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**Developing heating and ventilation system of constructing residential
buildings in the conditions of hot-dry climate**

**5A340201 - Construction of building and structures (Energy efficient
buildings)**

DISSERTATION

which is written to receive master's academic degree

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CONTENT

I.	INTRODUCTION.....	3
II.	CHAPTER – I. PREREQUISITES TO ARCHITECTURAL BUILDING PROJECTION OF MULTYSTOREY RESIDENTIAL BUILDINGS	11
	1.1. Hot and calm climate of the southern cities.....	11
	1.2. Microclimate of the dwelling, housing estate and its physiological value.....	15
	1.3. Space-planning and architectural constructive methods of improvement of a microclimate of the dwelling and housing estate.....	18
	Conclusion according to Chapter-I.....	22
III.	CHAPTER – II...AERODYNAMICS OF RESIDENTIAL BUILDINGS.....	25
	2.1. Aerodynamic situation of the area, accounting of the wind the mode at projection of the cities, constructing residential buildings.....	25
	2.2. Warm and wind mode of residential buildings.....	28
	2.3. Physical and mathematical model of natural aeration of residential building.....	32
	Conclusion according to Chapter – II.....	37
IV.	CHAPTER–III... REGULATION OF HEATING AND VENTILATION REGIME OF RESIDENTIAL BUILDINGS.....	39
	3.1. Bio-hygienic criteria of wind and thermal regime.....	42
	3.2. Comprehensive assessment based on projected construction (forecast).....	49
	3.3. Principles and means of regulating wind patterns of residential development.....	61
	Conclusion according to Chapter – III.....	70
V.	Main Conclusions.....	71
VI.	Literatures.....	74
VII	Appendix.....	77

Introduction

Importance of topic. In our Republic, for the years of the development on the path of independence constant care of the government and President I.A.Karimov on improving the welfare of the people and improve their living conditions find their actual implementation in the existing sequential reforms transformations, including in urban planning that is fully consistent with Constitution of our country.

Development of housing and architectural housing, increasing stability of the population with comfortable housing is one of the essential aspects of the welfare of the people of Uzbekistan.

In the book, I A Karimov " Uzbekistan on the Threshold of the XXI century security threat is the condition of progress " indicated that one of the main areas for strengthening the economic security now is to create favourable living conditions in cities by introducing a system of science-based urban development regional planning , eliminating all the negative consequences of modern urbanization .

The problem of environmental protection gets now increasing ecological, social and economic value. Protection and improvement of the environment as one of the main problems of the modern town planning and construction surrounding the person, is a constituent of design and planning work. The important section of this problem is the perfecting of the organization of life and active recreation of the population directed on strengthening of its health. In the conditions of hot climate the problem of improvement of the environment in the dwelling, a housing estate and, in general, an urban area is particularly acute. Use of solar energy in the southern cities for formation of the favorable microclimate in the dwelling and in the territory of city building during the summer period is one of logical steps in a solution of the problem of improvement of a surrounding medium. In the southern regions of the CIS and foreign countries which are close located to the equatorial latitudes, where power of radiation and duration sunshine have the considerable

sizes, the very favorable opportunities for broad use of energy of the sun are created. The set of systems of the fissile and passive transformation of solar energy which find application in buildings of various functional purpose are developed for these purposes. In the real work one of ways of passive use of solar energy providing the favorable microclimatic conditions in the dwelling and in the territory of building of the southern cities with extreme hot-dry climate is investigated. The thermal conditions of buildings in a larger measure depends on a microclimate of the territory of the city, on gardening and improvement of the area. Geographical area of Central Asia, except for areas mountain and mid-mountain territories, it is characterized by legibly expressed signs of arid climate. Here the considerable intensity of a sunshine, in combination with high summer temperatures, a high probability of sunshine and small mobility of air and low humidity, often leads to an overheat of premises and the territory of a housing estate. In these conditions there are considerable thermal loads of a human body at which, as we know, serviceability significantly goes down, efficiency physical and, especially, brainwork, and under extreme thermal conditions arise threat of an overheat of an organism. The modern science has particular achievements in the field of a structural climatology. In residential buildings of Central Asia A.S Antonini's works, N.M.Tomsona, V. Sheleykhovsky's G belong to the early microclimatic studies. Scientists of the CIS developed practical methods of the accounting of climatic impacts on a thermal conditions of buildings (V. I. Ilyinsky, V N. Bogoslovsky, B. F. Vasilyev, A. M. Shklover' K.F.Fokin, F.V.Ushkov, Nm.Gusev, I.S Sukhanov, etc.). Bases and scientific and methodical justifications of a climatic typology of the dwelling are developed in works V.E.Korenkova, N.P.Bylinkina, Vklitskevich, Aa.Gerburt-Geybovich, Sgoromosov's M, in relation to conditions of hot climate - I S Sukhanova, A V Yershova, T B. Rapoport, I.A Merporta, Academician Birkaya, G. K. Goldptgeyn, Z.P.Lomtatidze, G. I. Poltarak, etc. The space-planning and architectural and design actions providing the favorable microclimate in an urban area and in rooms, are considered in works

of G of V. Sheleykhovsky, S.B Chistyakova, T. S. Leontyeva, Aesenova, Mmchernavskoy and etc. Abroad the significant contribution to studying of a question climatic protection of buildings and building in hot climate D Aronin, D Atkinson, P Aueb, brought Saini's B, T In Olzhey, Rogers, G Lipsmayer, B Evans, Givoni's B, With Zokolya, B. Anderson and etc* aerations of city building dealt with Problems during the period 1936-1947y N. M Tomson, A. S Antonini. Theoretical pilot studies of aerodynamics of buildings and their complexes are generalized in capital works E I. Rettera, and also in monographs and articles In V. Baturina, I A Shepeleva, V. M. Eltermana, F L. Serebrovsky, I. K. Lifanov, V. N. Taliyev, V L. Titova, V. S. Kozacheykhr, etc. For the purpose of searching of opportunities of improvement - the microclimatic environment city building and the dwelling by use of solar energy, first of all, it is necessary, to analyse classification of climatic division into districts! Territories and types of weather conditions because of which to reveal the cities, which are characterized by specific signs of weather. So far in architectural and structural practice of projection and construction QMQ 2.01.01-94 "Climatic and physical and geological data for design" with the scheme of division into districts of the territory of the former USSR with the characteristic of climatic areas and sub districts of the developed dwelling QMQ is applied. The specified schematic cards of climatic division into districts reflect to pour background climate changes of large territories of the country. The accounting of local features of the nature and climate (a relief, the direction of a wind, a static atmosphere, dust storms, etc.) playing an essential role at projection of buildings and their complexes represents a special problem. Also classification of tropical climate of the English scientist G. A Atkinson is widely known. It generally considers temperatures but the moisture conditions prevailing during the whole year and allocates six types of climate hot dry, warm the wet, mountain, seaside deserts, monsoonal, ocean islands. Principles of a static method of a complex climatology (weathers classes) are developed in V K Liskevich and A A Gerburta-Geybovich's works for the particular modes of

operation of rooms. By them, it is offered the classification of weather conditions intended for the architectural and town-planning purposes on the following types of weather: hot, dry- hot, warm, comfortable, cool, cold and severe. The hot type of weather in turn has signs hot and dry, the hot and wet, hot and mountain climate. For the territory of the countries of Central Asia it is inherent the hot and dry sign of climate, areas covering and the territory of Transcaucasia, it is characterized by a hot humid climate. Having analyzed classification of meteo conditions of various authors, along with the weather conditions stated above the author allocated the following weather signs, specific to the southern areas, - hot wind and hot dry. Similar division of a hot arid climate into more shallow signs and their account in town-planning practice is the following important step in the solution of architectural and structural tasks. The climate of many areas of the southern republics of the CIS is characterized by two factors a heat and a calm. These features in many cities of Central Asia are made by the leading profile of climate in an annual cycle. The city with its building and gardening obstructing traffic air aggravates a static atmosphere.

Moreover, not incidentally a heat and a calm characterize the climate of many southern cities in summer months. Thus in the ground to microclimatic zone of a housing estate stagnation and an overheat are formed air, defining conditions of "closeness" which is a consequence discomfort able conditions for the person. For fight against an overheat there is a number of the former all-union and regional, republican recommendations about projection and construction of buildings and building in the conditions of hot climate. It is carried out many research works offering paths and tools on fight against an overheat. In this direction works in TASHLITI, Uzshakharsozlik LITI are conducted now. It should be noted that now there are not enough researches, and practical recommendations, bound to formation of the favorable microclimatic environment of the cities to hot dry climate. If to look at recommendations and proposals of various authors on fight against an overheat in the cities and buildings means of planning, building,

improvement, gardening and flood, and also researches in the field of thermal stability of the protecting designs, it is possible to observe that all of them are devoted to problem solving, bound to a hot and wind condition of climate. Development and recommendations about projection of inhabited educations and the building in areas with hot dry a climate profile, are practically absent except for the separate offers having local separate and descriptive character. In the section "Climatic and physical and geological data for design" 2.01 01-94, and also in classifications climatic areas and types of weather the concept "climate profile", owing to this fact is not given the typical are not allocated as specific conditions of climate "heat calm" for many cities and regions of the tropical countries and areas subtropics Central Asia, the demanding special account and means of regulation. Thus pertinently to consider a question of improvement of the discomfort able the microclimatic environment in the southern cities in aspect "the sun - the city - the building - the person". Formation of comfortable environmental conditions city educations in general, and internal spaces of the buildings entering in system of building, it cannot be solved without so important studying microclimate factor, as wind mode.

The carried-out analysis of the previous researches shows that questions of the organization of natural airing of inhabited educations formation of local (local) winds are practically low-studied also make a subject of further research. For solutions of this task, the single exact path is use of the mechanism of interaction of solar energy with active building surface (surface of walls, coverings, drives, sidewalks, paths, green planting, etc.). Gives researches of scientists of the CIS and foreign countries in the field of structural aerodynamics, meteorology, physics, and medicine to designers' rich theoretical and experimental material. However, along with practiced in town-planning projection methods of an assessment of the wind mode of city building note an essential gap in very perspective and the reference for the southern areas to a problem of natural aeration of building in extreme hot dry climate conditions. The purpose of dissertation work is development

theoretical and methodical bases on efficient formation of the warm and wind mode of buildings and buildings in the conditions of a hot arid climate.

The purpose of research work is development theoretical and methodical bases on efficient formation of the warm and wind mode of buildings in the conditions of dry-hot climate.

The object of research work is 9-storey residential building in Mirzo Ulug'bek district of Tashkent city.



Research problems:

1. Identification of the specific extreme climatic hot-dry conditions and the principles of the account them in town-planning and architectural and structural projection;
2. Divisions into districts of the territory of the cities, the composite relief according to landscape situation and identification of a complex of climatic factors areas with hot-dry climate;

3. Formats of the dwelling and thermal qualities of the protecting designs by studying of warm and wind processes in a dwelling zone under different conditions of an insolation of building;

4. Development of physical and mathematical model of warm and wind processes with the description of aerodynamic characteristics of building. Calculating prediction of aeration of the residential district and rooms of the building;

5. The mode of buildings and buildings by effective use of energy sun;

Research techniques:

- Dwellings of the southern city;
- Buildings with identification of thermally contrast zones and planes in the path use of the developed insolation device;
- Microclimatic division into districts;
- A relief with use of the COMPUTER;
- Mathematical factors of architectural and structural solutions of building theory and methods

Scientific novelty of research work.

The specific extreme climatic are for the first time studied the hot and calm conditions of the environment of the southern cities that are subject to the account in process of projection and construction of buildings and their complexes. The theory hot dry warm and wind processes is for the first time created, allowing to predict and regulate a microclimate of city building, built in the conditions of the plain and the composite relief. The method of landscape and climatic division into districts of the territory of the city, relief territory, and slopes of the mountains intended is developed to construction of buildings. new aspect the task of regulation of the city local is solved winds their role in thermal processes of wall, ground layers of air and the protecting designs is also defined. The interrelation of local winds of building of the thermal is established origins with a dynamic wind at

building aeration. The role of local winds in formation of a microclimate of building and buildings is defined. The theoretical model of transformation of air temperature allowing to calculate influence of common city heat and simple thermal spots of building on the adjacent territory is made. It is developed the program for numerical calculations on the COMPUTER is improved a method of calculation of aeration of rooms of the building taking into account a gravitational convection.

Practical value of research work.

In essence, new way of regulation warm and wind is found the mode of the environment of multistoried building of the cities with hot dry climate, based on rational use of energy of the sun. The role of multistoried building in regulation of the warm and wind mode is established. The engineering method of aerodynamic calculation the city is developed the building and buildings built on the plain and the composite relief, the microclimate allowing to predict and improve. The method of micro and bioclimatic division into districts of the territory of the cities and a relief situation based on a variety of a city landscape and exposition of a relief, which is a grant in town-planning projection, is defined. Study guide on perfecting of planning structures of building, space planning and design solutions of buildings and buildings in the conditions of hot dry of climate is developed. The foundation for drawing up the special section of normative documents on projection of buildings and buildings in the conditions of hot dry climate is laid.

Ingredient of research. Dissertation consist of introduction, 3 piece of chapter, literatures, appendix, drawings.



CHAPTER I. PREREQUISITES TO ARCHITECTURALLY STRUCTURAL PROJECTION OF THE MULTYSTORIED BUILDINGS.

1.1. Hot dry climate of the southern cities.

Rates of development of new territories and city building and buildings, especially in extreme adverse climatic conditions, in much depend on that, bases of planning and building of these cities taking into account local conditions and requirements of improvement of a microclimate are how correctly developed. Climatic factors effect on structure of the city, on methods of formation of the architectural environment (building) and nature of its impact on an environment. Problem of interrelation of a microclimate of the dwelling and climate of the environmental Wednesdays it is always actual as social conditions of development change societies, change dwellings, the technique develops. At each stage of development there are new requirements to the dwelling, there is a revaluation of the climatic environment from the point of view of new technical capabilities and, together with it, traditional concepts and the principles of the accounting of climate that developed for centuries when forming houses remain. Now in connection with body height of requirements to the dwelling and revival of the modern architecture in the cities and villages, the problem "climate and the dwelling" gains the special importance. One of the main climatic factors having essential impact on formation of the external and internal environment along with air temperature is the wind. The wind has essential impact on a state of pollution of the air basin of the city. Along with it the wind promotes heat removal from an active surface of building, influencing that most it is positive on a microclimate of building and the dwelling.

