, large rivers. Their specificity is a fan-shaped plan of the city, where the city center is located, as a rule, by the sea (river); a railway

is required for a cargo port; if there is a resort – a large number of tourists and vacationers; the presence of a large space corresponds to the architectural silhouette.

The *city-railway junction*, its territory is divided by the railway, which complicates transport communication within the city; usually several railway stations; availability of railway depot, warehouses.

*University city* – Campus, campuses in the complexes of large universities, combining several functions (education, sports, recreation and housing for students and teachers).

*Museum cities* are well-preserved ancient cities that are interesting in terms of acquaintance with the history of the country. Specifics: a large number of tourists, which determines the number of hotels, service facilities and more. The new building is subject to the historic buildings of the city.

Scientific cities are a new type of cities that emerged in the twentieth century. and demonstrates the growing role of science. Specifics: the size of the city is small; are located in good natural conditions (more often – the forest); in the building a large part of research institutes, houses of scientists, increased demands for silence.

Most cities have multifunctionality. As a rule, the functional nature affects the planning of the city, gives it specific features. Thus, on the territory of the industrial city there is a large number of industrial facilities (up to 50% of the territory), as well as railways, freight stations, access roads, sanitary protection zones. The design takes into account the location of the industry, the fight against harmful emissions.

Test questions on the topic:

1. What are the characteristics and types of cities?
2. How are cities defining and categorized?
3. What is formation of a city?

#### **Topic 4” The planning structure of the modern city”**

1. Population calculation.
2. City-forming and service factors.
3. Dependence of the planning structure of the city on the population.

A city is a human settlement of notable size. It can be defined as a permanent and densely settled place with administratively defined boundaries whose members work primarily on non-agricultural tasks. Cities generally have extensive systems for housing, transportation, sanitation, utilities, land use, production of goods, and communication. Their density facilitates interaction between people, government organizations and businesses, sometimes benefiting different parties in the process, such as improving efficiency of goods and service distribution.

The most important component of the city is the city-forming base – industrial (production) areas. The profile of the city determines the composition of its production base. Cities by economic profile are divided into industrial, resort, tourist, railway junctions, scientific centers, etc. According to the administrative and cultural significance, urban settlements are divided into regional, district centers, cities of regional subordination, cities, urban-type settlements, settlements.

There are two categories of population that form the city-forming and city serving bases. The city-forming group includes the able-bodied population who work at enterprises, not only within but also outside the city. The city service base consists of administrative, cultural, educational and other institutions, as well as the population working in them.

Determine the population. Short of counting the population yourself, you'll need to find an up-to-date record of how many people live in this area. Start by running a web search for the population of the place. Look for the most recent census data for a relatively accurate number. If you are looking for the population of a country, the CIA World Factbook is a good source.

If you are calculating the population density for an area that has not already been recorded, you may need to count the population yourself. This might include a colloquially-defined urban neighborhood. Try to get as accurate a number as possible.

The present population of a town or city may be obtained by extending the line of the last two preceding census figures up to the year in question. The future population of a town or city at the end of a design period may be predicted on the basis of the census data for a number of preceding census years.

A city can be distinguished from other human settlements by its relatively great size, but also by its functions and its special symbolic status, which may be conferred by a central authority. The term can also refer either to the physical streets and buildings of the city or to the collection of people who dwell there, and can be used in a general sense to mean urban rather than rural territory.

National censuses use a variety of definitions – invoking factors such as population, population density, number of dwellings, economic function, and infrastructure – to classify populations as urban. Typical working definitions for small-city populations start at around 100,000 people. Common population definitions for an urban area (city or town) range between 1,500 and 50,000 people, with most U.S. states using a minimum between 1,500 and 5,000 inhabitants.

**City (town)-forming population group:**

1. Industrial enterprises, the products of which are used outside the given city.
2. Institutions and service organizations whose scope of activities is beyond the boundaries of the given city:
  - education (higher education, secondary education, FPK);

- health protection (sanatoriums, rest homes, tourism institutions, etc.);
- science and scientific services (academies, research institutes, design and design organizations);
- management of finances and credits, communications, civil organizations.

3. Institutions and organizations of capital construction (personnel of organizations that carry out all types of new and reconstructive construction, as well as enterprises of the construction industry).

4. External transport.

5. Agricultural enterprises (typical for small and partly medium-sized cities).

Be aware of the limitations. It is simple and straightforward to calculate population density in this way, but it may not reveal more intricate details about an area. This is highly dependent upon the size and type of the area for which you are calculating population density. The formula sometimes says more about smaller, densely-inhabited areas than it does about larger areas that include both inhabited and uninhabited land.

Say that you calculate the population density of a county that is home to a huge amount of open land and national forest, but also to a very large city. The population density of the county at large will not tell you much about the density of the city: the actual space where people live.

Remember that population density is just an average. It may not correspond exactly to the population count of an area. If not, consider why. Try calculating the density for a smaller area within the original area.

At the stage of pre-project studies (feasibility study), an analysis of city-forming factors is carried out, on the basis of which it is possible to draw a conclusion about the prospects for the development of the city - the general economic potential, the dynamics of changes in the functional structure, the employment structure, the demographic structure and the prospective population, etc. This allows us to adequately formulate a general strategy for the development of a settlement (a strategic plan for the development of a municipality), which is the basis for the development of urban planning documentation.

In the future, the whole complex of city-forming factors that will affect the development of the city plan is analyzed

However, complete subordination or complete disregard for natural conditions is hardly possible; rather, one should speak of striving for one or the other.

Test questions on the topic:

1. How do you calculate population of a city?
2. What is the population to make a city?
3. What is city (town)-forming population group?

## CONTENT MODULE 2 FUNCTIONAL ORGANIZATION OF THE CITY TERRITORY

### Topic 5” Basic principles of the planning organization of the city”

1. Planning structure.
2. The influence of natural factors on the development of the urban plan.
3. Functional Zoning in Cities.
4. City-forming and city-forming factors.

Cities began to form many thousands of years ago, but there is little agreement regarding why cities form. The chances are that many different factors are responsible for the rise of cities, with some cities owing to their existence to multiple factors and cities that arose as a result of more specific conditions.

Two underlying causal forces contribute to the rise of cities. Site location factors are those elements that favor the growth of a city that is found at that location. Site factors include things like the availability of water, food, good soils, a quality harbor, and characteristics that make a location easy to defend from attack. Situation factors are external elements that favor the growth of a city, such as distance to other cities, or a central location.

*Planning structure* – characterizes the urban organism in the unity of the relationship of its parts, elements.

Models of Urban Structure Sociologists, economists, and geographers have developed three models to help explain where different types of people tend to live in an urban area – the concentric zone, sector, and multiple nuclei models. The peripheral model is a modification of the multiple nuclei model:

**A – Concentric ring model (Zonal model).** This model was the first to explain distribution of social groups within urban areas. Based on one single city, Chicago, it was created by sociologist Ernest Burgess in 1924. According to this model, a city grows outward from a central point in a series of concentric rings. The innermost ring represents the central business district. It is surrounded by a second ring, the zone of transition, which contains industry and poorer-quality housing. The third ring contains housing for the working-class and is called the zone of independent workers' homes. The fourth ring has newer and larger houses usually occupied by the middle-class. This ring is called the zone of better residences. The outermost ring is called the commuter's zone. This zone represents people who choose to live in residential suburbs and take a daily commute into the CBD to work (fig. 4).



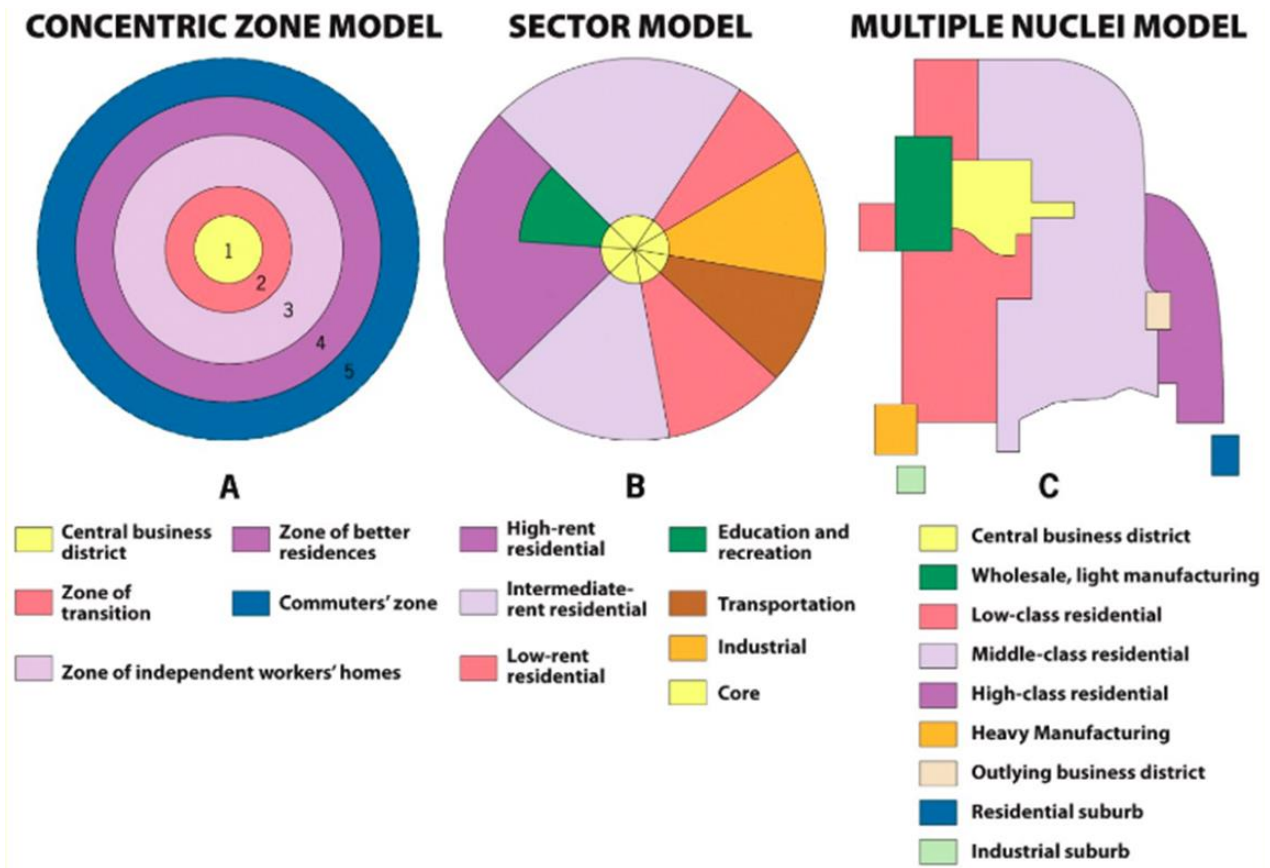


Figure 4 – Classical models of urban morphology (based on Park et al. 1925; Hoyt 1939; Harris and Ullman 1945)