Housing estate, according to the destination meeting the social and functional requirements in the planning and design relation has to correspond to geographical and climatic conditions of the location. The last requirement gets special sense in the conditions of hot climate where questions of providing the favorable microclimate and in the territory of building will be inserted into the dwelling on the first place. Existing structural rules also governed (Climatic and

physical and geological data for design), define conditions of projection and construction housing estate according to their geographical and climatic features. The planning which are carried out according to these standards, building, improvement and gardening in the southern cities do not reach necessary decrease in an overheat of the environment. Therefore the task - to carry out searching of paths and means of further decrease in a thermal conditions of a residential development of the cities of Uzbekistan Tajikistan, Turkmenistan, , Kyrgyzstan and the South of Kazakhstan with most is set hot climate. The solution of an objective naturally requires studying of the common bases of climatology and climatic features of the considered region and, mainly, a microclimate in building of the cities. Natural factors based on which the climate is formed in general and climate of the city in particular, are - a sunshine (direct and dispelled), temperature, humidity and traveling speed of air. Thus, interaction of solar radiation (insolation) with the irradiated (active) surface of city building represents the climate mechanism. In a warm season in the Central Asian region it is formed center of continental tropical air Nearly all five republics of Central Asia: Uzbekistan, Tajikistan, Turkmenistan, Kyrgyzstan and the southern part of Kazakhstan, are subject to action of the considerable radiation, in combination with high summer air temperatures, larger probability of sunshine, small mobility of air and its low humidity. These conditions often lead to an overheat premises and the territory of a housing estate that causes the considerable thermal loads of a human body, lowering its serviceability to 30% and more. The analysis of climatic factors of the cities of the southern region according to long-term meteorological data reveals existence during the summer period hot-dry conditions, in the cities of Central Asia. The climatic analysis of territories of the European, Asian, African and American countries shows existence in them of the cities which are characterized by hot hot-dry climate conditions. Building possesses articular aerodynamic properties, which depend on planning factors and improvement. In windy days in the territory of the rendered habitable housing estate, the speed of a wind decreases

by 60-70%. Thus in the territory of building of the low-windy cities it is formed dry conditions with a speed of wind stream up to 2 m/s. The similar wind condition gives the chance to development of weak airflows of a thermal origin. Speed of such convective streams on supervision of G of V. Sheleykhovsky on average 1m/with, according to P. A. Kratser to 3,3m/with, according to A. Kulikov — 0,7 4,8m/with, on A. Giyasova - 2m/with and more, reaches in some cases to 10m/with. In the most heated places of building warm and, therefore, more light air rises up, some swing pressure, influence of that is formed ambient more cold air directs in places with rarefied air. The similar phenomenon arises between resisting shadow and intoned of walls of buildings. Apparently, there are various forms of air circulation (aerations) of a thermal origin in the territory of a housing estate, but they, unfortunately, are low-studied. The available data on this matter generally represent theoretical prerequisites, and the conducted pilot studies carry the separate character. Owing to the significant amount drought of days, for planning of the cities of Central Asia a question of natural aeration plays the considerable large role. Owing to the significant amount of windless days in the cities of Central Asia a question of natural ventilation territories of a housing estate plays the considerable large role, than in other cities of the CIS. Courts on nature of change of a number of the main meteorological elements, it is possible to carry the period to a summer season from the beginnings of the third decade of May prior to the beginning of the third decade of September. Thus, the summer lasts 4 months - 123 days. Building is the accumulator of the considerable proportion coming solar heat, depending on thermal and optical characteristics structural materials. Heated surfaces of walls of houses and various coverings are sources of thermal radiation which intensity depends on an absolute temperature of coating surfaces. Mutually radiation of surfaces promotes increase of their temperature and interferes with cooling. G V. Sheleykhovsky notes that the feeling of "city closeness" is created by a caloradiance of large stone walls of buildings and pavements which proceeds still during 4. In the southern cities in summertime intoned surfaces of walls of houses,

simulated coverings and a soil heat up to high temperatures (+70 +75 °C). The surfaces which are not under the influence of sunshine have lower temperature +20... +25 °C. The difference of surface temperature of asphalt in a shadow, trees and on the sun can make 20. 25 °C that promotes air traffics in an urban area. The data which are available in literature by results of researches of TASHZNIIEP. Such situation is confirmed by F L Serebrovsky [168] who on the basis of theoretical and pilot studies shows that at the level 2,0m wind speed among 5-storeyed building does not exceed on average 60 70% of the speed of the main airflow on an open place measured at the same level. In a ground layer of air, it is lower than a level 2,0m, there is a gradual reduction of speed of a wind under the influence of the frictional force depending on a roughness of coverings of a site of the inhabited territory. According to researches of laboratory of a microclimate of TASHZNIIEP of town planning to the considerable change, as on force, and the direction the wind stream is exposed also limits of the building. For example, immediately behind the building getting in the way of an airflow, the speed of a wind makes 5 10% of wind speed on an open place. At the same time in narrow gaps between buildings traveling speed of air considerably increases (20... 30%) In conditions, little wind and calm arise the air currents of a thermal origin having character of local circulation of air masses. Power of convective streams and their activity are directly proportional to a difference of heating various a number of the located surfaces. In ground layers of the atmosphere, in a zone of stay of the person, the warm and moist and wind indignations that are going beyond the indexes climatic factors of this place are formed. These indignations can be variables in time, the relative frame territorially and contrast in an immediate vicinity. Speed of their emergence or termination is intimately bound to emergence or the termination of an insolation, and also to a type of an active surface and its size. Thus, actual possibility of regulation of the warm and wind mode of city building and buildings by a combination of conditions of an insolation of the spreading surfaces and power activity of the last appears. The analysis of design

materials and actual housing estate, allowed to define the closeness reason. Calm weather conditions appeared it.

1.2. Microclimate of the dwelling, housing estate and its physiological value

The calm together with a heat also creates an adverse microclimate for activity of the person and difficulty for regulation of thermal conditions. The modern city building represents the composite multicomponent habitat of the person. The inhabited environment makes particular impacts on an organism, causing responses. Function of the thermoregulatory device of the person in city building in extreme hot and windless summer days comes to extreme tension. In this regard for designers when planning building of the new residential districts and reconstruction existing important to know influence of various town-planning complexes, structures of building, elements of improvement and gardening of the territory on a microclimate, and consequently, and on a thermal condition of the person to choose the best for data climatic conditions option. In the cities with roast and an arid climate because of a discomfort able heat wind condition of environment their inhabitants mainly stay in the afternoon mainly in rooms (60.80% of the interrogated population), and in the evening and at night - on open sites (70.90% of the interrogated population). Indoors the thermal feeling of the person is defined by a combination of heating of internal surfaces of a protection, temperature, humidity, traveling speed of air, and in the yard, on the street and on rest platforms — existence of stone, concrete and asphalt coverings, massifs of walls, light planes, green sites, water surfaces and their heating by an intensive direct sunshine. Many researches connected with are also abroad carried out to the CIS detection of feature of a thermoregulation of a human body in roast season and considering acclimatization of local population. It works S I Vetoshkina, A N Diler, K A Rappoport, P. M Lerner, Geller, N A Karotchenko, Bgbagirov's YIM, X And Kuliyeva, Yusupov's AM, To B. Baratova, I A Kassirsky, Z.I Umidova and M F Avezbekova. use of results of these researches, and also the generalizing works N K Vitte, P I. Gumenera, And N. Marzeeva, B A Malysheva, Yu D.

Provincial, I S Kondrora, E I. Korenovskoy, B. A. Ayzenshtat and some foreign experts E Adolf, D. Gokott, D. Drasdayl, KYэбба, D. Segala, Bonkhidi's JI allows to plan borders of thermal comfort in rooms and in the territory of a housing estate. According to P.Yu Hamburg, if * at core temperature of air +18 °C and normal humidity 45.50 labor productivity it is possible for % to take for 100%, at temperature increase indoors to +25 °C efficiency decreases on 5. 12,5%, at the air temperature of +30 °C - on 13. 15%, at +35 °C — for 16 23%. By hygienists it is established that in overheating clocks labor productivity in the open air in the conditions of city building decreases to 30% Z.I. Umidova notes that owing to imperfection of the thermoregulatory device the environment overheat especially depresses children, being in the fissile region of thermal indignation 0,5... 1,0m over an earth surface. It is established that in the conditions of the dry atmosphere in motionless air unpleasant feelings at the person arise already at a temperature of +31 °C, and when driving air with a speed near 1m/with - at a temperature not less than +35 °C As V I Fedynsky, good hygienic effect notes at air temperature +25... +26 C it is observed at a wind speed 1m/page. At +27 28 °C wind speed 2m/page is necessary for the same effect. The comfort zone extends at once on 8 10 °C if motionless air turns into driving. According to M S Goromosov, at change of speed of a wind with 0,01m/with to 0,6m/with the thermalizes of the person a convection increases twice. At increase in a wind with 1m/with to 4m/with it increases for only 75%. Slight increase in speed of a wind very sensitively it is reflected in EET (the equivalent and efficient temperature characterizing heat feelings of the person who is on the shielded site). For example if to increase wind speed with 0 to 3,5m/with, the heat feeling on EET scale at the stable air temperature (+30 °C) and an invariable relative humidity (20%) makes from 23 °C to 19,9 °C, i.e. the assessment of climatic conditions passes from "hot" into a zone of "comfort" as last on a scale of EET lies ranging from 17 to 22 °C inclusive. When determining comfortable standards of a thermal conditions of the dwelling the accounting of climate, a place of its arrangement is obligatory and extent of

adaptation to it the person is made by the Kiev scientific research institute of the common and municipal hygiene the table of dependences of borders of comfort for the room from the climatic area and a season. The comfort border for the summer period accepted air temperature $+25... +26$ °C, mobility of air $0,01... 0,15$ m/page. According to M. S. Goromosov, optimum for an organism in summertime of a combination of air temperature indoors $+22... +25$ °C with the relative humidity $45... 55\%$. Results of research A.E of Malysheva confirm the given indicators. Delimitation of comfort of a thermal conditions in the territory of the yard, streets represents more the complex challenge from the physical and physiological parties in connection with existence of a large number of the factors participating in interrelations of the person with Wednesday. However there is a number of offers on establishment of the limiting limits of the complex characteristic of comfort. So, for example, G K Goldstein offers the lower for Tashkent to accept border of comfort on air temperature $+21. +22$ °C, on the relative humidity of air $35. 50\%$ and on the speed of a wind $0. 0,7$ m/with, and upper bound - on temperature of $+28 +32$ °C, on humidity of 35.40% and on to wind $0,03. 3,5$ m/with by data From V. Kauffman, comfortable values of temperature of fresh air make $+20. +25$ °C at $30 70$ °C of the relative humidity. A. A. Minkh as an upper bound of temperature of fresh air calls $+24 +25$ °C, E Adolf $+26,5$ °C of I. Gokot considers as comfortable conditions in tropics temperature $+23,9. +28,3$ °C at the relative humidity $25. 50\%$.



1.3. Space-planning and architectural constructive methods of improvement of a microclimate of the dwelling and housing estate

According to researches of institute of the common and municipal hygiene, the Sysina which is carried out in the territory of the residential areas of Tashkent, top border of comfort the air temperature of +28 °C is considered. The hygienic characteristic of a condition of the person in the conditions of roasting climate testifies that the most severe conditions is the heat combination to a static atmosphere. Along with it action mitigation is possible heats creation even slight weak driving of air near 1m/page. Thus, the above-stated estimates of a condition of the person indicate the need of searching of new paths and ways of airing of the territory of building, a zone of the dwelling and room of buildings. The most exact solution of a question of the organization of systematic natural airing of the territory of building and the dwelling and by that improvements of a microclimate is use of the mechanism of interaction of an insolation with an active surface of building (a surface of walls, coverings, journey, sidewalks and paths). Improvements of a microclimate of the dwelling and housing estate the Architecture of the national dwelling is formed, as we know, under the influence of social and economic and climatic conditions. In regions with hot climate traditional placements of settlements, the space planning and design solution of dwellings it is directed on fight against an overheat. In the favorable landscape climatic conditions foothill valleys of Central Asia there was a number of self-contained types of the dwelling for which the fissile accounting of natural factors, features is characteristic relief, with the reference volume composition and development of the open rooms. As a result of centuries-old experience of the people living in Central Asia the complex of the protective measures which are reducing adverse impact of climate on buildings and actively using its positive side was developed. In the southern areas peculiar types of lodger, different are created the local features connected taking into account natural factors. The low national dwelling in Asian oases organized round the composition and functional core the summer room of this or that look,

also rather well protected from immediate radiation by the sun, actively uses gardening and flood and has, as a rule, the favorable summer microclimatic conditions. The last circumstance confirmed with a number of researches So O K Katlyar, studied a microclimate of the national dwelling of Khiva in 1959, noted the favorable thermal conditions in them. The natural microclimatic researches conducted by A.V Yershov in the national dwelling of Tashkent with the summer room " shopping " revealed receptions of an intensification of vertical airing. The reference ways of fight against an overheat in the national dwelling (division of rooms on summer and winter, orientation of living rooms to the southern and southeast sectors, design actions for the organization of airing of rooms, receptions of shading of apertures and a shadowing of domestic space) creating satisfactory heating environments are described in microclimatic researches of B F Vasilev in Bukhara, the XX Hakimov in Isfare A A Amkhilokhiyev in the rural regions of Kyrgyzstan. Substantially worsens conditions of the microclimatic environment, in particular the wind mode, in the national dwelling in areas with hot calm conditions of climate. Insufficiently wide streets, intra quarter and intra domestic gaps between constructions, heavybodied planting of greens can detain, and sometimes absolutely stop formations of local winds of a thermal origin. This results from the fact that heating of a surface, during the summer overheating period at the expense of an insolation, happens mainly in an upper of buildings, and the bottom of buildings and the territory does not heat up or heats up much less. Thus prerequisites for braking of vertical driving of air in the lower circle of the building and building are created. Restriction of an insolation of the territory and walls of buildings is observed in carpet planning with the dense combination of houses with court yard and with very narrow drives between them. So aged quarters of the cities of Uzbekistan, Tajikistan, Kyrgyzstan, Turkmenistan, and also Iran, Afghanistan and the Arab countries where width of the yards is close to building height look. In such conditions the insolation of journey and walls during the day becomes variable and minimum, and, more than a half of surfaces of

external walls is in a shadow. Thus the discomfortable wind mode causing feeling of closeness is formed. Cooling of rooms during the hot period is reached compositionally by planning and constructive methods which provide the best inflow of a cool airflow to dwellings. One of the receptions is disclosures of domestic space towards the dominating wind; definition of a gap between houses of construction not less than 1,5-2,0 heights of buildings, effective use largely of green plantings, bushes and a lawn in combination with the reservoirs reducing the temperature of air to 6-8 °C, a predilection of heatproof and heat-inertial masonry blocks for construction of walls and clay of a heater for a roof which create indoors the temperature schedule which is not exceeding 27 °C; use of the cooling property of a ground floor and underground tunnels. Reducing air temperatures indoors on 3... 4 °C; application of a method of watering of a paved floor of the covered court yard reducing air temperature on 1,5-2,0 °C. Larger masses of green plantings seldom meet in a housing estate. There are in the yards individual big trees and also ordinary landscaping on streets and drives more often. Thus separate crowns and groups of trees in combination with water basins create the centers of contrast temperatures of the soil and air, thereby promoting activation of local winds. In 1-2 floor houses the insolation is assumed generally on roofs, the wood plantings having potent thermal insulation, shielding. As a result temperature in rooms and in court yard decreased to level comfortable (26 and 30 °C respectively) at an external temperature of 40.45 °C. The scheme of creation of the plan and volume in various regions of Central Asia had the modifications answering to features of local climate. The traditional principles of placement and construction of settlements differ in that in them local airing is provided, without watching significant density of building. Low building of carpet type can be divided down into two levels of an insolation. The lower level - the soil of small streets and the yards, and ground part of external surfaces of walls to 2 meters. The top level - a roof and part of the same walls is higher than 2 meters. At it the area of an insolation of the top level 10 times more the area the lower level and duration of