**B – Sectoral model.** Homer Hoyts model, the sector model, proposed that a city develops in sectors instead of rings. Certain areas of a city are more attractive for various activities, whether by chance or geographic and environmental reasons. As the city grows and these activities flourish and expand outward, they do so in a wedge and become a sector of the city. If a district is set up for high income housing, for example, any new development in that district will expand from the outer edge (fig. 4)

**C – Multiple nuclei model.** Geographers Chauncey Harris and Edward Ullman developed the multiple nuclei model in 1945. According to this model, a city contains more than one center around which activities revolve. Some activities are attracted to particular nodes while others try to avoid them. For example, a university node may attract well-educated residents, pizzerias, and bookstores, whereas an airport may attract hotels and warehouses. Other businesses may also form clusters, sometimes known locally as Iron Triangles for automobile repair or red-light districts for prostitution, or arts districts. Incompatible activities will avoid clustering in the same area, explaining why heavy industry and high-income housing rarely exist in the same neighborhood (fig. 4).

The findings of advocates of monocentric structure as previously discussed, one common and significant viewpoint is that both urban dispersion and polycentric development are associated with employment decentralization, which would easily create a jobs-housing imbalance within a given geographic area. Such an ‘imbalance’ would lead to increasing trip commuting distances and time in metropolitan areas. Conversely, some scholars argued that sub-center’s or given geographic areas of a polycentric or a dispersed city provide sufficient housing choices and jobs that are matched in both quantity and quality (when measured by their social-economic characteristics), then these areas could be considered as “balanced” thereby resulting in workers selecting residential locations as close to their jobs’ location as possible.

The planning structure is visually expressed in the placement of the main functional units and the configuration of transport links between various functional zones. City highways with adjacent territories are the most stable elements of the city plan (framework).

The planning structure is visually expressed in the placement of the main functional units and the configuration of transport links between various functional zones. City highways with adjacent territories are the most stable elements of the city plan (framework).

When describing the planning organization of urban planning systems, the following groups of concepts are used:

*Point elements* of the planning structure: cities, large separately located industrial and energy complexes, main transport hubs, functional or compositional centers (nodes, focuses). Center (node) – a point of concentration of any feature. In the city, these are public service centers, transport squares, compositional focuses, etc.

*Linear elements (planning axes)* – river valleys, mountain gorges, sea coasts, highways, engineering structures, compositional axes. Planning axes represent a concentration of some feature along the line (compositional or transport axes, functional or visual connections, etc.).

*Zonal elements* – vast territories with pronounced natural, economic and urban features, forests, reservoirs, territories with varying degrees of urbanization or the nature of functioning, zones of historical protected development, deposits, sanitary protection zones, etc.

The above concepts describe both natural and anthropogenic elements of territories and at different scale levels from the settlement system to the microdistricts.

Under very unusual circumstances, one might find that among a group of cities, no single city has unique site location advantages over others. This might happen out on a vast plain, like in Kansas, where there are no navigable rivers, waterfalls, or ports. In instances like this, situation advantages come to the fore, and a regular, geometric pattern of cities may emerge.

The city forming factors are a prerequisite for the emergence and further development of cities: natural and climatic (fig. 5); socio-economic (fig. 6); military-political; historical.

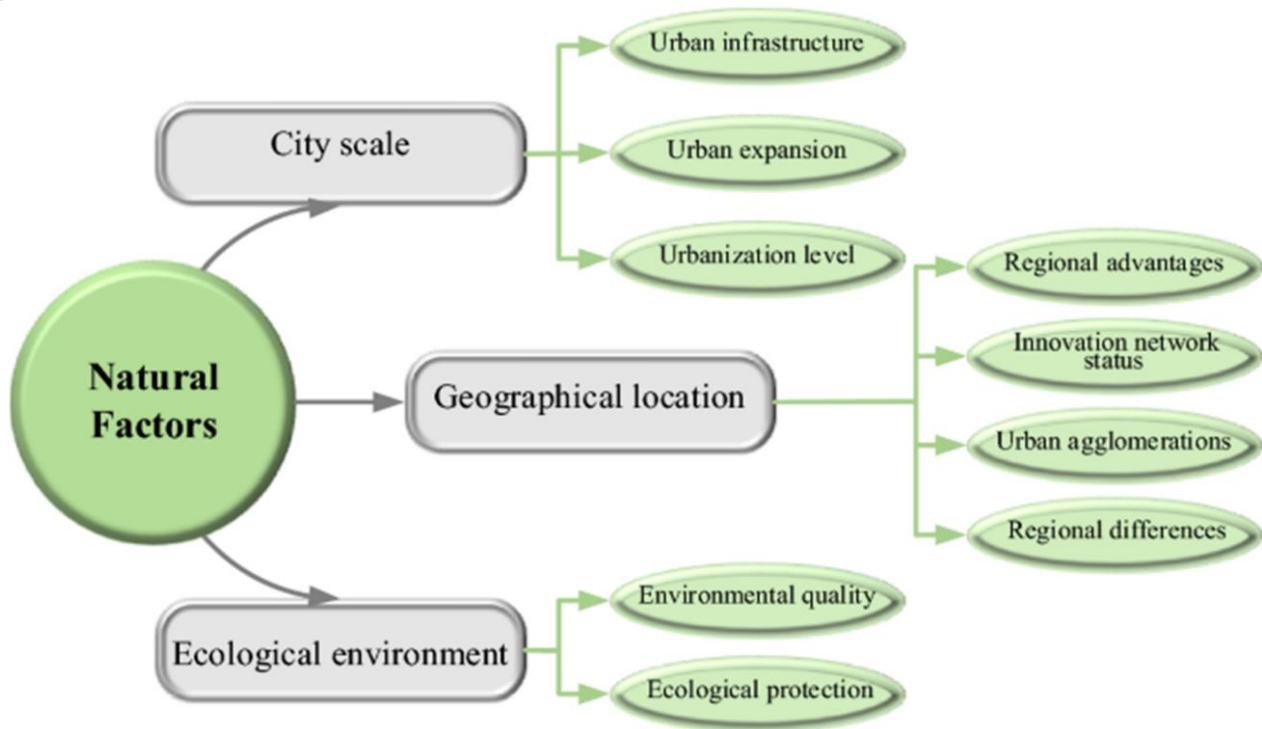


Figure 5 – Natural and climatic factors

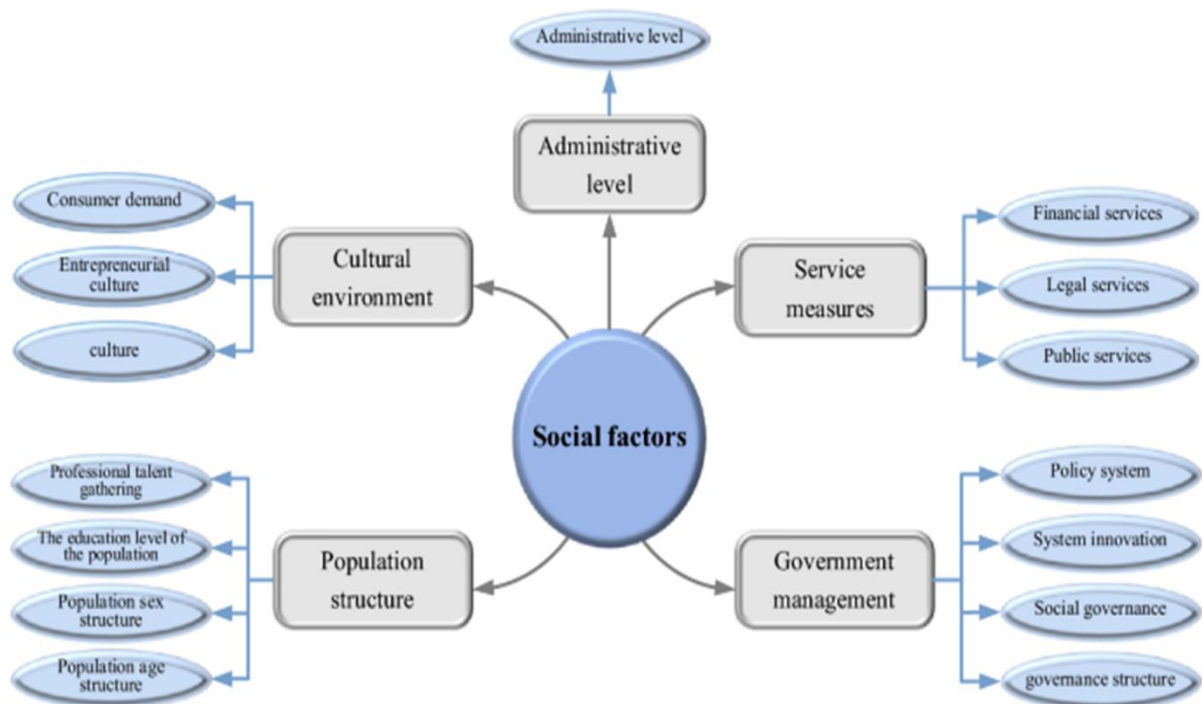


Figure 6 – Socio-economic factors

The planning structure is visually expressed in the placement of the main functional units and the configuration of transport links between various functional zones. City highways with adjacent territories are the most stable elements of the city plan (framework).