their insolation corresponds as 3 to 1. Thus, temperature characteristics top and bottom levels air the contrast are created. There are fissile heat exchange processes on the top level, and with them and convection currents in the top level with engaging of ground, cool air from internal courtyard and rooms of the house. In communication is defined by the above the following prerequisites improving the microclimatic environment in the modern one - and low buildings and buildings - selective input in domestic space of insolation and the favorable wind on temperature; formations by natural architectural and structural tools local winds of a thermal origin and increase in radius of their action; removals of heated air from rooms and the yard on background Wednesday. For the modern city construction the sharp increase in number of stores and density of building of the territory is characteristic. Thus are created new conditions of an insolation of the territory and buildings, in which traditional ways of regulation of thermal conditions are ineffective. To studying of a question of formation of the environment, favorable for the person in multistoried building of the cities with a hot and calm profile of climate very few researches are devoted. The developed and realized site planning of building, improvement and gardening of territories are carried out according to the established standards and therefore the last come into conflict with the processes of heat mass exchange proceeding in the calm mode. For example, perimetrialny building complicates mobility of air mass in domestic space and accumulates heat from the continuous arriving straight line disseminated and the building of radiation reflected from surfaces. Hobby for loggias and balconies, acting on the southern facades of buildings leads also to falloff of vertical convection driving of air near them and horizontal sub current of cool air from the territory, adjacent to the building. Ubiquitous dense largely krone gardening of building, along with formation of the dense shadow in the territory, creates an immovability of air mass in under a crown space with gradual temperature increase and air humidity, causing feeling of closeness. The territory of the yards, economic and playgrounds, sites of rest and sport become the main intoned surface when

heating a sunshine to 70 °C, creating thereby potent sources of heating of a ground layer of air to 45 °C and more, promoting development of convection currents. At larger gaps between buildings duration of an insolation of territories and walls of tasks during the day increases. The increase in the area of an insolation of external walls of buildings increases thermal discomfort in rooms and in high layers of air of domestic space. In too time screening of interhouse space by high and stretched houses aggravates the negative factors as leads to decrease in airing of domestic space from background and local winds. Studying paths of formation and activation of local winds in the territory of city building, we mark out that natural airing of inhabited educations is defined by degree of an insolation of an active surface of building by which thermally contrast centers are created microclimate, the movements of air masses which are the mechanism.

Conclusions on chapter 1

By results of consideration of a condition of a question it is possible to note following:

1. The region of Central Asia differs in a high probability of sunshine, high rates of a straight line and a dispelled sunshine; the considerable indexes of the reflected radiation; high climatic and microclimatic rates of air temperature; existence of heating of the spreading surfaces of the territory and walls of buildings to high temperatures (+70 °C); existence of the cities with little wind and calm wind conditions, existence of the composite relief.

2. The peculiar climate with the considerable microclimatic features on separate sites of its building.

3. Exceeds admissible hygienic indicators (+30., +33 °C and +40. +45 °C respectively) are also the problem demanding the permissions. Low settlements on the scales fit in natural landscape, without breaking it. An arrangement it is silent settlements in the foothills, on the coast the water area or at an edge of forests does not destroy the mechanism of cool breeze winds and therefore is the first effective remedy of regulation of a thermal conditions of a housing estate with multistoried

building changes a landscape, creating the, specific environment, in particular, can serve as a cause of destruction of the mechanism of breeze winds. Thus, the city with multistoried building is in a conflict with the nature where low settlements use natural phenomena as the natural benefit it is possible to call the following: Gardening in the form of individual or ordinary landing highly labial, largely krone of the trees providing a shadowing of roofs, and also spaces of the yards and small streets without violation of their airing. The handling towards the yard of light of apertures, entrances and broad disclosures of walls of rooms of the device in the external irradiated walls small, with a sun blind of the apertures important blew. Creation of canopies, through for airing, on the first or the second floors of rigging of the yard. Realization of the protecting designs of houses and roof from the materials which are reflecting, but not accumulating thermal radiation. Counter picture of a thermal conditions. Area of an insolation of all roofs buildings 10 times less the area of an insolation of the territory serving it. In other words, the greatest thermal storage in inhabited massifs happens a ground layer of air, i.e. in the environment of environmental, the person airing of ground space sharply decreases. Building, playing the negative role in fight against an overheat: Green plantings are able to shield only the territory and first floors of buildings, leaving top open for action of a sunshine. The significant gaps between houses deprive of their possibility of screening of each other from sunshine. Light openings of rooms come to the irradiated surface of walls, receiving all cooperative radiation the available loggias and balconies do not carry out a role of aivan and will prevent through airing. The protecting, load-bearing frames are diathermic with the fissile thermal storage. Thus buildings allow noting the following features. The modern houses do not always meet hygienic requirements, most often due to the lack of climatic differentiation structural standards and underestimation of local climatic conditions at construction. In the dwelling air temperature is much higher (to +33°C) at admissible indexes (+26 °C) of comfort, and mobility of air is much lower than admissible level (to 0,01... 0,05m/c), from here task decrease in an

overheat of a medium surrounding the person still demands the decision. The available means of regulation of thermal conditions of the room buildings is subject to comprehensive study and adjustments, taking into account hot calm climate of the area.

CHAPTER II. AERODYNAMICS OF RESIDENTIAL BUILDINGS.

2.1. Aerodynamic situation of the area, accounting of the wind the mode at projection of the cities, constructing residential buildings.

Account of local climatic features in the design of housing and residential development becomes the determining factor in deciding how urban development be high-rise home. Thus paramount importance is the definition of the specificity of high-rise buildings and residential building in a hot climate, dry If systematize outlines the factors considered in the formation of a microclimate home, it turns out that they are linked by a system of interaction scheme - Climate extra-urban environment (macro) - the climate of the city (mesa environment) - Climate district (foci microclimate) - climate around blast furnace air shell (foci microclimate) - Climate apartments (foci climate) - and back With an increase in the number of stores, the role of home microclimatic regime change plot development, which is reflected in the change in aerodynamics development, the relationship between the heated surface and greens in volatility relative humidity. All this leads to a change in the microclimate of building, entailing changes in the microclimate of apartments. Indoor climate is the result of the transformation of walling urban climate. At the same time, the climate is the result of urban transformation macroclimatic among the elements of building. In this regard, urban development with the architectural and construction elements are material structure formation and regulation of climate and building buildings. The interaction of the active surface insolation of urban development is the main climate factor. Question natural ventilation of urban development in calm weather conditions is little known and is not currently practical method for solving the prediction and design. Over the past 20 years, the authors conducted a study on the aeration of urban areas and areas of the building, which resulted in the developed practical methods for predicting and calculating, based on the following assumptions * on the hot-wind and hot-dry conditions; thermodynamics and aerodynamics, plants) processes natural aeration urban area; processes of formation of local winds of thermal origin

in urban development, building; climatic conditions, local winds, which are formed in urban development and the establishment of the relationship between them and the difficult terrain; medium, hot-climate southern cities and improvement of the air basin with the use of architectural means, building and finding practical ways of natural ventilation of urban development. In the design of cities, buildings and buildings entire territory of Central Asia is under the influence of Western transfer of air masses in the atmospheric layer from 2-3 to 12 km During the summer in the northern part of this area is preserved * dominance of the northern and north-easterly winds, but along the valley of the Amu Darya River observed mainly western and south-western winds. Many cities of Uzbekistan with high industrial potential and dense demographic composition located in the Fergana Valley with a unique physical and geographical condition. Spatial-temporal distribution of the frequency of occurrence of weak winds (0. 1 m / s) in the Fergana Valley varies quite a wide range, from 11% in the throat of the valley, up to 84 ... 85% in the northwest and the north-eastern parts of the valley from these data on the territory Fergana Valley allocated approximately four zones with different repeatability weak winds According to the nature Daily repeatability light winds all the stations of the Fergana Valley can be divided into two groups. The first group and the areas located in the center of the valley. They are characterized by high frequency of weak winds early in the morning and at night. Most likely; this is due to the fact that there is no possibility for the free flow of air.



Most Likely; this is due to the fact that there is no possibility for the free flow of air. The second group of cities and towns of the Fergana Valley where there is good air circulation-type mountain valley winds increased frequency of "weak winds occur in the afternoon and evening, and the decrease observed in the early morning and at night. The combination of surface inversion with light winds called stagnant air and belongs to the most unfavorable * weather conditions, since in this rapidly deteriorating climate parameters (temperature and air mobility) causing a feeling of stuffiness in humans and is most intense accumulation of impurities in the lower atmosphere. The cities with similar weather conditions in where stagnant air quality during the night of 25 to 75% of daylight hours from 10 to 18%, can be attributed Namangan, Andijan, Kokand, Fergana, Isfara, Khujand and others. Depending on the magnitude of the air flow distinguished: macroclimatic winds, winds climate meso (intermediate) and winds microclimate. Microclimate wind may differ from macroclimatic both in speed and direction. Macroclimatic wind observed at the surface is different from the wind blowing at a fairly high altitude (called geostrophic) and the speed and the direction of the wind macroclimatic arises either under the influence of macro-climatic, or is purely local. Meteorological observations were noted, local winds between field and forest. I.A.Goltsberg cites the case of local winds between forest, field and field strips, NA Troitskiy- example of education "urban breezes" between green spaces and streets through which in effective temperature. The reason for the development of local circulation on the roads between lane is the temperature inhomogeneity of the surface of bridge and wood strips. Most clearly this phenomenon occurs at low wind speeds and calm in the daytime bridge surface overheats compared surface wood strips. Because of this, there are local air currents moving in a closed circuit in the afternoon rising above the bridge and falls over the forest belts, at night with a backward motion.

2.2. Warm and wind mode of residential buildings

In recent years, the classification of local winds. After analyzing the classification of local winds generated in frontier layer, with respect to urban development, it can be noted. The following local winds, which are formed in the cities is an air flow of small extent (from several meters to ten kilometers), generated by the active surface features of buildings. These features caused by the heterogeneity of heating different parts of the underlying surface, creating a perturbation of the wind field and temperature. Urban local winds from the energy point of view, can be attributed to the movement of free convection, developing under the influence of forces Archimedes In order to enable them to develop the necessary absence general air transport capable to eliminate local free convection movement. Urban local winds occurring in the weakened circulation is a thermal convection motion. They form due to thermal perturbations caused by the monotony of heating and cooling the active surface of the building and the adjacent air. Formed in this horizontal gradient of temperature (green garden or park, irradiated facade - shadow facade, Lake -territory building, etc.) and is the cause of local circulation. Thermal perturbations can be both periodic and continuous. Local periodic winds occur due to thermal perturbation different intoned the active surface in the wind general circulation, or when the latter is weakened or absent. At the absence of the wind field of general circulation in the territory formed urban independent air flow local character expense thermal differences Conditions for the development of micro-breeze circulation the more favorable, the greater the contrast in temperature In the presence of the general circulation of the wind field, on the one hand there is a weakening of the pressure of the wind in the friction layer of air friction against the total pressure gradient. On the other hand, thermal perturbations themselves contribute to the growth of the surface layer, that is, increase his power in the southern cities of the CIS. Based on the analysis of the opportunity to make the following model form: macro aeration - local circulation! air occurring in large-scale geographical landscape between the city and the

mountains, water areas, forests; mesa aeration - local winds, developing within tight built building, alternating between urban development and green areas; micro radio - local winds generated within the territory of green and greened courtyard, on the territory and urban spaces in between houses the space between the irradiated and shadow urban facades.

The process of the emergence and spread of local winds in the city and in the "city - suburban area" insufficiently studied the influence of organized city on climate trends can be seen in an increase in air temperature. An increase in temperature occurs in every big and small city of identifying and analyzing the causes of the "urban heat island" has been widely discussed. Of the numerous studies on the meteorological conditions in the cities of the CIS and abroad, it is known that in them there is an increase in air temperature and humidity changes, the reduction of wind speed in comparison with the surrounding area. One of the significant factors that reduce comfort urban environment, is the formation of heat islands, the occurrence of which is associated with the radiation factor studies in Dushanbe, Alma-Ata, Samarkand and other cities of the CIS and their suburban area in July at low speeds wind showed that the maximum heating of the air inside the city was observed in areas where there are large areas of asphalt, not landscaped pedestrian highway and in areas with dense multi-store buildings. At these sites, the maximum difference in air temperature towns and villages are found in the afternoon of 18 ... 21h - up to 5,5 °C, and minimum - in the morning at 6 8 hours at a temperature of up to 2,5 °C. The air in urban areas Dushanbe day for 3 to 8 °C at night 6 .. 8 °C warmer than the surrounding mountainous and rural areas.

When considering the spread of local winds in terms of geographical landscape "city - suburban area" notes that in the warm air isobaric surface over the city are located at large distances from each other than in the cold. This gives rise to a closed air circulation. Then, too, the same areas of the isobaric surfaces are arranged horizontally, so that the surface of the underlying layer and at all

altitudes no horizontal pressure gradient and the horizontal movement of air no insolation In the urban area "B" the active surface is heated and gradually spreads to the upper layers of air isobaric surface over the area will begin to rise and disperse Since barometric degree increases with altitude, and the warm air is more than in the cold, the higher the level, the more rises isobaric surface. On the upper level pressure over the area of B is greater than the above areas A and C, there is a horizontal pressure gradient and begins the movement of air from high pressure to less this movement causes a change in pressure in the lower levels. In the area due to the outflow of air in it decreases, and in areas A and C due to the air flow it will increase accordingly in the area in isobaric surfaces descend to lower levels and in areas A and C pressure and begin the movement of air from higher pressure to a lower, of the areas A and C, the air will move the area B.

The curvature of the lower isobaric surfaces will decrease height, and some average height isobaric surface remains flat. Even higher isobaric surfaces remain curved upwards and will continue outflow of air from area to area A and C, this will be offset by the outflow of warm air upward movements in the area in and over the areas A and C air, affluent top will sink Thus between the heated areas of the city In not heated periphery A and C formed thermal air circulation, consisting of four units-over warm surface - upward movement of colder - downward, at the earth's surface - a movement from a cold to a warm area, and above a certain level cooled and air moves over a warm area to a cold circulation of this type arises as a result of cooling and any particular area of urban development over it develops a downward movement of the air, and over the adjacent, not cooling sections - the rising circulation, similar to that described above, is due to various heating urban areas of the surface.

Air flow impact Nuka thus at the underlying surface, typical only for certain areas and called local winds Local winds of thermal origin are also breezes and mountain-valley winds on the border of the city-countryside there is a considerable horizontal temperature gradient corresponding to the "cliffs" heat island, which can

reach 4 °C km⁻¹. Most of the city is a "plateau" of warm air with a slight rise in temperature towards the center of the city. The thermal homogeneity of the plateau is broken influence Parks and Lakes (area cold) and dense building industrial and office buildings (heat island) In the central part of the city is "peak" heat island, where the air temperature maximum to 48 °C or more. Optimum conditions for the formation of large values of temperature town village is a gentle breeze and a cloudless sky. Such conditions promote the development of micro-climatic features due thermal difference in the properties of the underlying surface Differences in air temperature between the urban and rural areas is significant.

The intensity of the heat island also depends on the size of the city population and emergence of heat islands due to the following factors increase incoming radiation effective radiation heat storage and horizontal vertical surfaces increase the absorption of shortwave radiation due to the influence of the geometry of the canyons on the albedo a large amount of heat acquired by the city in the daytime, due to its thermal characteristics and consumption of these stocks in the afternoon, a building with heat anthropogenic origin; decreasing costs of heat by evaporation due to the absence or insignificance of vegetation in urban areas; reduce heat loss through turbulent exchange due to the weakening of wind speed in urban areas. Heat island is a reflection of the amount of micro-climatic changes associated with anthropogenic transformation of urban surfaces Even an isolated complex of buildings creates a microclimate that is different from that which would have been in this area in its natural state.

Asphalt surface and walls of buildings in the daytime under the influence of insolation * accumulate a significant amount of heat and at night give it to the surrounding air Temperature contrasts most clearly manifested in the evening, just before sunset and after it. As an example, where the temperature measurements are presented in the middle of the courtyard formed by a complex of five-store prefabricated buildings and outside the inner courtyard paved, landscaped It should be noted that after 2 hours after sunset surface of the walls and the courtyard 4 5

°C warmer than the surrounding air. Territory of the city can be likened to the island of heat and winds of impingement to the center - a breeze that blows in the afternoon from the suburbs into the city. From here, it follows that the development of wind fields is determined by radiation and circulation conditions are known from the theory of breezes calculation formulas, which can be determine the speed of the horizontal and vertical components speed and wind also holds description air circulation field-forest, which can be approximately regarded as an analogue of the wind fields. The above depending satisfactorily defines breeze wind component, which is defined as the average speed of the lower reaches, however, it should be noted that the law relating to the breezes, winds on the fields of urban territory is not covered and requires additional research. For the formation of the wind blowing from commuters toward the center of the city, requires a certain temperature contrast of the active surface of the city and suburban areas. If we use a first approximation, the data obtained for the breeze that occurs on the banks of the pond, then the amplitude of the temperature June 12 °C with the horizontal length of the local wind is 10km, therefore, the minimum diameter of the city, in which the possibility of occurrence of wind fields, should make 20km Study the formation mechanism of natural aeration is done considering thermal convection, which is the basis of education. When local winds insolation surface of urban development (external walls of buildings, streets, roads, warm people, etc.) is heated and heat transfer to the surrounding air by radiation and convection. The temperature of the air in the city center about 5 ... 6 °C above air temperature in open spaces or undeveloped suburbs. In this case, the warm air from the center of the city rises, and in its place comes the flow of air from the outskirts.

2.3. Physical and mathematical model of natural aeration of residential building.

Natural convection is the rise of air in a gravitational field due to local temperature increase of the active surface construction, which causes a decrease in

density, and hence the upward force or buoyancy. The values of the upward forces are determined according to the principle of Archimedes. Convective heat transfer is dependent on the temperature distribution in the stream in turn is determined by the nature of the temperature field distribution of the flow velocity, that is, high-speed field, depending on the mode of air movement when moving air can flow two basic modes: laminar and turbulent. In laminar flow heat transfer to the body surface performed conductivity because the particles can not air move in a direction normal to the surface of the solid body - underlying surface construction. In the turbulent flow regime, the heat transfer in the direction normal to the underlying surface is carried out as thermal conduction and convection. Thermal convection is a type of turbulent mixing in the atmospheric boundary layer elucidation of the physical nature of this process showed that it is in the vertical transfer, which caused considerable heterogeneity of thermal field horizontal and vertical. A more detailed analysis, in particular the pulsed nature of the mechanism of this phenomenon, the so-called "law of long line exchange" has been identified A. A. Skvortsov. It is known that air warmed on a hot surface, rises up carrying with them the acquired heat to the surrounding air. This heat transfer can be done in three ways - by radiation, thermal conductivity and stirring - convection. This process is called a well-known theorist of atmospheric heat-exchange A. Skvortsov - author of the theory of convection between the bunk can be mass-current or exchange. According to this theory, "the process of the formation of convective exchange is made with layers of long lines and closed circulation is accomplished by periodic destruction and restoration tiers." This set Skvortsov AA pattern he proposes to call "law ferocity exchange." "The first tier has the lowest power 3-4cm, it call three baked. The second tier extends to 2-gp up, it is called the lower the surface layer as opposed to following the third, which is called the upper ground layer." "According to some calculations, the latter extends up to several hundred meters. In baked layer air movement going up and down on the narrow portions with small quantities of air, which leads to the presence of vertical

movements. This is confirmed by field observations of convective currents formed in the space between the houses at a height of 0.5 m from the concrete track.

The speed of the vertical flow is 1,12m / s at a height of 4.0 m from the concrete track speed vertical flow is 0,51m / s General characteristics of air mobility in space between homes with unimproved actively intoned, open soil can be defined as a predominantly vertical with a speed of 0.3 yes 1.3m / s, and in the green big spaces between Crohn's homes space - primarily as the calm, with a single vertical yield up to 0.5 m / s As the most general conclusion we can say that in the open actively intoned parts of the territory there are pulsating vertical currents up and down with partial horizontal movements of air in baked layer (within a few centimeters), and therefore not generally create significant wind movement of air in the surface layer. In the yards of green areas with active areas, where are overturned the order of the temperature gradient is established with the calm accumulation stable temperature to + 34 °C. Along with this, there is a very important detail seen in the temperature and wind conditions on the greening between the brownie space where microclimatic measurements conducted at the level of 0.0, 0.5, 1.0, 1.5, and 2.0 m in the 14h day Above the concrete covering travel, near green spaces, at the height of 0.5m recorded air temperature - respectively 41.4 and + 36,6 °C, and the convective flow 1,42m/s over travel and 1Dm / s adjacent to the passage of gardening In other areas under the canopy of trees the air temperature is kept around + 34 °C and the wind speed is close to zero.



These figures coincide with the general conclusions on the activity of convective currents at the junction of the two foci of microclimate on field observations Wii Urban Development, However, this phenomenon was noticed by other authors, was not considered from the standpoint of building thermal physics, in particular unexplained processes in the individual micro foci, as well as their combinations. This problem can be briefly described as "the theory of convective turbulent jets in a residential area" The theory of convective turbulent jets seen in the writings Mr. N.Abramovicha, V.M.Eltermana, I.A.Shepeleva, V.N.Talieva et al. authors in the field of hydrodynamics and thermodynamics, regardless However, civil engineering developed their theory of convective jets round and flat section can be fully applied in the consideration of our problem of local (local) wind thermal origin. The scheme of free convective jet on V.M.Elterman and provides V.N.Talievu.

According to a simplified scheme of the jets, air, approaching the heated horizontal surface and warmed himself, rises vertically upwards, forming a funnel with a total jet boundaries ABCD and EF3KH. The jet is divided into three sections overlocking ABFE, transitional and VSZHE main BSZHN separated compressed section BF and transition SJ In the boost phase is mainly manifested buoyancy force, under the action of which the velocity of the heated air is continuously growing, relatively less heated. During the transition, and the main portion, along with restructuring fields velocity and temperature exert forces of turbulent viscosity, under the action of the jet which gradually widens its motion. The lateral boundaries of the second and third portions on its continuation heating surfaces intersect at some point in the M-called pole of the convective flow. A very important provision is the angle of lateral expansion θ second and third sections of 12° 25° (adopted in the said literature and personal observations). * stream and convert it into a vertical, in the sequence in which they are superimposed. Such a scheme is due to the formation of horizontal flows of vertical jets, very specifically defines the geometry of the expansion of the vertical-flow, as well as a decrease in

the vertical flow speed and temperature. When convective jets of circular cross section each incoming horizontal plane layer of air can be described by the volume and speed of the vertical of its continuation in a circular cross-section. On the basis of Boyle's law. can be written where W_B - vertical jet flow rate, m^3 / s ; W_r – second horizontal flow, m^3 / s . In turn, for the n - layer where $r > s_n$, D_m - vertical and horizontal velocity of the n -th layer inflow, m / s , $W_B = W_r$, $W_{Bn} = 1$) EP $(7cR_{2n} - 7CR_{2n-1})$, W_m h_m $27ER_n$, N to the size of the community side of the angle of the jet must add the community size heated micro site in the works of these authors. $55 R_n$, R_{n-i} - radius of the jet, following each other, m ; h_m – height horizontal-term stream of n -th layer, m .

Comparing equations, we obtain $Y) w$ h_m $27 [R_n = D_{gn} (7CR_{2n} - TIR_{2n-1})$, from where $m > HS (7tR_{2n} - tIR_{Vi}) V_m = h_{nj} 27rR_n$ or $T) nr (R_{2n} \sim R_{2n.i}) D_m = h_m 2R_n$ Here we see a linear function of R elementary stream that requires measurement $R_{nn} R_{n-} !$. And if so, under the scheme of flat jets of some length on poluchaem- $W_1 = 'i) 1h_1 \text{ £}$, $W_2 = x > -fal = "About ihi \text{ £ } ctga$ from (2.7) $d ihi-6 = d 2hi \text{ € } ctga d i = v 2ctga$ If we take this formula for $a = 12 \text{ °C } 25 '$, the $ctga = 0,22$ and then $\wedge 2$ and $1 = 0.22 D 2 5$ To calculate the speed ratio of the vertical and horizontal jets in the regulation of heat and wind conditions in the surface layer of the yard. This accuracy is sufficient. Thus, knowing the velocity of the air at the periphery of the vertical plane, we can calculate the velocity of the horizontal in flow.

Last justifies the need for the dissection of large areas of land surface heating strips of greenery. In terms of landscaping and gardening it can take the form of a grid of narrow bands thermally active coatings on the greening of the territory The most comprehensive picture of the convective heat transfer horizontal surfaces reflect formula ELTERMAN V.M, which can be used to calculate the convective currents generated at the development area. Acceptability of these formulas have confirmed our field observations conducted in the building calm city In the heat transfer from the active surface of the city to the border air layer

play a major role following processes: convection and turbulent heat transfer, molecular heat transfer, radiation and absorption of radiation, phase changes of water (evaporation) Heat flux transported by air particles per unit time through unit area is made up of two streams - convective and turbulent Q_T . Convective heat flux due to the orderly movement of air at an average speed \bar{v} $Q_c = \bar{v} \rho C_p (T_s - T_a)$ where C_p - the heat content Since, the horizontal component of the mean wind speed is hundreds of times greater than the vertical component, the convective heat transfer is mainly by horizontally- called advective heat flux turbulent heat flux due to velocity fluctuations.

Turbulent heat flux in the vertical has the form $Q_t = -K \rho C_p \frac{dT}{dz}$ where $\frac{dT}{dz}$ - potential temperature gradient; K - coefficient of turbulent exchange, or moving to - factor of turbulence $k = \frac{K}{\rho C_p}$, m^2 / s . The coefficients A and B are subject to the conditions of the atmosphere! Significant changes in both time and space. They depend on the vertical gradient of wind speed, atmospheric thermal stability properties of the active surface of the city (its roughness, thermal heterogeneity), and others. In the surface layer of air above the city (up to 100m), the coefficient of turbulence in all conditions increases with altitude. Turbulent heat flux in the horizontal direction is proportional to the change of horizontal temperature θ in this direction coefficient of horizontal turbulent heat transfer.

Conclusions of the chapter II

1. Modeled the formation of macro aeration, aeration mesa and micro aeration and classified local winds to be considered in building design and construction

2. Dynamic convective processes on the surface of urban activities allowed for a physical-mathematical model that allows predict natural aeration of urban development.

3. It is possible to establish the relationship between, on the islands of warmth and coolness, speed of wind between them, to quantify the thermal

wind mode of air pollution on different intoned heat island urban area and their impact on the environment.

4. A methodology for the calculation of the transformation of the air on a computer, allowing to determine the effect of the distribution of urban adjectival temperature at a relatively cool suburban area, to calculate the impact of systems of green areas, flooded areas, single heat spot on the adjacent urban areas and dissemination degree and dispersion of emissions at point surrounding area development



CHAPTER III. REGULATION OF HEATING AND VENTILATION REGIME OF RESIDENTIAL BUILDINGS.

Nowadays, environmental problems become economic and social importance. On the correct and timely, solution to this problem depends on the health and well-being of not only living, but also future generations.

Protecting and improving the environment as one of the problems of urban development - an integral part of design and planning work at all stages of design, starting with the general scheme of settling on a national scale, the region and ending with the project of detailed planning and techno work projects of individual elements of the city. At each level, the design has its own specifics in setting goals, objectives and selection of research methods and evaluation.

At each stage of the design must take into account the complex factors influencing the biological and hygienic environment. On the origin of these factors are divided into natural and anthropogenic. The natural concern climate, topography, soils, vegetation, surface water and groundwater. Among anthropogenic factors can be distinguished man-made physical (noise, electromagnetic radiation, etc.), man-made chemicals (air pollution, hydrosphere, soil) and mechanical man-made (violation of topography and soil cover, deforestation, etc.). There are factors that activate each other fogs and release of toxic substances into the atmosphere, low temperatures and strong winds, solar radiation, and motor vehicle emissions and others. Some of them have the ability to potentiation in the environment, leading to a sharp increase in the integral index, which reflects the cumulative impact of all factors of the urban environment on human health.

Among the climatic factors that have a significant influence on the external environment is wind and heat. Wind contributes to the transfer of air masses with different physical properties (heat and cold, wet and dry), aligns the temperature differences between the individual parts of the city and has a significant impact on

the state of air pollution of the city. Analysis of urban planning practice in our country, along with examples of correct account of wind and thermal conditions in the construction of new and reconstruction of old cities (identified cases of insufficient capacity to regulate the use of the wind regime architectural and planning tools, and here and there a discrepancy planning and development of climatic conditions, aggravate the discomfort aeration mode area. This is partly explained by the fact that the currently valid regulations to accounting for wind conditions relate only to cases of selecting the location of residential and industrial areas in the urban areas with respect to the prevailing winds (wind speed and repeatability to destinations in the cold and warm periods of the year). Special instructions related to registration and regulation of wind and thermal regime in the design of residential development in existing building codes are not available.

Specificity of climatic conditions and, in particular, wind and thermal regime so far taken into account only in the development of individual projects, mostly experimental. No differentiated approach to planning and building cities in different wind and thermal conditions, and urban areas in the same city.