### **Functional Zoning in Cities: Concept and Overview**

*Functional zoning* or functional city zoning is a method used for dividing land use by its function. Typically, land use is divided in two ways, by its function and by its physical characteristics. An example of functional zoning would be an area that has designated zones based on a function such as an industrial zone, a recreational zone and a residential zone. An example of an area zoned by its physical characteristics is defined in terms of characteristics like development density, minimum lot size, and building coverage, placement and height.

The division of the city into distinct functional areas was not always characteristic of the city, in pre-industrial cities one can observe spatial combination of functions. The emergence of a new principle of organizing a city (functional zoning) is associated with the industrial revolution in Europe.

For the first time, the principle of functional zoning was formulated by T. Garnier in 1903. The novelty consisted in a clear distinction between functions and processes in the city and, as a result, in new methods of organizing living space and transport and pedestrian traffic. Garnier proposed spatially separate: housing, labor, recreation, training, movement etc.

Main functional areas (use zoning):

- residential (occupies about 50 % of the city, in the residential area can be identified residential, institutional area (1–2 %) and public-business areas or commercial area (2–5 %);
- industrial area (5–20 %);
- warehouse and communal area (2–10 %);
- zone of engineering and transport infrastructure (10–14 %);
- recreational area (15–20 %).

In urban and transportation planning, land use is the object of zonal characterization. Each land use zone is subject to a series of regulations depicting what can be built regarding criteria such as nature, function, and density, giving municipal governments tools to influence urban development. There are four major types of land use zoning: functional zoning; form-based zoning; intensity zoning; incentive zoning (fig. 7).

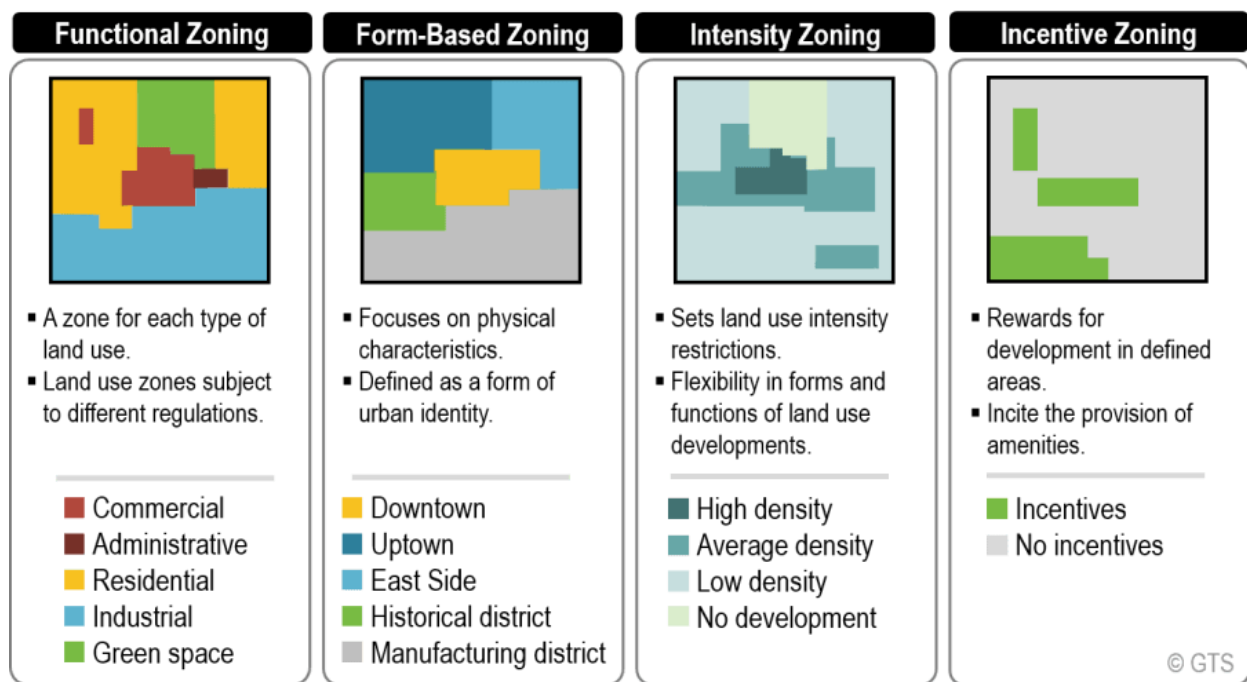


Figure 7 – Types of Land Use Zoning

### Planning organization of the city

When describing the planning organization of urban planning systems, the following groups of concepts are used:

1. *Compact (centric) structure* – characterized by the greatest polarization in the development of space and the greatest compactness of connections. This is the most common type of city in the pre-industrial era.

2. *The linear planning structure* is formed along the main transport artery or is dictated by specific natural conditions (relief conditions, hydrography). Linear structures are less compact and compact in relation to the main transport highway that forms them.

3. *The lattice (network) structure* reflects the relatively uniform development of the territory, is a combination of the main centers and axes, is formed on the basis of the synthesis of centric and linear structures.

4. *The process of urban development* is influenced by a significant number of factors. One of the main tasks of urban planning theory and practice is their study and maximum consideration in design. It is customary to single out city-forming and city-forming factors.

5. *The city-forming factors (functions)* can be: a convenient position in the settlement system, location at the intersection of transport routes, the development of mineral deposits, the location of large industrial enterprises, research complexes, resorts.

6. *City-forming enterprises (industries)* – enterprises, groups of enterprises, industries or activities that are leading (dominant) in the economy of the city, for example: a complex of recreational facilities and hotels in a resort town, a research institute system in a scientific town, a large plant (enterprise) in an industrial city, the system of administrative institutions in the capital center, etc.

7. *The city-forming population* is the population employed in the city-forming enterprises (in the city-forming industries) of the city.

Test questions on the topic:

1. Why is planning structure important?
2. What are the environmental factors in urban planning?
3. What factors might influence urban planning in the future?
4. What is functional zoning concept?
5. What is formation of a city?

### **Topic 6“Basics of the formation the residential area”**

1. Structure of residential area.
2. General concepts of planning district, residential district, microdistrict, quarter.
3. Determination of boundaries, dimensions of residential area.

*The residential zone(area)* is a part of the territory of the settlement intended for the population's living and is occupied by: residential development, enterprises and service centers, community centers, educational institutions, sports complexes, enterprises that do not have harmful effects on the environment, green spaces, streets and squares.

The area of the residential area depends on the national economic profile of the city, its functional characteristics.

Residential area means land used as a permanent residence or domicile, such as a house, apartment, nursing home, school, child care facility or prison, land zoned for such uses, or land where no zoning is in place.

The residential area is the main element of the planning structure. The function of the residential area is to provide maximum convenience and comfort for the population, to create an architectural and artistic image of the building in compliance with sanitary and hygienic and construction norms and rules.

The structural components of residential formations are specialized areas, or zones, in which residential and public buildings, structures and appropriately equipped open spaces are located. Urban housing entities consist of specialized territories, the main of which are regulated (fig. 8). Thus, in residential areas, in addition to the actual residential areas, which occupy about 60% of the total area, there is a zone of the district public center, green public areas, a zone of sports facilities, a communal zone.



Figure 8 – Residential area structure

*Residential district* – the main structural element of the residential zone area of 80–400 hectares, within the boundaries of which residential quarters (microdistricts) are formed, institutions and enterprises with a service radius of not more than 1 500 m, as well as objects of urban importance are located.

*The residential dwelt district* is a structural element of a residential area of more than 400 hectares, at the borders of which residential areas are formed. Its borders are streets and roads, which is typical for residential areas, as well as the highway for uninterrupted traffic.

*The planning residential district* is a relatively isolated part of the city, which has natural and artificial borders, which can be occupied both completely and partially under residential areas, production areas, landscaped recreational areas.

*Residential quarter (residential complex)* – the primary structural element of the residential environment, limited by main or residential streets, thoroughfares, natural boundaries, etc., up to 20–50 hectares with a full range of institutions and local service enterprises (large block, micro district) and up to 20 ha with an incomplete complex.

*Microdistrict, is a residential complex* – a primary structural element of the residential area construction in the Soviet Union and in some post-Soviet and former Communist states. Residential districts in most of the cities and towns in Ukraine and the republics of the former Soviet Union were built in accordance with this concept.

*Group dwelling* – buildings or building containing family dwelling units, each building containing not less than three and not more than eight dwelling units designed and built in accordance with the group dwelling regulations in effect at the time of construction.

The starting positions of the spatial organization of residential formation are: determining the boundaries and area of formation, as well as the nature of their relationship with other elements of the planning structure of the city; population calculation; determination of the required volumes of residential stock and types of residential buildings, composition and capacity of service facilities, composition of the main functional zones and their share in the overall balance of the territory. The boundaries and, accordingly, the total area of residential formations are largely determined by the type of these formations. These parameters can be quite rigidly set when designing the living environment (for example, for microdistricts and quarters when designing a residential area) or can be clarified and adjusted based on the master plan of the city. A master plan includes analysis, recommendations, and proposals for a site's population, economy, housing, transportation, community facilities, and land use.

The boundaries of the residential area are the main streets and roads of citywide importance, natural, artificial borders. Individual residential areas that are not part of residential areas are formed as separate structural units with more developed elements of urban service.

The various residential districts are intended to provide suitable areas for residential use and development appropriate to the environmental characteristics of the land and the character of the neighborhood.

The differentiation among the residential districts is intended to provide for variety in the size and density of residential neighborhoods and a diversity of housing opportunities after consideration of soil types, terrain, and infrastructure capacity.

The residential districts may allow for certain non-residential uses when it can be demonstrated that they are compatible with nearby residential uses and preserve neighborhood character and property values.

Test questions on the topic:

1. What is the structure of residential area?
2. What are the basic elements of planning a residential area?
3. What are the boundaries of a residential area?



## Topic 7“Production area of the city”

1. Structure of the production area.
2. Basic provisions of the organization of the industrial territory.
3. Planning solution communal warehouse space.

*Production territory* – a part of the territory of the city, which consists of objects of material production, utilities, industrial infrastructure, science and scientific services, training, other objects of non-production sphere, which serve material and non-material production. It is characterized by planning integrity and affects the functional – spatial organization of the city and the formation of its planning structure.

Production areas often occupy 30 % of the area of the city, and sometimes more than 50 %, which is typical of large industrial centers.

Industrial enterprises determine:

1. Growth and development of cities (the main city-forming factor).
2. The size of cities (the presence of groups of large enterprises – their distance from the city).
3. Planning structure of the city (cooperation of main, auxiliary and service facilities).

*Industrial area* means an area predominantly zoned general industry or any other equivalent zoning, with the purpose to accommodate all forms of industry including manufacturing and related processing, but excludes noxious or hazardous risk activity.

Industrial area may contain oil refineries, ports, warehouses, distribution centers, and factories (fig. 9).

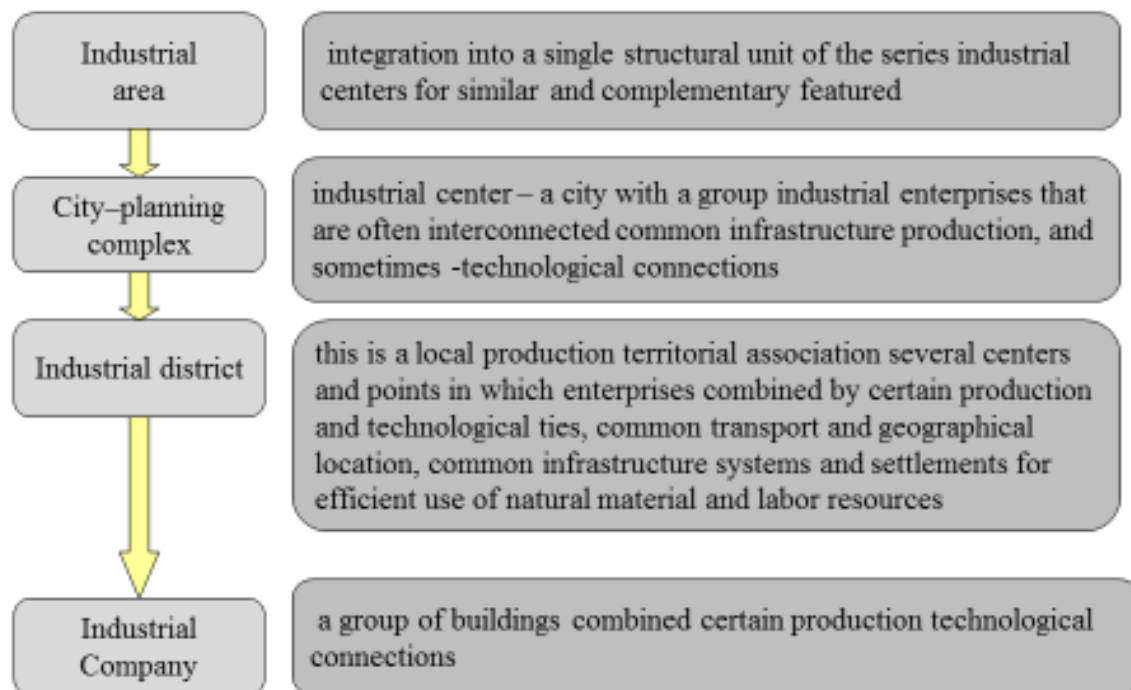


Figure 9 – Structure of the industrial area

*Industrial district* – a form of industrial organization characterized by a geographic concentration of SMEs and some large enterprises, differently but highly specialized in several phases of the process, actively involved in the production of a distinctive product or family of products through cooperative and competitive relations.

Industrial district (ID) is a place where workers and firms, specialized in a main industry and auxiliary industries, live and work.

Basic provisions of the organization of the industrial territory: production facilities should be placed compactly; an industrial zone must be provided with transport links to other functional areas without fail; a part of the territory with production functions can be 60–65 % of the total territory of the area.

**Placement of production areas is not allowed:**

- in the first and second zones of the zone of sanitary protection of sources water supply;
- within the coastal protective strips of rivers and reservoirs;
- on lands for recreational and health purposes; on lands nature reserve and other nature protection purposes;
- in the zones of active karst, landslides, subsidence or collapse of the surface under by the influence of mining, mudflows and snow avalanches, which can threaten the construction and operation of enterprises;
- on sites contaminated with organic and radioactive waste;
- in areas of possible catastrophic flooding, etc.

The production area is divided into zones according to their function destination. The production territory includes: industrial, utility and warehouse, scientific, scientific and industrial zones, as well as the zone external transport and the block of engineering support of the city.

Plots of enterprises included in the industrial district, make up 50–60 % of the entire territory. The rest is used for accommodation warehouse and energy facilities (5–8 %), transport communications and structures: access railway tracks, automobile streets and roads, motor transport enterprises, workshops, sorting stations, depots etc. (5–7 %); cultural and household and scientific and technical centers (2–5 %); green areas (10–12 %) and as a reserve area (10–20 %).

To reduce the harmful effects of industrial areas, transport, warehouse zones to residential areas of the city between they arrange sanitary and protective zones greened strips in width in accordance:

I class – 1 000 m, II class – 500 m, III class – 300 m, IV class – 100 m, V class – 50 m.

I harm class – enterprises with the most hazardous industries (chemical enterprises, metallurgical, cement plants, etc.) – the width of the sanitary protection zone is 1 000 m.

II harm class – enterprises with less hazardous industries (some chemical enterprises (ammonia factories, lasagna factories), small enterprises, etc.) – the width of the sanitary protection zone is 500 m.

III harm class – enterprises for the recycling of non-ferrous metals, precision engineering – the width of the sanitary protection zone – 300 m.

IV harm class – enterprises of light and food industries with a low freight turnover (textile production, food processing) – the width of the sanitary protection zone is 100 m.

V harm class – enterprises with the least hazardous industries that do not emit harmful impurities, dust, noise with a small turnover of light and food industries (bakeries) – the width of the sanitary protection zone is 50 m.

Enterprises and industrial sites with sources of air pollution with hazardous substances of the I-st and II-nd harm classes should not be placed in areas with prevailing winds at speeds up to 1 m/s, with prolonged or often repeated calms, inversions, fogs 30–40 %, during the winter 50–60 % of the days).

Industrial groups that include enterprises that require, according to the organization, a sanitary protection zone with a width of 500 m or more, should not include enterprises that, according to the Cods, should be located near the border or within the residential area.

### **Grouping of enterprises, their location in the structure of the city**

Basic provisions of the organization of the industrial territory:

- production facilities should be placed compactly;
- an industrial zone must be provided with transport links to other functional areas without fail;
- a part of the territory with production functions can be 60–65% of the total territory of the area;
- when placing industrial areas, the factor of balance between places of employment and places of residence is taken into account;
- for the full functioning of the industrial area, one or several public service centers are envisaged, mainly at the junctions with residential areas.

*Separate* – in different parts of the city, distant from the residential area of the placement of groups of enterprises or entire industrial areas, the production of which emit significant amounts of harmful substances.

*Tape (single-panel)* placement – for enterprises of the same or similar sanitary classification of production (see Fig. 10).

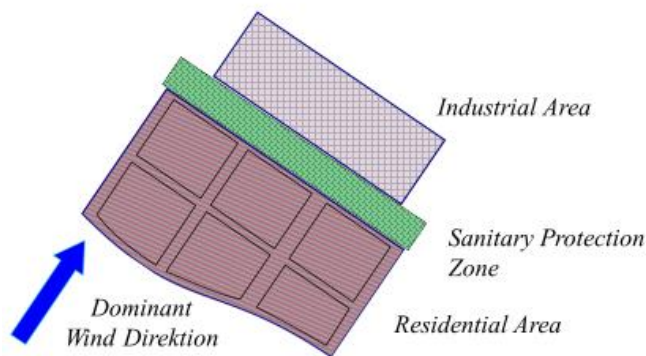


Figure 10 – Optimal location with respect to the prevailing winds. Tape arrangement of the industrial area

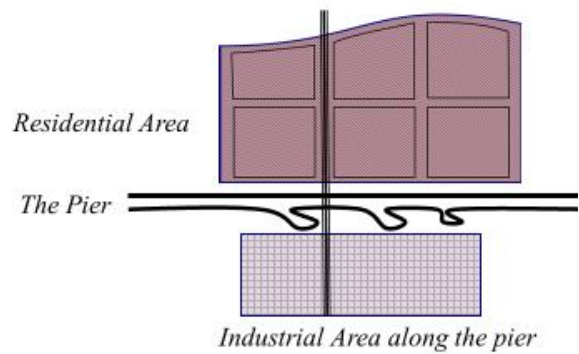


Figure 11 – Tape arrangement, consistent (multi-panel) of the industrial area

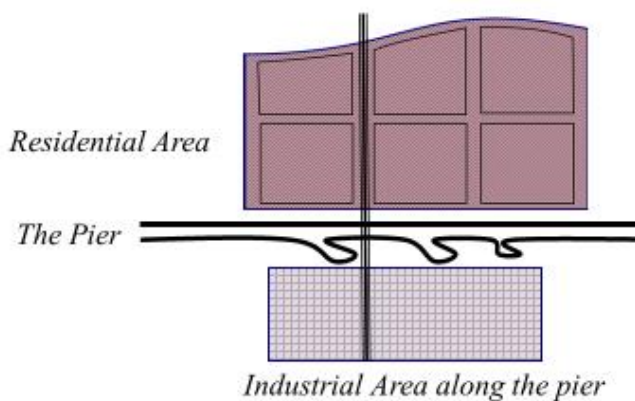


Figure 12 – The location of the industrial area zone is determined by the presence of the harbor

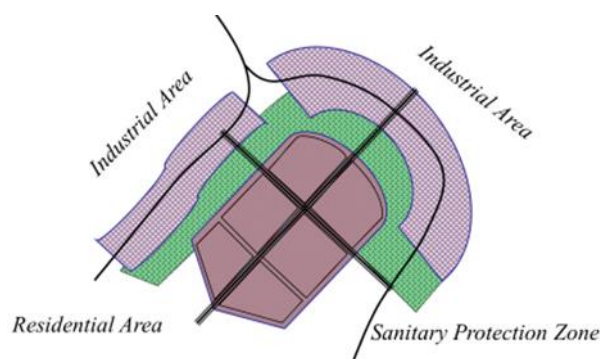


Figure 13 – Unsuccessful location of the industrial area for urban planning considerations along the railway tracks

*Tape arrangement* of the industrial area determined by the presence of the harbor (see Fig. 11).