Currently, there is no benefit, which have been scientifically proved methods of assessment and prediction of wind and thermal regime in the design of buildings. The need to fill this gap and identified the preparation of this work. Wind (vector factors characterizing the speed and direction) is one of the leading climatic factors; He has the greatest influence on the formation of a microclimate of the environment (distribution of temperature and humidity, etc.), warm feeling of a person and the state of air pollution.

The main objective of development is to provide designers rather simple methods of assessment and prediction of wind and thermal regime in order to optimize sanitation residential development.

The accounting for wind and thermal regime should be addressed at all stages of urban planning, from the settlement system and ending with the detailed

plan, with the evaluation methods and techniques of control of wind and thermal regime specific to each stage of urban planning. Accounting and control of wind and thermal regime should be implemented in conjunction with other environmental factors (radiation and thermal regime of air pollution and others.). Assessment of the current state of wind and thermal conditions (aeration) of the construction site must be carried out prior to the development of design solutions development and serve as a basis for the adoption of certain planning decisions. Evaluation of the specificity of the local environmental conditions and developed based on an assessment of the existing state of wind and thermal conditions of aeration map area should serve as a basis for the location of cities with different national economic profile in the settlement system and the various functional areas in the city in order to prevent the demolition of contaminated air from the industrial cities and objects on other economic profile of the city and residential areas.

City of Industry Profile and large industrial zones in the city should be designed on the leeward side of the other cities of the metropolitan area and the residential areas of the city, guided by prevailing wind direction in the uncomfortable for the area during years. The construction of large industrial facilities is also allowed up or down relative to the prevailing wind direction of the city that should be determined by winds of the other points of the compass, which can serve as an additional source of air pollution of the city.

Special consideration is required when selecting a wind territory for industrial and residential zones in areas of the valley and closed topography with slopes greater than 4%, as simultaneously with the redistribution of the speed and direction of the main wind flow, it affects the redistribution of the concentration of pollutants in the air. It is necessary to take into account the possibility of the formation of stagnation of cold air masses over the lowered portions territory "heat islands", inversions, which contribute to the formation in the daytime veil of smoke. To revive the residential zone of the living environment should be designed

on the windward side to the prevailing direction of winds, as well as upstream, with respect to industrial and agricultural enterprises with technological processes, which are sources of release into the environment of hazardous substances. Allowance must be carried on the wind uncomfortable for the area during the year, using data from long-term observations stations Hydro meteorological and Handbook of Climate Republic (diurnal variation, winds of good and bad points of the compass, average and maximum wind speed of unfavorable points of the compass), as well as criteria comfortable wind speed for the area.

The criteria for assessing the comfort of wind and thermal regime are bio-hygienic standards and wind speed coefficients K (quantity that characterizes the ratio of wind speed in the construction area or in a particular reception building to the wind speed according to the meteorological station located near).

3.1. Bio-hygienic criteria of wind and thermal regime.

Criteria for assessing cumulative effects of temperature and relative humidity, wind strength and direction, solar radiation and other factors on the body is feeling the heat of man, which should serve as a basis for assessing the environmental comfort. Thermal comfort - a set of meteorological conditions under which the thermoregulatory system is in a state of least stress. Wind speed largely than other climatic factors affecting the warm feeling of a person because of changes in the intensity of the heat loss due to evaporation from the surface of the skin, as well as the heat transfer through convection and radiation. The thermal background, humidity, thermal insulation properties of clothing, exercise, etc, determines changing the warm feeling of the person depending on the wind speed. During the summer breeze "removes" the feeling of heat, and in winter increases the feeling of cold: strong winds on 1 - 2 m / s is equivalent to lowering the temperature by 2 - 3 °. Effect on mobility air heat change by convection and radiation are given in Table. 1 adj. 1.

When detecting the influence on the human body should take into account the wind speed of air temperature, since the cooling effect of the wind is temperature dependent motion of air (thermal equivalent air speed). At a wind speed of 1.5 m / s equivalent to the heat normally clothed person will be: at a temperature of 21 ° C – 5 C°, at a temperature of 32 ° C - 2,5 ° C, at a temperature of 43 C ° - 1 °C (which is equivalent to reducing the temperature of the air respectively at 5, 1 and 2.5 °).

In determining the comfort of the human environment, use of integrated indicators of human exposure to the wind speed, air temperature and humidity, that is the equivalent-effective temperatures - EET. For example, increasing the air velocity of from 0 to 3.5 m / s to reduce the EET 3,5 °. Reducing the relative humidity of 100% at 20 static air EET decreases by 7 °. EET dependence on air velocity is given in Table. 2, and the conditions are the same warm feeling of the person at the positive and negative air temperatures are given in Table.3 and 4 adj.1.

Hygienic study of the thermal being at different wind force and under different climatic conditions allowed to establish the value of the comfort of wind speeds to be considered in the design of urban development. Comfortable wind speeds should be considered:

For the conditions of Central Asia with temperatures above + 40 ° C in the summer - the wind speed in the range of 1 - 4 m / s.

Wind speed above 5 m / s perceived by man unsatisfactory.

Methods estimation of wind and thermal modes of residential buildings.

The background score of the construction area.

For the purposes of urban planning must take into account wind conditions on the basis of a comprehensive zoning maps of wind speed on the contrast and

most uncomfortable - summer and winter seasons, which gives an overview of the wind regime in different parts of the territory of the Republic (see. Fig. 1 adj. 2) .

Under certain conditions, congestion and air pollution capacity assessment should use data Handbook on Climate Republic repeatability wind speed 0 - 1 m / s (by month and at different times of the day) and map zoning Republic repeatability wind speed 0 - 1 m / s (see. Fig. 2 adj. 2). On the territory of the Republic has vast areas; where the wind speed 0 - 1 m / s is observed in 60% of the year and more on-map identifies the following areas with different recurrence wind speed 0 - 1 m / s: Area I - 20%, the area II - 20 - 40% District III - 41 - 59%, district IV - 60 - 70%. Cities located in different latitudes are exposed to typical for the area of air currents. Local winds occur under the influence of the earth's surface topography, proximity to the sea and the nature of the coastline they depend on the thermal conditions of the Earth's surface and are characterized by different speed and different diurnal it.

In connection with the tasks of architectural and planning are essential nature of locally determined and locally bounded winds, bearing local names: breezes, mountain-valley winds, down-wind (hair dryers, boron) and others. Table. 5 adj. 2 shows the classification of local winds and their estimation from the urban planning point of view.

In connection with the construction of high-rise buildings and structures necessary to use data on the calculated wind speed at a height of 100 and 200 m. A schematic map of the distribution of wind speeds at these altitudes (for M.V.Zavarina) is shown in Fig. 3 adj. 2, and the wind speed calculated at these altitudes, the possible times of five years are shown in Table. 6 adj. 2.

To identify areas with identical requirements for planning and building to be used schematic map of zoning (for Butyvoy I.V) is characterized by a feeling of comfortable warmth guests. (See Fig. 4 adj. 2). On maps, diagrams, four zones with different repetition EET (17 - 22 ° for 13 hours in the summer months): 1st

least 30% of the days in the past month - the zone "minimum comfort", 2nd - 30 - 50% Days month - the zone "sufficient comfort", which occupies the central regions, between 52 - 55 ° C and 46 - 47 ° N .; 3rd - 50 - 70% of the days in the past month - the zone "optimum comfort", which occupies the south of the European territory of the CIS and central and southern parts of Kazakhstan; 4th - more than 70% of the days in the past month - the zone "maximum comfort", which occupies the low mountain regions of Central Asia. From the zoning follows that in the CIS, which lies to the north of 47 - 50 ° N, the cooling effect of wind leads to a low frequency of occurrence for human comfort conditions. The use of wind protection activities and shifts dramatically increases the comfort zone (see. Fig. 4 adj. 2). To evaluate the effectiveness of windbreaks should use the graph shown in Fig. 5 adj. 2 (for A.V.Yakovlev). An indicator of the severity of the conditions bio thermic is the ratio of hygienically unacceptable conditions to cold as a percentage. Severity criterion is its 20% probability.

Estimation of wind and thermal regime, taking into account physical and geographical conditions of the area.

About 50% of the territory of the CIS refers to the crop, hilly and mountainous terrain. In this case, taking into account only the background characteristics of the wind regime is not sufficient: it is necessary to identify the specific features of micro-climatic wind conditions in some parts of the construction site with the given conditions of the terrain. The terrain causes a change in air currents, prevailing over relatively flat areas of the territory. Airflow under the influence of the relief may expand or contract, causing a reduction in its speed in the former case and increase in the second.

In assessing wind and thermal regime in connection with the terrain are used: the rate of change of wind speed in a hilly area, depending on the forms of relief for wind speeds of 2 to 7 - 8 m / s compared to the open level ground; the rate of change of wind speed 3 - 5 and 6 - 10 m / s under various conditions of the

relief compared with an open flat area at a height of 2 m above the ground; coefficients of the wind speed at a height of 2 and 10 m depending on the landforms (ratios to the wind speed in the open level ground); the rate of change of wind speed under construction in complex terrain (see. Table. 7 - 10 App. 2).

In the analysis and evaluation of wind and thermal conditions of the development area, use the following materials: A Guide to the climate of the Republic; material: Hydro meteorological, sanitary-epidemiological stations, local Hydro meteoobservatorii; local research and design organizations; literature relating to the characteristics of the natural conditions of the construction area or city. Assessment of wind conditions can be expressed by using the graphical method of the image, allows you to select on the plane terrain areas having different wind speeds (maps wind conditions).

Maps of wind regime of the projected area should be prepared based on the hypsometric scale of 1: 10,000 and 1: 50,000 (for V.P.Lyadov et al.), and should consider the following morphological characteristics of the projected area:

- Angles terrain with relatively equal division of seats on the elevated (flat watersheds) and reduced areas of the territory;
- The orientation of the slopes of the prevailing direction of the wind (windward, leeward and side wind);
- Division slopes into three parts, including the upper, middle and lower parts of the hills;
- Bottoms of the valleys, depressions, gullies, or scavenged windswept;
- Hills with flat tops and gentle slopes;
- The length of the lines flow of air at the mountain terrain.

For the mapping of wind regime was based on the two schemes, drawn because of topographic scheme for the distribution of slopes exposition and angles scheme areas. Changing wind characteristics depends on what part of the slope (upper, middle or bottom) is active portion (slope angle with almost no matter) and it

occupies a position relative to the prevailing wind (windward, leeward etc.). Typically, the distribution pattern of slopes for a relatively quiet terrain (with slopes up to 3 °) is given on the four exposures: north, south, east, and west. In the context of highly rugged terrain (with slopes greater than 10 °) the number of exposures taken into account can be increased to eight (including intermediate exposure: north-east, south-east, south-west and north-west). A method for constructing the scheme of distribution of slopes for exposures given in the Appendix. 2 in Fig. 6 (for F.L.Serebrovsky).

Scheme angles terrain is drawn on a separate copy of the topographic base. Tgα slope angle of incidence can be calculated using the formula:

$$\mathbf{tga} = \mathbf{h/L}, \quad (1)$$

where h - height of the cross section of the relief horizontals;

L - Inception (distance) between the contour lines.

To produce such calculations and facilitate determining slope of the earth surface, the bottom frame under a large-scale topographic maps (1: 100,000, inclusive) placed scale foundation, on which can be graphically determine the slope angle of incidence anywhere. A method for constructing angles terrain is given in Appendix. 2 in Fig. 7.

For maps wind conditions (aeration) outline map terrain slope exposure and elevation angles should combine, highlighting the boundaries of slope exposure and border crossings slopes, all slopes must be separated into three parts: the upper, middle and lower. With characteristic wind regime of the analyzed area (see. Climate Handbook of observational data or the nearest weather station), and the coefficients of wind speed on the relief provided by the appropriate shaded areas characterized by different aeration mode (see. Fig. 8 adj. 2). In this case, it is first necessary to take into account wind speed and direction, which is

characteristic for the most uncomfortable period of the year (in most parts of the country this winter). Using data from the weather station, you can get the absolute wind speed at which we are interested parts of the territory. To determine the wind speed at a height of 2 m above the ground (microclimate person), you should use a table conversion of wind speed with height weathervane weather station at this height or traffic given in Appendix. 3 (see. Table. 11 and Fig. 9) (for A.V.Yakovlev).

The dependence of the wind speed V of height h should be determined by the formula:

$$V = a + b \cdot \lg(h + c), \quad (2)$$

where a, b, c - constants determined from observations.

A simple logarithmic straight line cannot always express the distribution of wind speed with height, so it has to determine the exponential expression:

$$V/V_1 = \sqrt[3]{h/h_1} \quad \text{Or} \quad V/V_1 = (h/h_1)^{\frac{1}{n}}. \quad (3)$$

The simplest expression of the wind speed at the height of interest to us, for $n = 4$ (for EI Ritter) is known and the wind speed at the height of the wind vane V_0 is the formula:

$$V/V_0 = (h/h_0)^{\frac{1}{4}}, \quad (4)$$

Where V - velocity of the wind in the point of interest at a height h .

To calculate the wind speed U at the desired height z we are still working two formulas (for S.A.Sapozhnikova):

up to 10 m – formula

$$U_z = U_{10}(b + 0,6), \quad (5)$$

where U_{10} - wind speed on the weather vane at a height of 10 m;

b - variable term depending on the height z , for which is determined by the speed of the wind;

down from 10 m – formula

$$U_z = U_{10}(c + 0,8), \quad (6)$$

The values of b and c are given in Table. 12 adj. 3.

Using these formulas, we obtain at a wind speed of 10 m / s at a height of 1.5 to weathervanes - 2 m speed of 7 m / s at the site in the absence of snow cover and 8.5 m / s above the snow surface aligned. Current wind speed at the desired height, we need to consider, depending on the projected rise buildings. Within wind vane heights of 6 to 20 m wind speed varies on average 0,082 m / s at the rise of 1 m.

3.2. Comprehensive assessment based on projected construction (forecast).

Comprehensive assessment of the wind regime includes the following stages (see. Fig. 10 App. 2):

- Analyzed wind conditions at the site, subject to development, with respect to the local weather station data; are corrected for relief. Identify the dominant wind direction by season: focus on the winter wind;
- Developed planning requirements specific to the wind regime of the territory (decrease or increase of the initial velocity of the wind, the percentage of sheltered and ventilated areas of the territory). They may be different for the winds prevailing in the winter and summer seasons. In this case, first accounting subject wind prevailing in the most uncomfortable season;

- Estimated wind regime options built using computational methods and nomograms Grafoanalytic using sketch planning and development of the neighborhood, indicating the number of stories of buildings and take into account the wind direction (see. Fig. 11 - 15 App. 2). The result of evaluation is to map the territory of the projected construction of aeration (Fig. 16 App. 2). These maps can be used for correction of the wind regime at the design stage: in case of need in the sketch planning and building neighborhood amended orientation of buildings, their heights, lengths, used elements and landscaping to improve the comfort mode aeration territory development.