*Consistent multi-row* placement with respect to the residential zone of enterprise groups according to the principle of increasing harm (see Fig. 12).

*Consistent (multi-panel)* – for enterprises of various sanitary classification of production (see Fig. 13). This scheme is a vivid example, unsuccessful location of the industrial zone for urban planning considerations along the railway tracks.

Within the territory of the city, only warehouse complexes connected with direct service to the population are located: enterprises and objects of the food industry, trade and fruit and vegetable farming; distribution refrigerators, fruit and vegetable bases; storage of vegetables and fruits, other consumer goods.

Utility and storage areas should not be located on the territory industrial nodes, which include enterprises of classes I – III according to the sanitary characteristics of production and their sanitary protection zones. The utility-storage zone can be located along the railway and external highway. It will be separated from the residential

territory by sanitary and protective zones. The width of the sanitary protection zones between warehouse areas and residential areas depends on the type of warehouses and ranges from 50 m for communal warehouses to 500 m for others.

For the maintenance of passenger and cargo transportation, as well as rolling stock within the city and the surrounding area, areas for facilities and devices of various types of interurban transport are provided. Sorting and loading facilities are provided in the production areas stations and freight yards. They should be located on the outskirts of the city and on connecting branches serving a number of industrial enterprises. Sorting stations are located in areas of mass loading and unloading of railway cars.

For railway stations, horizontal and straight sections with a slope of no more than 1,5 % should be provided, and in difficult conditions – up to 2,5 %. Stripping lanes for the placement of vehicles.

A sanitary protection zone should be provided between the railway and residential buildings, the width of which, counting from the axis of the extreme railway track to the buildings, should be at least 100 m, and when the railway is located in a recess and when special noise protection measures are implemented, at a distance of at least 50 m, more than 50 % of the area of the sanitary protection zone must be landscaped. Its width to the borders of the plots of garden and cottage buildings is necessary take at least 50 m.

Railway stations within settlements should be placed on boundaries of central and peripheral zones near residential and public areas buildings with provision of convenient transport links with the center settlement, its main residential and industrial areas, stations of other types of transport.

#### Test questions on the topic:

1. What is the structure of production area?
2. What are the main requirements for the location of the industrial territory of the city?
3. What are the boundaries of an industrial territory of the city?
4. What are the main planning methods of formation the sanitary protection zones?

## **Topic 8“Landscape and recreation area of the city”**

1. Greening system of the city territory.
2. Classification of green spaces.
3. Landscaping of residential areas and neighborhoods.

*Recreational areas* would include land that is designed, constructed, designated, or used for recreational activities. Examples are national, state, county, or city parks, other outdoor recreational areas such as golf courses or swimming pools and bodies of waters (oceans, lakes, rivers, and streams) when used by the public for fishing, swimming, or boating. Public and private areas that are predictably used for hunting, fishing, bird watching, bike riding, hiking, or camping or other recreational use also would be considered recreational areas.

The following is not included in the landscaped area: footprints of buildings or structures, sidewalks, driveways, parking lots, decks, patios, gravel or stone walks, other pervious or non-pervious hardscape, and other non-irrigated areas designated for non-development (i.e., open spaces). Excessive use of impervious areas is discouraged as it will increase storm water runoff. Designated recreation areas and areas permanently and solely dedicated to edible plants, such as orchards and vegetable gardens.

Urban greenery is divided into public greenery and special greenery. These two groups together create a system of greenery in residential and industrial areas. District and microdistrict gardens, squares, boulevards and embankments serve for short-term rest of inhabitants. For each type of landscaping choose special species of trees that provide effective protection against noise, pollen, gases and overheating. The system of park ensembles and garden and park complexes is an important part of the architectural composition and planning structure of the city as a whole. Garden and park complexes of various types, types and sizes include several large parks, gardens, squares, pedestrian boulevards and rivers, lakes and streams, and also park constructions.

The composition of green areas of general city use should include a city park with an area of 100 hectares, located next to the city center. The rest of the area should be used for district and specialized parks: children's, sports, botanical, etc. The existing massifs of the surrounding forests are being transformed into urban forest parks. Along with the centers of peripheral districts, they form district parks.

*An urban park* or metropolitan park, also known as a municipal park (North America) or a public park, public open space, or municipal gardens (UK), is a park in cities and other incorporated places that offer recreation and green space to residents of, and visitors to, the municipality. The design, operation, and maintenance is usually

done by government agencies, typically on the local level, but may occasionally be contracted out to a park conservancy.

A park is an area of open space provided for recreational use, usually owned and maintained by a local government. Grass is typically kept short to discourage insect pests and to allow for the enjoyment of picnics and sporting activities. Trees are chosen for their beauty and to provide shade, with an increasing emphasis on reducing an urban heat island effect.

The greening system, on the one hand, can be determined by the division of the city into planning elements, and on the other hand, it can determine the planning structure of the city.

When forming a system of green spaces, the size and functional profile of the city, climatic conditions (rainfall, air temperature, winds, presence of reservoirs, rivers) should be taken into account.

The system of green areas should meet the following main tasks:

- functional organization of urban areas for various purposes, including for public recreation in nature;
- sanitary and hygienic – improving the urban environment and improving the microclimate;
- architectural and artistic – formation of a coherent and architecturally expressive landscape of the city.

The evaluation criteria for the variant of the landscaping system of the territory are:

- the uniformity of their distribution on the territory of the city, especially in relation to residential buildings, transport and pedestrian accessibility;
- the continuity of the system, which depends on the possibility of planning unification of gardens and parks with boulevards, embankments, green streets and alleys;
- the complexity of the organization of inner-city and suburban green areas, planning unification of inner-city open spaces with suburban forest parks and forests.

The system of green areas should correspond to the planning structure of the city. Certain green spaces correspond to each planning unit:

- microdistrict – microdistrict garden;
- residential area – residential area garden, boulevard, square;
- planning district – district park;
- the city – city parks, gardens, children's and sports parks, hydroparks, forest parks, boulevards, squares, embankments.

In practice, the following landscaping schemes are used (Fig. 14).

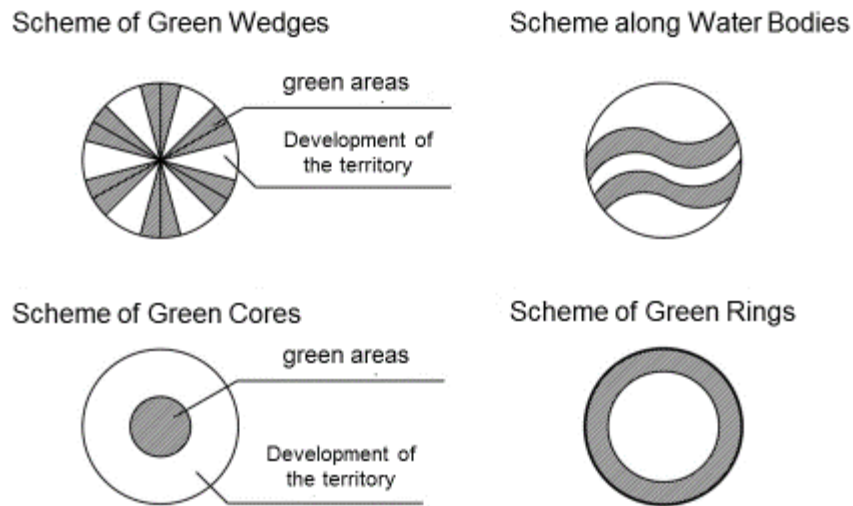


Figure 14 – Sample schemes of urban landscaping structures

The structure of the green space system also depends on the size of the city. A small town is the simplest structure: a city park, boulevards, neighborhood gardens. The middle city – a city park, gardens of residential areas, squares, boulevards, gardens of microdistricts. A big city – a city park, gardens of residential areas, children's and sports parks, hydroparks, forest parks, boulevards, squares, gardens of microdistricts. In a large city, district parks, botanical and zoological gardens are added to the listed green areas.

The accepted classification of green plantings is supplemented by the need to connect the landscaping system and the placement of its objects with planning structure of the city. Green areas classified as:

1) by territorial characteristics:

- urban;
- non-urban;

2) by functional purpose:

- general use;
- limited use;
- special purpose.

Decorative and planning functions of green spaces are possible divide into three large groups: landscape-forming, planning, organization of recreation of the population.

*The landscape-forming functions* of green spaces, which are an organic part of the planning structure of the city, consist in their active participation in the creation of landscapes of residential areas. Large green massifs, located between separate areas of development, unite them, provide the city integrity and completeness. The abundance



of colors and forms of plants, the change in the color of the foliage of trees and shrubs during the seasons of the year, enliven urban landscapes.

*The planning functions* of green spaces are the organization of urban areas. Even small areas of green spaces, freestanding trees and shrubs, lawns and flower gardens, located on city highways and squares, play an important role, organizing traffic and emphasizing the most relevant elements of architecture. Green spaces planted near residential buildings are the basis of functional division of residential areas, isolating them from roads and transport highways, limiting children's playgrounds and recreation areas from household areas, etc.

Green spaces are of great importance in solving the problem of *organizing public recreation*. Landscaping of residential areas is a category of urban planting, which is the most massive and probably one of the most difficult measures. Landscaping has a great influence on the formation of the landscaping system of residential areas and microdistricts. Plantations in residential quarters belong to the number of limited-use plantations that serve the residents of the quarter in which they are located.

Test questions on the topic:

1. What are green areas of the city?
2. What are the characteristics of a green city?
3. What are the schemes of urban landscaping structures?
4. What are the boundaries of the green spaces of the city?

## **CONTENT MODULE 3 TRANSPORT**

### **Topic 9” External transport zone. Railway transport”**

1. External transport zone.
2. The importance of transport in city planning and development.
3. Railway transport: railway stations and railway stations, sanitary requirements.