The test of planning decisions in terms of aeration should be the ratio between the area of the territory with a favorable wind conditions and the whole territory of the district. In conditions of high wind speeds (the predominance of winds according to the weather station at an average rate of more than 5 - 7 m / s) wind shading area shall be the maximum, and in calm conditions - minimum. For an average wind speed of 7 m / s at a height of 1.5 - 2 m from the ground permitted conditions are provided with a decrease in the initial wind speed by 50% (as the upper limit of allowable wind speed for a person according to hygienists is 3.5 m / s). Evaluation criterion in these cases will be the maximum size of the area of the yard, street, neighborhood, etc. (But not less than 65 - 70%) over which the wind speed ratio is 0.1 - 0.5 of its free flow rate ($K = 1$).

Value zones optimal wind speeds should be calculated as a percentage of the total study area free from development. According to the calculation should be carried out izoanemony that limit the territory, characterized by differences in wind speed of 0.25 from its free flow speed ("threshold of feeling" wind speed). Evaluation of the wind regime of planning options necessary for the optimal placement of residential and public buildings with the shape and size of the zones enhance the wind speed. The quantitative expression of the relationship between

the ratio of the length and width of the facade of the building and a separate long wind shadow - the basis of the methodology of planning in difficult wind conditions.

To estimate the wind conditions at the site plan sketch planning and development of the district (with an indication of the number of stores of buildings) should be applied according to the calculations of the wind shadow contours (aka - the best bands of wind speeds) and calculate the percentage of sheltered spaces to the whole of the district-free building. In the case of large areas characterized by uncomfortable mode of aeration in the sketch, planning and development district must make the appropriate changes.

Aeration mode the layout of the final planning and construction of the district can be studied in the wind tunnel as to obtain quantitative characteristics of the wind regime, and to obtain an overview of aeration neighborhood (using lycopodium dust building layout) to determine the placement of children's playgrounds, recreation children and adults without additional calculations (see. Fig. 17 and 18 adj. 2).

To calculate the length (and depth) of the wind shadow of the building, depending on changes in their height, length and direction of the wind to the front of the building, use the graph shown in Fig. 11 and 12 of the Appendix. 2, which in turn can determine wind speeds comfort zone on the territory of the planned development with the aim of adjusting the layout and site selection for placement of child care centers, playgrounds, recreation areas, and others. The length of the shadow of the wind varies from 1.5 N (which corresponds to the ratio of the length facade of the building to a height of 1: 3) to 12 N (with respect to the length of the facade of the building to a height of 20: 1) at a wind angle of 90° to the front. In the context of complex terrain, use graphs shown in Fig. 13 adj. 2 (for TG Makharashvili).

The methodology of the calculation of the optimum wind speed zones using the graph in Fig. 11, see the Appendix. 3.

Example. Calculate the depth of the zone of optimal wind speed behind the length of 80 m and a height of 27 m (9 floors) and wind direction at an angle of 90 ° to the front of the building: $80:27 = 3$. On the abscissa L / H perpendicular to restore a value of L / H , equal to 3, and continues until the intersection with the curve. Ordinate value corresponding to this point in the graph is equal to 4. Thus, the depth of the zone of optimal wind speeds of 9-storey building length of 80 m is 4 H (4×27 m) or 108 m.

Fig. 12 adj. 2 a graph of the calculation given area gradation based on a wind speed reduction of 40 to 70% relative to its free stream velocity (Sokolov on SD).

Calculation of the optimum depth of the zone 1 wind speeds depending on the length L and the height H of the building can also be made using the formula:

$$l = H \sqrt{8L/H}, \quad (7)$$

The resulting dependence (7) with respect to the extent of legitimate home to its height of from 1 to 24, and allows a simple way to calculate the depth of the zone of optimal speeds on building sites, depending on the parameters of buildings.

Example. Determine the size of the depth of the wind shadow behind the length $L = 60$ m and a height $H = 36$ m (12 floors).

Substituting the parameters L and H in the formula (7), we obtain

$$l = 36 \cdot 3,64 = 131 \text{ m.}$$

Increase in the length of the building will contribute to the growth area of optimal speeds. Size of the area of wind shading S can be determined by the formula:

$$S = 0,8 \cdot L \cdot l, \quad (8)$$

For the combined area of the parameters you will wind shadowing:

$$S = 0,8 \cdot 60 \cdot 131 = 0,63 \text{ ga.}$$

Under the conditions of strong winds windscreen best achieved by using extended multiple-buildings located across the prevailing wind direction. The influence of the number of floors and the length of the house by the amount of optimum wind speeds are given in Table. 13 spun. 2. Compared to the 5-storey house, this area of the 16-storey building is doubled. With an increase in the length of 1.5 times and the number of stores house 3 times area of optimal wind speed increases by 2.5 times. Building located at a small angle (45°) to the prevailing wind, this contributes to reduction in the area 2 - 2.5 times.

To determine the parameters of building is not too large gradients of the coefficients of wind speed on the development area at the discontinuities between the linear buildings not exceeding 10 - 12 N (which is not at odds with the city-planning requirements), you should use the nomogram number 1 shown in Fig. 14 adj. 2. Description of the nomogram given in the appendix.

Examples of use of the nomogram number 1

Example 1. Selection of the optimal building height for the given parameters of the distance between the buildings N, wind angle to the front of the building over the house α° L and ΔK : N = 100 m; $\Delta K = 0,3$; $\alpha^\circ = 60^\circ$; L = 60 m.

Using Table. (tab. 16 App. 2), we determine that the $\Delta K = 0,3$ and wind direction $\alpha^\circ = 60^\circ$ building height cannot exceed 27 m. Thus, it may be selected 5- and 9-storey building. It remains to determine which one is most appropriate for the given conditions. For given values of N and α° find the factor A, which is equal to 0.42.

Take granted at $H = 15$ m. We define for $N = 100$ m from the nomogram value V . It is equal to 0.05. For $H = 15$ m, $D = 17,2$. Thus in $\cdot D = 0, 86$. According to the formula:

$$K_m - K_5 = A \cdot B \cdot D, \quad (9)$$

Find that $\Delta K = 0,42 \cdot 0,86$. Hence $\Delta K = 0,36$, which satisfies the specified value.

Now consider a 9-storey building with the same parameters: $H = 27$ m, $B = 0,035$, $D = 11,25$. BD is equal to the product of 0.39 and ΔK is 0.16, which does not meet the specified conditions. Thus, the 5-storey building with given parameters is optimal. The values of A , B , D are shown in Table. 14 and 15 adj. 2. Values K_5 for different heights at different wind direction to the front of the building are given in Table. 16 and 17 of the Appendix. 2.

Note. There may be occasions when considered building heights do not give an exact match with the given values of ΔK . In this case, you should stay on the value of ΔK , closest to the target.

Example 2. Selection of the optimal cut N between buildings at the given parameters building height H , wind angle α to her house and length L : $H = 36$ m (12 floors); $\alpha = 30^\circ$; $L = 60$ m.

The criterion for selecting the optimum distance between the houses N will assume the smallest value of K_m .

According to the values of H and L , find the factor D . It is 6.5. Select the desired value for us N , for example $N = 80$ m. Nomo gram find the values of A (N) and B (N), respectively equal to 0.19 and 0.095. Then $\Delta K = A \cdot B \cdot D = 0,19 \cdot 0,095 \cdot 6,5$; $\Delta K = 0,12$. From the table of values K_5 find that for the 12-storey building at $L = 60$ m and $\alpha = 30^\circ$ $K = 0,57$, and $KT = 0.57 + 0.12 = 0.69$.

Consequently, we can accept the selected distance between the houses, but it is not optimal, since the maximum wind speed can be reduced selection of the most appropriate distance between the houses. Storing the values $N = 70$ m. Then $B = 0,14$; $A = 0,15$; $D = 6,5$, and $KT - K5 = 0,14$; $K_m = 0,14 + 0,43 = 0,57$. This gap between the houses is more optimal from the perspective of creating a comfortable environment for people wind regime in the territory of construction.

Note. If K_m value given in advance, the width of the gap between the buildings N is chosen the one that provides the value of ΔK , closest to the target.

Example 3. Selection of the optimal length of the house with the given parameters L building height H , the distance between the buildings and the N wind angle to the building of α °: $H = 27$ m (9 floors); $\alpha = 45$ °; $N = 120$ m. For given values of N , H and α nomogram find the values of A and B , which are, respectively, 0.52 and 0.001.

Suppose that $L = 150$ m. Then D (for $H = 27$ m) is equal to 19.2, and $K_m - K5 = 0,52 \cdot 0,001 \cdot 19,2 = 0,01$; $K_m = 0,01 + 0,72 = 0,73$.

For other lengths at home, for example $L = 120$ m, the coefficient D will be equal to 17.5. Consequently, $K_m - K5 = 0,52 \times 0,001 \times 17,5 = 0,009$.

For the length of the house $L = 90$ m coefficient $D = 15,5$, and $K_m - K5 = 0,52 \times 0,01 \times 15,5 = 0,008$; $K_m \approx 0,73$.

Thus, given the parameters and construction of the wind direction thereto at 45 ° change in the length of only one building is not exert any significant effect on the aeration mode area. Last changed significantly, if we at the same time the length of the buildings will change the magnitude of the gap between them and their orientation with respect to the prevailing wind.

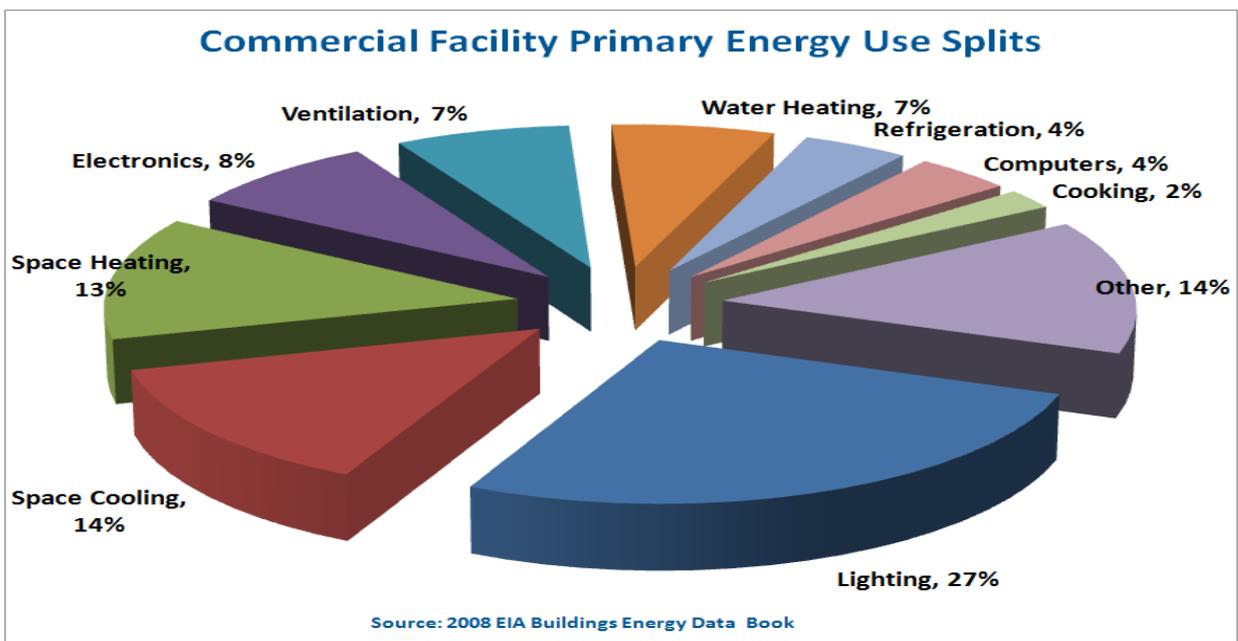
Example 4. Determination of ΔK and K_m . Using the nomogram, we can determine the values of ΔK and K in existing buildings:

For known values of H , N and L using the methodology described above define the factors A , B and D , and hence the value $(K_m - K_5)$ for all wind directions (α°).

Let $H = 27$ m; $L = 60$ m; $N = 90$ m; $\alpha = 30^\circ$.

Nomogram determined by: $a = 0.23$; $B = 0.06$; $D = 11,25$. Hence $K_m - K_5 = 0,16$. K_5 , according to the table and set parameters, nor 0.71. Then $K_m = 0,71 + 0,16$; $K_m = 0,87$.

Thus, using the nomogram number 1, we can determine the optimal parameters in the building in terms of taking into account the prevailing wind. Can be selected several gaps between buildings, adequately meet these criteria and have a choice of any one of the selected gap should be done in terms of cost, terrain and other factors.



Calculation mode aeration roads or building sites between the parallel standing buildings can also be performed using the formula. Working formula to the nomogram number 1 is as follows:

$$K_x = K_5 + g[C(N - 5)]^2 - g[X - C(N - 5)]^2, \quad (10)$$

where K_H - required coefficient of wind speed;

K_5 - coefficient of wind speed of 5 m from the lee of the facade (K_5 data for some parameters buildings are designed and presented in Table. 17 App. 2);

g - the coefficient expressing the slope of the curve changes in wind speed between the hedges (g value derived by us and the same: $g = 10^{-4} (H / N - 0,011 \cdot H + 0,066) (24,5 - 30H / L)$);

N - line width or size of the gap between the two counter-posed buildings;

X - setpoint distance in meters from the lee of the facade; $C = (0,5 + 0,0033\alpha^\circ) /$

This formula is simple to use and does not require lengthy calculations.

Example. Determine the ratio of wind speed at a distance of $X = 55$ m downwind from the facade of the building with the following parameters: $H = 36$ m (12-storey); N - the distance between the buildings of 60 m; α° - direction of the wind to the front of the building of 45° ; L - length of the house, which is equal to 120 m; K_5 for given parameters, according to the table 0.48; $C = (0,5 + 0,0033\alpha^\circ)$.

Derive the value of the coefficient g :

$$g = 10^{-4}(0,6 - 0,396 + 0,066)(24,5 - 9) = 10^{-4} \times 4,18;$$

$$C = (0,5 + 0,0033 \cdot 45) = 0,648; C(N - 5)^2 = (0,648 \cdot 55)^2 = 1276;$$

$$g[C(N - 5)]^2 = 10^{-4} \cdot 4,18 \cdot 1276 = 10^{-4} \cdot 5296 = 0,52; [X - C(N - 5)]^2 = (55 - 35,6)^2 = 376,4;$$

$$g[X - C(N - 5)]^2 = 10^{-4} \cdot 4,18 \cdot 376,4 = 10^{-4} \cdot 1573 = 0,16.$$

Substituting all calculated values in the formula (10), we obtain: $K_x = 0,48 + 0,52 - 0,16$; $K_x = 0,84$.

Consequently, the ratio of the wind speed of 55 m from the lee of the facade with the above parameters we have chosen to be equal to 0.84 of the free stream velocity of the wind. Reduce or increase the wind speed at a given distance from the building can be, for example, by changing the orientation of the house. To reduce the wind speed should increase the angle of the direction of the prevailing wind to the front of the building, and to increase speed - to reduce it.

Nomogram number 2 (see. Fig. 15 App. 2) allows a more detailed analysis of wind conditions on building sites and determine the values of the coefficients of the wind speed at any point between the parallel standing buildings (description nomogram number given in Appendix 2. 2).

Calculation mode aeration using nomograms number 2 is as follows.

Example. Given - the wind direction to the facades of buildings $\alpha = 67,5^\circ$, the height of a 5-storey building $H = 15$ m, width of line (or the distance between two parallel buildings standing) $N = 80$ m.

Define: X , that is, at what distance from the windward leeward side of the facade of the building there is a maximum ratio of wind speed at a given width of the line N , and the value of the coefficient K_x wind speed at 40 m from the windward leeward facade of the building.

Decision. In the graph on the right in the first part of the nomogram number 2 from the point corresponding to $\alpha = 67,5^\circ$, restore perpendicular to the

intersection with a sine wave and determine the value of A. For a given value of α function $A = 0.007$. From the point corresponding to a given building height ($H = 15$ m), restore perpendicular to the intersection with the line $\frac{X_m}{N} / (H)$ the corresponding value found A. From the encounter draws a direct parallel to the axis N, to its intersection with the perpendicular, corresponding to the width of the highway $N = 80$. Thus, we find that the maximum wind speed for the given parameters observed at a distance of 48 m from the leeward side of the facade windward building, i.e. $XT = 48$ m. The value of A is given in the Appendix. 2. The second part of the nomogram is used to determine the values of KH (Function B and C).

We define the ratio of wind speed at 40 m from the lee of the facade of the building.

The X-axis of the point $X = 40$ m perpendicular to restore to its intersection with the line B (X) for $X_m = 48$ m and find the value of the function, which is equal to 2.2. The value of C corresponding to $X = 40$ and $m = 48$ m XT equal 0.44. Substituting the values obtained in the formula (11), we obtain:

$$(K_x - K_5)/(K_m - K_5) = B \cdot C, \quad (11)$$

$$(K_{40} - K_5)/(K_m - K_5) = 2,2 \cdot 0,44 = 0,96.$$

Putting $K = 0,9$, and $K_5 = 0,26$, according to the table, we get:

$$(K_{40} - 0,26)/(0,9 - 0,26) = 0,96; K_{40} = 0,87.$$

Thus, with the help of the nomogram number 2, we can determine the value of the coefficients of the wind speed at any point between the two parallel buildings.

Nomogram method makes it possible to solve the problem and return - select the appropriate number of storeys of the house, the length and orientation, which would provide the necessary conditions of aeration area of building (ie, to predict wind regime of the territory at the design stage). Nomogram number 1 and 2 should be used for the analysis of the wind regime in conditions of both the projected and existing buildings with parallel placement of buildings (along highways and between the main site). At another location of the building evaluation and prediction of wind conditions can be performed using the graphic-analytical method of calculation (see. Nos. 3.19 and 3.20).

Calculation mode of aeration can also be generated using a formula. Working formula to the nomogram number 2 is as follows:

$$K_x = K_5 + \frac{2,7(K_m - K_5)(X - 5)}{(0,5 + 0,01 \cdot \sin 2\alpha \cdot H)(N - 5)} \cdot e^{-\frac{X - 5}{(0,5 + 0,01 \cdot \sin 2\alpha \cdot H)(N - 5)'}}$$

where KH - required coefficient of wind speed; K5 - coefficient of wind speed of 5 m from the lee of the facade; Km - coefficient of maximum wind speed; X - setpoint distance, m, from the facade of the building; H - height of the building, m; N - the distance between two parallel standing buildings; α° - wind angle to the front of the building.

Example. Determine the value of KH at a distance X = 25 m from the lee of the facade under the following set: H = 27 m (9 fl.); N = 90 m; $\alpha = 60^\circ$; K5 = 0,63 (for given parameters according to the table); Km = 0,9 (adopted by the average value).

Substituting the given parameters in the formula (12), we obtain:

$$K_x = 0,63 + \frac{2,7(0,9 - 0,63)20}{85 \cdot 0,73} e^{-\frac{20}{0,7385}}$$

$$K_x = 0,63 + 0,24e^{-0,32} = 0,63 + 0,24 \cdot 0,72; K_x = 0,8.$$

Thus, using this formula, we can determine the wind speed at any point between the parallel-standing buildings, whose parameters are selected using a working formula to nomogram № 1. Such a detailed assessment of the wind regime in the territory of construction may be needed to determine the boundaries of the placement of children's institutions, zones recreation, landscaping and others.

3.3. Principles and means of regulating wind patterns of residential development.

Functional zoning development with the aeration conditions (wind and thermal regime).

The basis for the rational distribution of functional areas can serve as compiled for a specific city map diagram zoning on temperature and wind regime (see. Fig. 19 App. 3).

Interposition of industrial and residential areas to a large extent determines the condition of the air basin residential areas. Residential zone should be placed on the windward side to the prevailing wind direction and on a hill, well-aerated areas of the urban area. In areas with the same frequency of winds in opposite directions at the summer and winter seasons residential areas should be located on the left and right of the winds of these areas in relation to an industrial enterprise, sources of emissions of harmful substances.

Planning and construction of residential areas shall be based on landscape-climatic conditions, which determine in each case functional zoning, tracing and orientation of streets; methods of construction, landscaping and beautification; types of residential and public buildings and so on. At the same time in areas with effective wind conditions should orient the street at an angle to the direction of the prevailing wind, and in areas with poor aeration regime - in the direction of the prevailing winds favorable points of the compass. When choosing a site for the functional areas of a residential area the main objective is to create a more healthy

environment for living and working conditions of the population with the rational use of natural terrain features based on its evaluation of microclimate.

For residential areas and neighborhoods should be given a territory that best meet sanitary requirements (dry, well-ventilated areas insuliruemye and protected against the ingress of cold strong winds, hot dry winds, dust storms, etc.), if possible close to the open water and green spaces.

To improve the microclimate necessary to provide for measures aimed at creating optimal conditions for ventilation (maximum use of natural factor mobility and local convective air currents, protection against adverse winds and snegozanosov) and radiation regime (optimal sun exposure, protection from excessive direct sunlight, reducing the intensity of the reflected exposure and the emission of solar radiation in the overheated environment).

Functional-spatial organization of residential development (placement of driveways, walkways, green spaces, areas of schools, kindergartens, recreation of children and adults, sports fields, etc.) must be solved taking into account the intensity and direction as the prevailing winds, so and winds transformed local conditions (topography, buildings, green area, surface water, etc.). Site selection, best suited to this type of use should be based on the evaluation of the aeration regime of the territory in order to improve the existing microclimates and sanitation.

For this, the objectives of the direction of footpaths as possible should be combined with a direction favorable air currents; playground for children located in an area characterized by optimal aeration conditions; use surface is characterized by different heating to create convection currents.

Methods of planning and development to ensure optimal conditions of wind and thermal regime.

To create a comfortable microclimate conditions necessary differentiated approach to the development of entire districts of the city due to the terrain and the location of the site in the city with respect to the prevailing wind direction in order to ensure acceptable air velocity over most of the built-up area.

Construction changes wind speed and direction, ruling on an open undeveloped territory, and depending on the architectural composition creates a certain wind conditions. The angle change direction of the prevailing wind at 30 - 90 °, and the wind speed ratio varies from 0.1 to 1.2 with respect to wind speed ratio according to the weather station as 1.

Impact on the aerodynamics of the building have its position in the city and the orientation of the building or planning techniques with respect to the prevailing winds: the coefficient of wind speed in the areas of building, located on the windward edge of the city, 0.1 - 0.2 higher than in similar methods of building, located under the protection of the earlier building.

Optimality criterion architectural composition development in conditions of high wind speeds is such a solution, in which almost the entire area of the territory is characterized by the development of wind speed ratio of 0.1 - 0.5 times the initial wind speed ($K = 1$); at low wind speeds optimality criterion is a planning solution, in which the ratio of wind speed is 0.5 - 1 or more. To create such an environment the wind regime and should seek when choosing the composition of building to enhance the comfort of the human environment.

The building, located perpendicular to the facade or at a slight angle (30 °) to the prevailing wind is the best barrier on his way into the building. For building a zone of lower wind speeds, the depth of which is from 3 to 7 N windproof home. To calculate the area of "calm" area behind the building, you can use the formula (13) (for Serebrovsky FL):

$$S_{\text{шт.}} = b \cdot \sin\gamma \cdot b(l - 0,18b), \quad (13)$$

depending on the direction of the prevailing wind γ , l the length of the house and the depth of the wind shadow b .

To determine the size of the wind shadow behind the building N_m , having a length less than $10H$, you can use the formula (for GK Goldstein):

$$N_m = (10,84H - W)K, \quad (14)$$

where W - width of the building shell, m; K - coefficient taking into account the length of the building, adopted according to the calculation according to NM Thomson; its value is given in Table. 18 adj. 3.

The value depends on the wind shadow of the geometric dimensions of the building. Its size increases with increasing height or length of the house and decrease its width.

The distance between the facades of buildings should be taken with regard to their location relative to the direction of the prevailing favorable wind currents: parallel - $2H$; at an angle of 45° - $3H$; perpendicular - depending on the number of rows - from 3 to $5H$. Gaps between the ends of the buildings located facade to the direction of the prevailing winds should be taken: the purpose of less efficient ventilation building sites - up to $1H$, and for effective aeration territory - from 1 to $1,5H$ and more. When development of the territory should seek optimal architectural planning and design solutions development, that is, to this, which provides comfortable or conditions close to them at the lowest cost to the natural and artificial climate control for a long time: the horizontal building with gaps between buildings less $2,5H$ additional heat losses are at a level of 5% of the main; widening the gap to $3H$ leads to an increase in additional heat losses of up to $16 - 18\%$ of the basic (in F.L.Serebrovsky). Orientation of buildings, taking into account the prevailing winter winds years reduces their additional heat loss by $10 - 15\%$, which is of great economic importance.

Planning and construction areas urban area located at high wind speeds, should take into account the direction of the prevailing wind rumba and adverse terrain conducive to distort the direction and speed of change in the free wind flow. The choice of optimal architectural and planning decisions should be made to create comfortable conditions of wind regime in the territory of the future building.

To do this:

- the main highway to the newly built-up urban areas to design an angle of at least $40 - 50^\circ$ to the direction of the prevailing unfavorable winds. It should be borne in mind that the most favorable conditions are formed on highways in width from 25 to 60 m;
- vegetated windward and elevated areas multilane urban area planting broad crown of evergreen trees and shrubs with ($K = 0,2 - 0,5$);
- use the most elevated parts of the urban area and the windward slopes of the construction of public buildings and high-rise buildings of considerable length, facades facing into the wind adverse rumba, to create a barrier on his way into the building; wind speed at the tops of hills, a height of 80 - 100 m, in 2 - 3 times higher than the velocity of the wind at their bases;
- In addition to public buildings on the windward borders of residential areas and neighborhoods in order to protect from the wind site development and residential apartments used windproof complexes with a special layout of apartments, where on the windward side of the horizon turned stairwells, utility rooms and common rooms apartment;
- in the space between windproof complexes take the free formulation of linear and point the buildings under normal insolation;
- on parts of the territory, open access wind, use the P-, T-, T, and U-shaped grouping of buildings facing interlocked angle on the windward side of the horizon ($K = 0,2 - 0,5$);

- to reduce wind pressure on wind-proof buildings, as well as to eliminate the strengthening wind speed zones in the gaps between the buildings ($K = 0,8 - 1,1$) use shrubland group or band openwork structure; immediately after planting strip width of 10 m wind speed is reduced to $K = 0,2$ of its speed on the windward side of the strip, and on building sites, in 40 - 50 m from the strip planting, wind speed ratio is 0.4 - 0.5;

Childcare centers located in the area of wind shade provided windproof buildings, that is, at a distance of up to 7 - 8H from the leeward facade windproof home.

The optimal wind regime is formed on the territory of the courtyard spaces in size from 0.35 (for the 5-storey building) to 1.4 hectares (for 9 - 12-storey building); allowed to increase the area of the yard to 1.8 hectares. The gap between the buildings, facades located to the direction of the prevailing wind, forming the yard space, should not exceed 3 - 4H.

Table. 19 adj. 3 presents techniques architectural composition with the aim of building the windshield area, and Fig. 20 adj. 3 shows the dimensions of the wind shadow zones ($K \leq 0,5$) depending on the parameters of buildings within which can be accommodated and childcare rest areas.

Planning and development areas located in areas with mild winds, shall be subject to the direction of the prevailing winds favorable points of the compass. In this case, the choice of optimal architectural and planning decisions, special attention should be focused on creating the conditions most effective ventilation area development. To do this:

- the main highway and street design in the direction of the winds favorable points of the compass or at an angle to them no more than 30 - 40 °. Cross-section windward sections of streets should be expanded (the optimal width of 90 - 120 m) in order to better access the interior of the wind in the building

- made it easy streamlined building facing to the street ends at an angle of 45° relative to the direction of a favorable wind (wind speed ratio will be 0.5 - 1.2);
- gaps between the linear buildings located facades to the wind, take at least 5 - 7 H;

storeys building to increase gradually from the windward to the leeward side of the city;

- Avoid closed building techniques;
- square yard spaces take more than 1.8 hectares. Effectively ventilated yard area of 4 hectares, formed 5-storey buildings, with breaks between buildings located facades to the direction of the prevailing wind, more than 5H;
- system of gardening urban area directed to strengthening wind speed coming into the territory of the city.

Table. 20 adj. 3 presents techniques architectural composition construction to enhance ventilation area.

Using the obtained patterns and proposed methods for calculating wind conditions, it is possible already at the stage of development of design solutions lay the foundation for the comfort of the wind regime of the territory of the future residential development.

Landscaping and beautification techniques for controlling wind and thermal regime.

The primary means of regulating the wind and thermal regime in the urban environment is building. However, only a statement of buildings of various parameters, orientation, groups can not always create the desired effect of microclimate. An additional means of control mode can serve as aeration landscaping. In alternation with the buildings green spaces can regulate wind and thermal conditions in local areas.

Question windshield area with the help of green space plays a special role in areas with strong winds. Please be aware that the approach to a large green area of 50 - 70 m wind speed is reduced by half. Small green area has a moderating effect on the distance of 150 m, an array of more than 3 hectares - up to 200 m, an array of 15 hectares - up to 800 m. When placing a wood strip in the area of building wind shadow covers only 18 square units, while placing it in front of buildings protected area is doubled (by VN Adamenko). The distance by which extends the impact of the strip does not exceed 15 times the height of the plants. Green spaces can reduce wind velocity by more than 50%. Quantitative results windbreak planting strips properties are given in Table. 21 adj. 3.

Shelterbelts can also be used to intensify the development area of ventilation (air channels, et al.). For quick microclimatic effect it is necessary to apply a high age planting materials - various climbing plants - buzz canopies, gazebos and lane goals of different shapes. Taking into account the hygienic value of solar radiation on the playgrounds of the preferred tree species with lace and pyramidal crown.