### **Types of external transport. External transport zone in the urban plan structure**

*The external transport* serves suburban, local and long-distance passenger and cargo transportation, connects settlements in a single settlement system.

Types of external transport:

- railway;
- automobile;
- air;
- water (river, sea).

Any transport system is characterized by the presence of: transmission channels (communication lines, highways, sea routes, air corridors) and receiving and sending points or input-output devices (stations, airports, river ports).

Buildings of external transport can occupy a large area (up to 15 % of the city) and have specific features of placement in the structure of the city.

Buildings of external transport can occupy a large area (up to 15 % of the city) and have specific features of placement in the structure of the city.

The Transport Zone is used to delineate important transport infrastructure, this includes major roads and the rail network. The categories are as follows:

- Transport Road Zone 1 (TRZ1) – State transport infrastructure;
- Transport Road Zone 2 (TRZ2) – Principal road network;
- Transport Road Zone 3 (TRZ3) – Significant municipal road;
- Transport Road Zone 4 (TRZ4) – Other transport use.

#### Air Transport

Due to noise exposure, airports are usually located at a distance from housing (5–10 km depending on the class of the airport).

Air terminals (ground passenger services, check-in, etc.) are divided into central, eccentric and peripheral depending on the position in the city structure.

#### Water transport

River and sea, functioning is limited by seasonality and configuration of the rivers, cargo ports occupy large areas, in large historical cities often prevent the center from reaching the river.

#### Automobile transport

The most dynamically developing mode of external transport at the present time is characterized by: variability, off-seasonality, maneuverability, speed. In the future - the formation of a unified system of highways.

In the structure of the city, high-speed motorways and multi-level junctions can occupy large area

Motorways of high speeds try to route around cities or tangentially to them in order to avoid the transit of motor vehicles and the dismemberment of the city by highways.

### **Placement of the utility and warehouse area and external transport zones**

After the preliminary determination of the border of the residential territory, it is necessary to return to the formation of production territories, where, in addition to industrial districts, a communal storage zone and an external transport zone should be located.

Within the territory of the city, only warehouse complexes connected with direct service to the population are located: enterprises and objects of the food industry, trade

and fruit and vegetable farming; distribution refrigerators, fruit and vegetable bases; storage of vegetables and fruits, other consumer goods.

Utility and storage areas should not be located on the territory industrial nodes, which include enterprises of classes I-III according to the sanitary characteristics of production and their sanitary protection zones. The utility-storage zone can be located along the railway and external highway. It will be separated from the agricultural territory by sanitary and protective zones. The width of the sanitary protection zones between warehouse areas and residential areas depends on the type of warehouses and ranges from 50 m for communal warehouses to 500 m for others.

For the maintenance of passenger and cargo transportation, as well as rolling stock within the city and the surrounding area, areas for facilities and devices of various types of interurban transport are provided. Sorting and loading facilities are provided in the production areas stations and freight yards. They should be located on the outskirts of the city and on connecting branches serving a number of industrial enterprises. Sorting stations are located in areas of mass loading and unloading of railway cars.

For railway stations, horizontal and straight sections with a slope of no more than 1,5% should be provided, and in difficult conditions – up to 2,5 %. Stripping lanes for the placement of vehicles.

A sanitary protection zone should be provided between the railway and residential buildings, the width of which, counting from the axis of the extreme railway track to the buildings, should be at least 100 m, and when the railway is located in a recess and when special noise protection measures are implemented, at a distance of at least 50 m, more than 50 % of the area of the sanitary protection zone must be landscaped. Its width to the borders of the plots of garden and cottage buildings is necessary take at least 50 m.

Railway stations within settlements should be placed on boundaries of central and peripheral zones near residential and public areas buildings with provision of convenient transport links with the center settlement, its main residential and industrial areas, stations of other types of transport.

#### Test questions on the topic:

1. What are the types of external transport?
2. Name the types of external transport; identify their main features.
3. What are the schemes of urban landscaping structures?
4. What are the boundaries of a green spaces of the city?

## Topic 10” Public Transport”

1. City traffic and its role in city planning.
2. Basic transport characteristics.
3. Classification of public transport.

*Public transport* (also known as public transportation, public transit, mass transit, or simply transit) is a system of transport for passengers by group travel systems available for use by the general public unlike private transport, typically managed on a schedule, operated on established routes, and that charge a posted fee for each trip.

The traffic system performs a great extent of exchange with the environment, and is closely connected in addition to that. The planning of the traffic represents today one of the aspects of the integrated environmental planning in the urban area. The need for the ever bigger surfaces intended for traffic subsystems on the one hand, and the incapacity to sufficiently secure those surfaces, creates additional problems for the planners. Thus, the approach to the planning of the traffic network must be of interdisciplinary type. By that it must be taken into account that each city and its traffic system have various characteristics, in the sense that each city area has its specific traffic layout. For this reason, it is impossible to generalize and come to a universally applicable solution, but it is necessary to research and test the possible solutions.

Examples of public transport include city buses, trolleybuses, trams (or light rail) and passenger trains, rapid transit (metro/subway/underground, etc.) and ferries. Public transport between cities is dominated by airlines, coaches, and intercity rail. High-speed rail networks are being developed in many parts of the world.

Public transport includes vehicles (metro cars, trams, buses, trolleybuses, taxis), and road devices (rail tracks, tunnels, ramps, etc.).

Objects of urban transport: electrical stations and networks of energy supply of transport, repair shops, tram and trolleybus parks, garages, depot, service stations.

### **Classification of public transport** (Fig. 15).

1. **By moving environment:** water transport; air transport; space transport.

*Ground transportation:* by the number of wheels; railway; automotive; cycling; animal; driven vehicles; horse-drawn; pack; top; pipeline; pneumatic.

*Other types of ground transportation:* lift; escalator; elevator; funicular; canal road.

2. **To destination:** public transport; special use vehicles; individual transport.

3. **By energy used:** vehicles with own engine; driven by wind power; driven by muscular strength; man driven vehicles; animal driven vehicles.



Figure 15 – Classification of public transport

All public transport runs on infrastructure, either on roads, rail, airways or seaways. The infrastructure can be shared with other modes, freight and private transport, or it can be dedicated to public transport. The latter is especially valuable in cases where there are capacity problems for private transport. Investments in infrastructure are expensive and make up a substantial part of the total costs in systems that are new or expanding.

#### **Social requirements:**

1. Mobility of movement;
2. Saving personal time of citizens;
3. Environmental protection from harmful effects.

Most public transport systems run along fixed routes with set embarkation/disembarkation points to a prearranged timetable, with the most frequent services running to a headway (e.g.: “every 15 minutes” as opposed to being scheduled for any specific time of the day) (table 1). However, most public transport trips include other modes of travel, such as passengers walking or catching bus services to access train stations.

Table 1 – Regulatory requirements for the organization of public transport

Transport	The average speed of the message, km / h	Passing capacity of transport lines in one direction – Throughput, (hour/day)
Bus	17–20	3–5
Trolleybus	16–18	4–7
Tram	15–17	6–12
Express-bus	20–25	3–10
Light Rail	25–30	10–20
Metro	40–45	20–45
Electrification railway	50–60	30–50
Monorail	60–70	10–30

Distance between public transport stops: for buses, trolley buses and trams – no more than 600 m , for express buses and light rail – 800–1 200 m, for the underground – 1 000–2 000 m, for electrified railways – 1 500–2 000 m.

Test questions on the topic:

1. What are the types of public transport?
2. Name classification of public transport.
3. What are the traffic system?

### **Topic 11” City road network”**

1. Definition of the road network of the city.
2. Classification of city streets and squares.
3. Planning systems of main streets and their characteristics.

*Street* is a part of the territory of the city, bounded by red lines from buildings or territories, which is intended for providing traffic and pedestrians, diverting surface runoff, laying distributed utilities.

Functional classification is an ordering system that defines “the part that any particular road or street should play in serving the flow of trips through a highway network.” Functional classification categorizes streets according to their ability to move traffic, and provide access to adjacent properties. Street types under functional classification include “local streets,” medium-sized “collectors,” and highway-type “arterial” (Fig. 16).

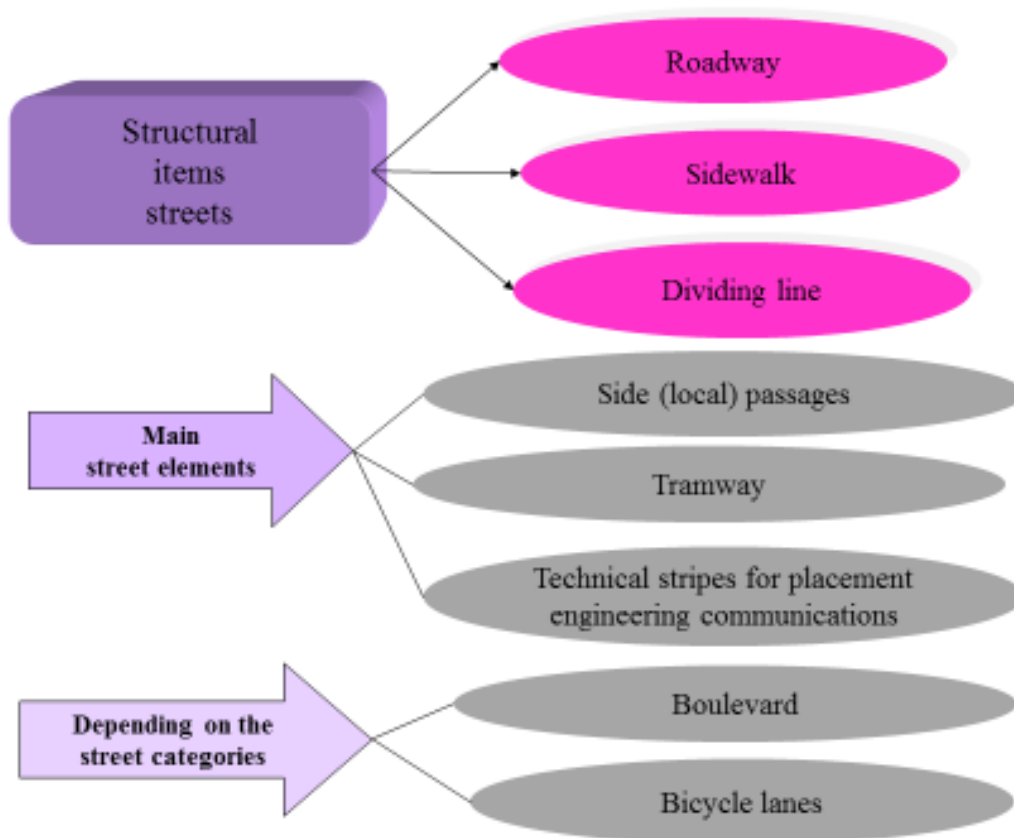


Figure 16 – Functional classification categorizes streets

The network of streets and roads is formed in the form of a single system, its structure depends on the size of the territory and the mutual location of the main elements of the city. Main streets and roads connect the main functional zones and elements of the city into a single organism. At the beginning of the design, the places of greatest attraction of the population should be identified and connected with main streets of city-wide importance. Main streets are provided in the directions of the main passenger flows, on the connections of residential areas with the city center and large industrial enterprises. The shortest and straightest section of the main street of city-wide importance should connect the city center with the passenger railway station. The distance between main streets should be determined within 800–1000 m, that is, their pedestrian accessibility for residents of the most distant building should not exceed 500 m.

When laying out highways, relief forms, requirements for slopes, which should be within 0,4–6,0 %, should be taken into account to ensure traffic safety and drainage. The most economical is the laying of highways along Thales or watersheds. It is necessary to avoid tracing main streets parallel to the prevailing wind direction if its speed exceeds 3,5 m/sec. This especially applies to the direction of the winds in the winter period. At least two highway exits from the city should be provided for communication with other settlements.

The main transport and composition nodes of the city are squares according to their functional purpose, they are divided into central, station, market, transport, and pre-factory. Squares are designed on a calm terrain with a slope of 1,0–3,0 %. Their configuration should be as simple as possible. In the case of a rectangular shape, the ratio of width and length is from 1:3 to 1:1.

The project should provide for a station square with dimensions of 0,5–1,5 ha. Transport networks pass along the periphery of the station square. At the intersection of transport networks, cities form transport squares, and in the city center - the main square of the city.

A *city square* (or square, plaza, public square, city square, urban square, or piazza) is an open public space, commonly found in the heart of a traditional city but not necessarily a true geometric square, used for community gatherings. Related concepts are the civic center, the market square and the village green.

Most squares are hardscapes suitable for open markets, concerts, political rallies, and other events that require firm ground. Being centrally located, town squares are usually surrounded by small shops such as bakeries, meat markets, cheese stores, and clothing stores. At their center is often a well, monument, statue or other feature. Those with fountains are sometimes called fountain squares.

Roadway patterns are very essential in the development of the settlements of a city. However, recent development in cities does not give importance to the study of the road patterns that give rise to numerous roads that are not interconnected, housing schemes and commercial developments built far away from where roads are very distant from the center of the town.

The increasing distance between the residential and commercial hub of the city increases the dependency upon cars for the daily travel chores each household member makes frequently.

The roadway patterns also increase the response time the emergency response vehicles take to reach a certain place. There are different types of road pattern used in highways, when the road is constructed in a pattern like rectangular pattern, radial pattern, hexagonal pattern, etc. for proper management of traffic it is called a road pattern.

The traveled way comprises the central portion of the thoroughfare. It contains the design elements that allow for the movement of vehicles, transit, bicycles and freight. The traveled way is also where vehicles, via on-street parking, interface with the street-side.

Fundamental principles of the design of this portion of the thoroughfare include uniform cross-section along the length of the thoroughfare and transitions designed to move vehicles laterally or change speed where cross-section elements change (Fig. 17).



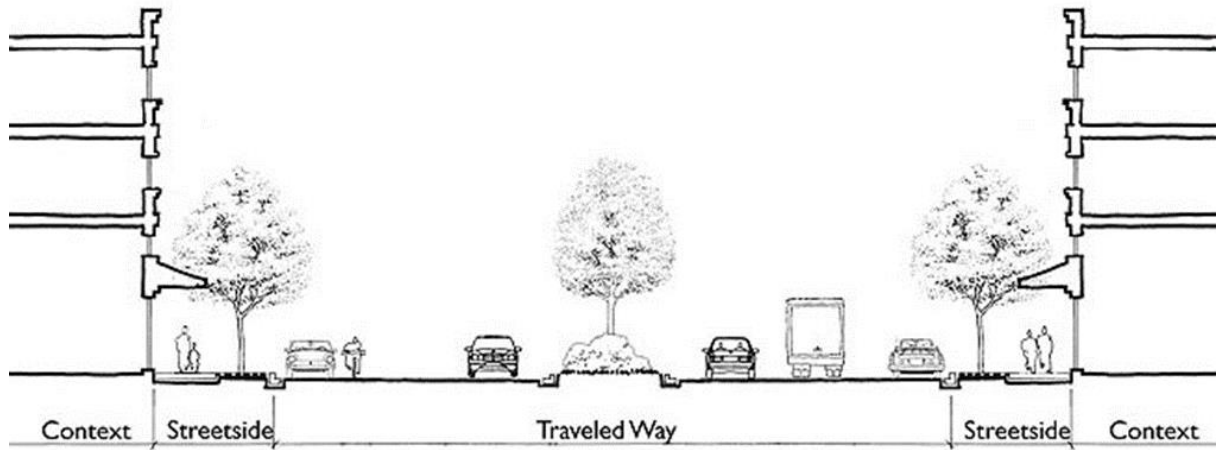


Figure 17 – The traveled way is the component of the thoroughfare between the curbs

Roadway patterns are very essential in the development of the settlements of a city. However, recent development in cities does not give importance to the study of the road patterns that give rise to numerous roads that are not interconnected, housing schemes and commercial developments built far away from where roads are very distant from the center of the town.

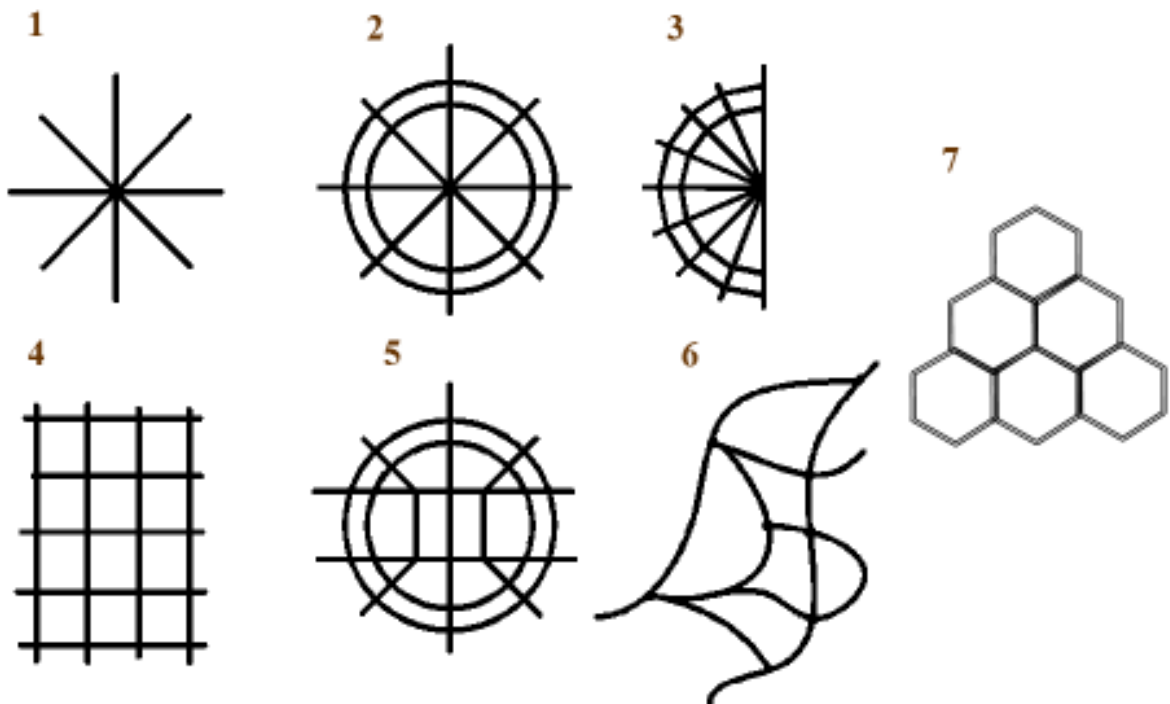


Figure 18 –Types of road patterns (principal schemes)

1 – radial pattern; 2 – radial and circular pattern; 3 – radial or star and grid pattern; 4 – rectangular or block pattern; 5 – radial or star & block pattern; 6 – history of grid pattern road (free pattern road) 7 – hexagonal road pattern

The increasing distance between the residential and commercial hub of the city increases the dependency upon cars for the daily travel chores each household member makes frequently.

When a road is constructed in a rectangular, radial, hexagonal, or any other pattern for proper traffic management, it is called a road pattern.

The roadway patterns also increase the response time the emergency response vehicles take to reach a certain place. There are different types of road pattern used in highways, when the road is constructed in a pattern like rectangular pattern, radial pattern, hexagonal pattern, etc. for proper management of traffic it is called a road pattern (Fig. 18):

### **1. Rectangular or Block Pattern.**

In this type of road pattern, the complete area is divided into a rectangle or block-shaped plots to create a rectangle or block pattern. Streets and roads in block patterns intersect at a 90° (right angle).

Other branch roads may be slightly narrow, but the main road that goes through the center of the area should be sufficiently wide. The rectangle or block design provides a nice view when seen from a height.

#### *Benefits of Block or Rectangular Pattern*

To construct back-to-back buildings with front-facing roadways, the rectangular plots may be further divided into smaller rectangular blocks.

The city roadways have adopted this pattern.

Construction and maintenance of highways using this design are relatively simpler.

#### *Drawbacks of Block or Rectangular Patterns*

This pattern is inconvenient since the roads are perpendicular at junctions, causing the traffic to converge towards a single point.

### **2. Radial Road Pattern.**

In this road pattern, the network of roadways is constructed in the shape of a circle that radiates away from the center of the area.

This pattern is divided into three types based on its layout.

#### **2.1 Radial or Star & Block Pattern.**

This type of road network combines radial and block road patterns. The whole area is arranged into a block-pattern road network that runs between the radial main streets and radiates outward from the center.

#### *Benefits of Radial or Star & Block Patterns*

Safer when compared to a rectangular pattern.

It reduces congestion at the main bottleneck point.

If one radial route is closed, another may be utilized as an alternative.

#### *Drawbacks of Radial or Star & Block Pattern*

Lack of safety equipment such as post-support bases, crash attenuators, and rail transitions.

It is only effective when the downstream end of a two-lane ramp does not need a merging.

## **2.2 Radial or Star & Circular Pattern.**

This network is a combination of radial and circular road patterns. It is a road pattern in which the major roadways, or radial roads, radiate outward from the center and are joined by the ring roads, or concentric roads, which likewise radiate outward.

### *Benefits of Radial or Star & Circle Pattern*

Compared to the abovementioned patterns, it is safer since all the traffic moves in the same direction.

This traffic plan includes roundabouts, which enhances traffic flow. Additionally, this lowers the vehicle's fuel consumption.

Lowers the chances of rear-end collisions.

### *Drawbacks of Radial or Star & Circle Pattern*

Its design is complex, and it isn't easy to provide a decent curve.

It impacts driving abilities (most drivers experiencing this issue are senior citizens).

The appropriate installation of traffic signals, road markings, and illumination is required to alert the driver.

Splitter islands must be made long enough to include a crosswalk and a roundabout description.

## **2.3 Radial or Star & Grid Pattern.**

This kind of road network combines radial and grid patterns. From the center, a radial network of roads radiates outward. The grid pattern is then used to interconnect the main radial streets.

### *Benefits of Grid and Star and Radial Pattern*

It increases the effectiveness of land usage unit density.

Using Savannah's cellular structure improves traffic flow in both directions.

It has a high percentage of 3-way intersections, offering great vehicle traffic safety.

Cut-through traffic is reduced.

### *Drawbacks of Grid and Star and Radial Pattern*

There should be sufficient distance between splitter islands.

High construction cost for additional traffic lights and road markings.

## **3. Hexagonal Road Pattern.**

A hexagonal pattern is a network of roadways that form a hexagonal shape, similar to a circular road pattern. Three roads intersect with the constructed region at each corner of the hexagon. A hexagonal boundary is further split into plots of the appropriate sizes.

### *Benefits of Hexagonal Road Pattern*

Travel time and distance are cut down.

Reduced traffic congestion

### *Drawbacks of Hexagonal Road Pattern*

There should be enough traffic signs, pavement markings, and illumination to alert vehicles to lower their travel speed and minimize the risk of accidents.

## **4. Minimum Travel Pattern.**

The town is served by sector centers, suburban facilities, and neighborhood centers in this road plan, all of which are connected to the city center by a highway that can be reached in the shortest amount of time. Also, the shortest roads interconnect the city center with neighboring and suburban centers. The alignment of the road is made straight to shorten it.

### *Benefits of a Minimum Travel Pattern*

The potentially dangerous collisions are almost eliminated.

### *Drawbacks of the Minimum Travel Pattern*

The right amount of traffic signs, pavement markings, and illumination should be in place to alert vehicles to slow down.

For senior drivers, intersections may be particularly difficult.

## **5. Grid Pattern.**

A network of intersecting parallel lines, real or imaginary, is referred to as a grid. When seen from above, this pattern is made up of streets that connect at right angles to form squares. A physical network not always constructed of straight or parallel lines may also be called a grid.

Regular grid systems often have greater infrastructure costs than those with disjointed street patterns.

Street width, street length, block width, and pavement width are the four main factors that affect street costs.

### *Benefits of a Grid Pattern*

Grids benefit pedestrians since there are several routes from point A to point B.

Grids benefit restaurants and retail establishments since they provide several corner lots.

A grid's navigation is quite simple.

### *Drawbacks of Grid Pattern*

Grids are dangerous for motorists and bicycles because they contain numerous junctions and many potential conflict places.

Grids may encourage individuals to take shortcuts through residential areas.

Grids don't work well in places with many hills since they result in unnecessarily steep streets.

Traffic mayhem may readily occur on a grid that is uneven or unfinished.

## 6. Linear Pattern.

It comprises a road that expands linearly in one direction, potentially due to certain natural resources like the sea or ocean existing on one side of the city.

### *Benefits of a Linear Pattern*

The potentially dangerous collisions are almost eliminated.

### *Drawbacks of the Linear Pattern*

The right amount of traffic signs, pavement markings, speed breakers, and illumination should be in place to alert vehicles to slow down.

### **Planning systems of main streets and their characteristics**

*The street hierarchy* is an urban planning technique for laying out road networks that exclude automobile through-traffic from developed areas. It is conceived as a hierarchy of roads that embeds the link importance of each road type in the network topology (the connectivity of the nodes to each other). Street hierarchy restricts or eliminates direct connections between certain types of links, for example residential streets and arterial roads, and allows connections between similar order streets (e.g. arterial to arterial) or between street types that are separated by one level in the hierarchy (e.g. arterial to highway and collector to arterial) (Fig. 19). By contrast, in many regular, traditional grid plans, as laid out, higher order roads (e.g. arterials) are connected by through streets of both lower order levels (e.g. local and collector.) An ordering of roads and their classification can include several levels and finer distinctions as, for example, major and minor arterials or collectors.



Figure 19 – The network structure of Radburn, New Jersey exemplifies the concept of street hierarchy of contemporary districts. (The shaded area was not built)

At the lowest level of the hierarchy, cul-de-sac streets, by definition non-connecting, link with the next order street, a primary or secondary “collector” – either a ring road that surrounds a neighborhood, or a curvilinear “front-to-back” path – which in turn links with the arterial. Arterials then link with the intercity highways at strictly specified intervals at intersections that are either signalized or grade separated.

Test questions on the topic:

1. What is the classification of a street?
2. What are the different types of squares in urban design?
3. What is a network of roads called?
4. What are the types of road patterns?
5. What is the concept of the street hierarchy?

## RECOMMENDED LITERATURE

1. Безлюбченко О. С. Планування міст і транспорт : навч. посіб. / О. С. Безлюбченко, С. М. Гордієнко, О. В. Завальний ; Харків. нац. ун-т міськ. госп-ва ім. О. М. Бекетова. – Харків : ХНУМГ ім. О. М. Бекетова, 2021. – 270 с.
2. Martyshova L. Fundamentals of urban planning : lectures (for second-year full-time foreigner students first (bachelor's) level of higher education specialty 191 – Architecture and town planning) [Electronic resource] / Beketov National University of urban economy in Kharkiv ; L. Martyshova. – Electronic text data. – Kharkiv : O. M. Beketov NUUE, 2021. – 80 p. – Regime of access : <https://eprints.kname.edu.ua/57622/>, free (date of application: 25.12.2022). – Title from the screen.
3. Методичні рекомендації до виконання розрахунково-графічної та самостійної робіт з навчальної дисципліни «Планування міст і транспорт» (для здобувачів першого (бакалаврського) рівня вищої освіти всіх форм навчання, спеціальності 192 – Будівництво та цивільна інженерія, освітні програми «Міське будівництво та господарство», «Промислове та цивільне будівництво», «Цивільна інженерія») [Електрон. ресурс] / Харків. нац. ун-т міськ. госп-ва ім. О. М. Бекетова ; уклад. : О. С. Безлюбченко, Т. В. Жидкова. – Електрон. текст. дані. – Харків : ХНУМГ ім. О. М. Бекетова, 2021. – 39 с. – Режим доступу : <https://eprints.kname.edu.ua/60083/>, вільний (дата звернення: 25.12.2022). – Назва з екрана.
4. Проектування міських територій : підручник : в 3 ч. / [за ред. В. Т. Семенова, І. Е. Линник] ; Харків. нац. ун-т міськ. госп-ва ім. О. М. Бекетова . – Харків : ХНУМГ ім. О. М. Бекетова, 2018. – Ч. 1. – 449 с.: іл. – (Серія «Міське будівництво та господарство»).
5. Ткачук О. А. Міське господарство : навч. посіб. / О. А. Ткачук.– Рівне : НУВГП, 2018. – 244 с.
6. ДБН Б.2.2-12:2019. Планування і забудова територій. – [Чинний від 01.10.2019]. – Київ : Держбуд України, 2019. – 183 с.
7. Caves R. W. Encyclopedia of the City : book / [Edited By Roger W. Caves] Routledge. – London, 2005. – P. 704. ISBN 978-0415862875.
8. Pobiner Joe. 3 urban planning trends that are changing how our cities will look in the future / Joe Pobiner // Building Design + Construction. Retrieved . – Landon : Publisher BD+C University (CEUs), 2020. – P. 13.
9. Levy John M. Contemporary urban planning / John M. Levy // Book. – Routledge, New York : Publisher Routledge, 2017. – P. 7.

*Електронне навчальне видання*

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**БЕЗЛЮБЧЕНКО** Олена Степанівна

## **ПЛАНУВАННЯ МІСТ І ТРАНСПОРТ**

### **КОНСПЕКТ ЛЕКЦІЙ**

*(для здобувачів першого (бакалаврського) рівня вищої освіти спеціальності 192 – Будівництво та цивільна інженерія)*

*(Англ. мовою)*

Відповідальний за випуск *О. В. Завальний*  
*За авторською редакцією*  
Комп'ютерне верстання *Т. М. Апатенко*

План 2022, поз. 53Л

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Підп. до друку 21.04.2023. Формат 60 × 84/16  
Ум. друк. арк. 2,8

Видавець і виготовлювач:  
Харківський національний університет  
міського господарства імені О. М. Бекетова,  
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Свідоцтво суб'єкта видавничої справи:  
ДК № 5328 від 11.04.2017.