The correct mode of ventilation of residential areas can provide appropriate methods of gardening. To this should be avoided thickened planting trees, number and location of which shall be satisfactory to limit sun exposure and partial windscreens; in local areas, you can use the lawn and low bushes, trees with high boles (not less than 3 m); avoiding high hedges (not exceeding 0.75 m); orientation alleys, breaks in green areas, and cover areas determined taking into account the main wind direction; use raznovysotnyh amounts of green space in order to create local air currents;

Note. Placement of green space in each case should be based on the mode of aeration projected residential development.

To ensure optimal conditions for ventilation of residential yard space areas should be disclosed in the direction of green areas, water surfaces, etc .; gaps

between houses vegetated; use small forms - arbors, lane goals, awnings and other elements of landscaping, construction of which simultaneously provide local areas of the territory of the windscreen and sufficient air.

For windscreens residential area on the border of it, facing the adverse winds, there should be a belt of several bands of green space width of 20 - 25 m, located at a distance of four heights of buildings from building and planting windbreaks to effectively scavenged parts of the territory (at least two series with lace 25 - 40%, preferably from evergreen deciduous and coniferous trees).

Note. Strip of three rows of trees, located at a distance of four heights of buildings from construction reduces wind pressure three times. Recreation areas and playgrounds should plant trees and gardens on the windward side.

The ability to predict wind conditions at the design stage by means of the proposed methods was hallmarked on the project of building area of Tashkent and other cities, as well as two versions of planning neighborhoods developed on the basis of the existing design solutions: the first option - in order to maximize the windshield area, the second - in order to maximize ventilation area development. The results of evaluation of the wind regime of the project with the aim of solving neighborhood windshield area showed that in the comfort of wind conditions is 87.5% of the territory, free from development. Project Residential District to enhance ventilation area showed that the territory of the building there is no wind conditions, which would be characterized by coefficients of wind speed less than 0.5 of its free-flow speed: the whole territory of the district effectively ventilated. Therefore, using the regularities found and applying the proposed technique can be at the stage of development of design decisions to lay the foundation of comfort wind regime territory of the future residential development.

Conclusion according to Chapter-III.

1. Study the laws of the formation of warm wind regime of modern residential development, the establishment of criteria relations for integrated assessment of its effectiveness.

2. Determination of thermal and thermal properties of the modern multi-store (different altitude) residential development and mathematical expression of its warmth and wind processes for the design of their application.

3. Analytical dependences of heat and wind regime built with predefined geometric parameters, which could contribute to correcting the adverse micro-climatic conditions.

4. Creation of methods of field observations on the analysis of development of heating and ventilation regime of residential buildings.



MAIN CONCLUSIONS

In the last decade, the issue of construction in the hot, dry climate paid much attention. Intensively developing the productive forces of the Republic of Uzbekistan. Territory of which differ hot-dry climate. Distinct features with high air temperatures and low precipitation characterize the climate of the Republic. Territory of the Republic is subject to the action of significant solar radiation in combination with high summer temperatures, low mobility of air, low humidity. These conditions lead to overheating of the residential and residential areas, causing significant thermal loads on the human body, greatly reducing the efficiency of the ego. As shown by urban planning practice in the Republic and abroad is not fully take into account the specifics of climatic conditions.

Analysis of materials draft master plans of the city of Tashkent has shown that they have little attention is paid to the fight against overheating, which is largely due to insufficient knowledge of thermal and thermo-physical processes taking place in a modern residential development. Modern high-rise residential buildings in hot, dry climates creates its own heat and wind regime, characterized by high temperatures, hard shifting on the background of calm. Existing regulations (ҚМҚ 2.07.01-94) still do not have accounting standards calm and special requirements to the formation of heat-wind regime for environmental hot-dry climate. Climate of many cities in the region in the summer months it is characterized by hot dry. Therefore, planning residential development must focus on calm.

Thus, the state of the question, operating time is current rules and regulations for planning and building cities need to be improved architectural design of residential areas. All this shows that the chosen thesis presents current urban planning and social problem. Undergraduates managed to make the first steps in a comprehensive solution to this problem, taking into account all that has been reach in the science and practice of professionals. The purpose of this research is to provide thermal and thermal forming the foundations of the wind

regime warm modern multi-story residential buildings in hot-dry climate. To achieve this goal were carried out comprehensive research questions and solved a number of scientific and practical problems, which include.

- Temperature, humidity and wind zoning of the city Tashkent in order to form a local warm-wind regime of individual sections of the modern high-rise buildings is offered.
- A new approach to the use of solar energy to heat the formation of the wind regime of the environment.
- compared data of previous studies of domestic and foreign materials.
- Defined qualitative characteristics of the formation of heat - wind regime of the environment of residential development at different density and orientation of buildings.

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APPENDIX 1

Evaluation criteria wind and thermal regime

Table 1. Heat transfer by convection and radiation at different air velocity and temperature of +25 ° C.

Air velocity, m / s	Convective heat transfer, %		Air velocity, m / s	Convective heat transfer, %	
	radiation	convection		radiation	convection
0,09	52	48	0,81	26	74
0,25	39	61	1,21	23	47
0,36	35	65	2,25	18	82
0,49	31	69	4,0	14	86

Table 2. Dependence of EET on air velocity.

Air velocity, m / s	EET, °C	Air velocity, m / s	EET, °C
0,0	31	1,0	29,8
0,25	30,8	2,5	28,2
0,5	30,3	3,5	27,5

Table 3. Conditions teplooschuscheniya same person for positive values of air temperature.

Air temperature, °C	Relative humidity, %	Wind speed, m / s	Air temperature, °C	Relative humidity, %	Wind speed, m / s
22	80	0	24	100	2
25	55	1	27	70	5
27	40	2	30	25	5

Table 4. Terms of the same thermal sensations of the person at negative air temperatures.

Air temperature, °C	Wind speed, m / s	Air temperature, °C	Wind speed, m / s
-25	0,5	-11	10,5
-21	4,5	-5	14,5

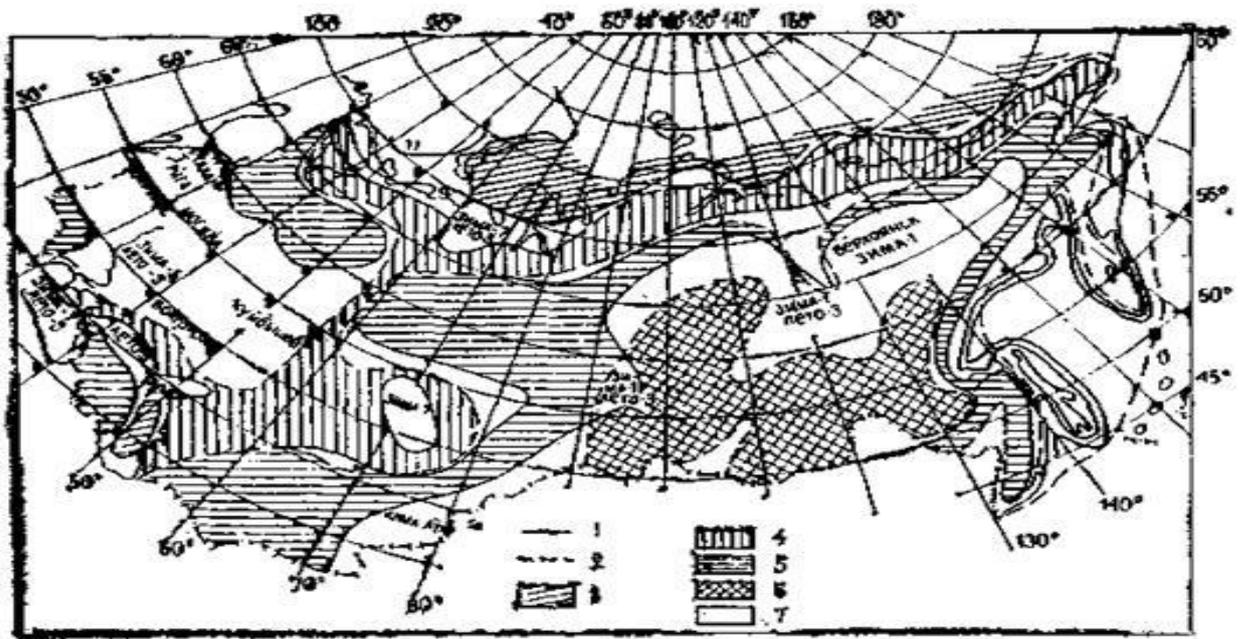


Fig. 1. Comprehensive zoning map CIS average wind speed for the winter and summer seasons.

--- The average wind speed in January, m / s (1); - · - · - The average wind speed in July, m / s (2); 3 - an area characterized by average wind speed of 7 m / s; 4 - same as 5 m / s; 5 - the same 3 m / s; 6 - same as 1 m / s; 7 - zone, characterized by varying wind speed for the winter and summer seasons.

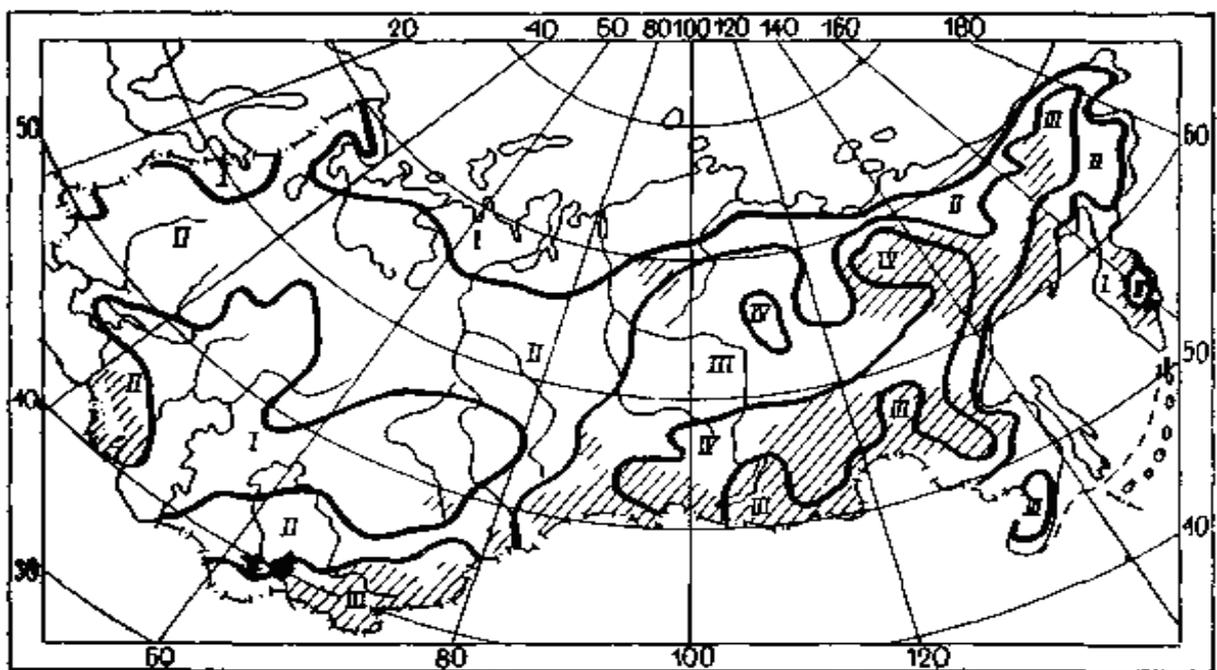


Fig. 2. Schematic map of the area (I - IV) repeatability of wind speed 0 - 1 m / s

I - 20%; II - 20 - 40%; III - 41 - 59%; IV - 60 - 70%.

APPENDIX 2

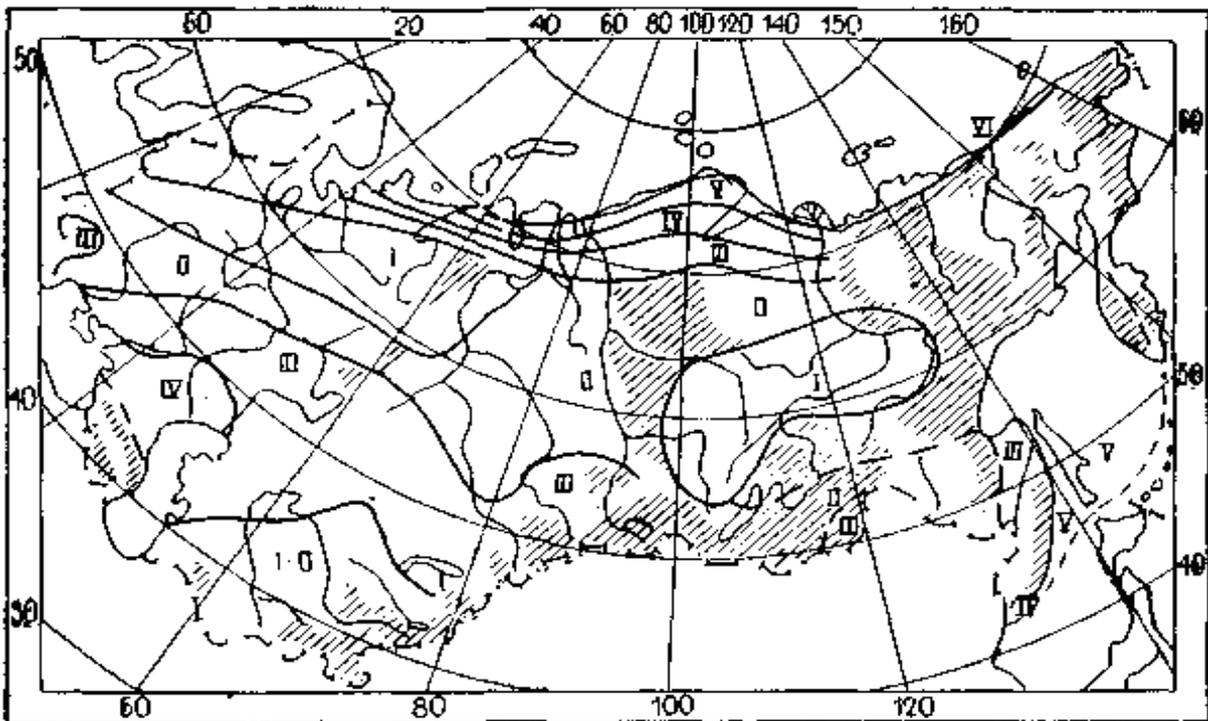
Assessment methodology wind regime

Table 5. Classification of local winds (by EA Burman)

Wind	Genetic characterization		Morphological characteristics		Generally accepted definition of the wind	Urban planning assessment Local winds (at KI Semashko)
	Printing feature	The main feature of the disturbance of circulation	Spatially kinematic	Temporary		
	Winds weakened circulation		Reversible winds			
Wind	The proximity of the land and the sea (lake)	Periodic thermal (temperature gradient land-sea)	Reversal of the direction with height	Daily periodicity direction and speed	Blowing in the afternoon with the sea on dry land, and at night from land to sea	Favorable wind to ventilate the urban area. He dominates in cities located on the shores of large water basins, and brings in the hot daytime hours in urban areas cooler air masses from the water surface
Mountain-valley	Mountain slopes and valleys	Periodic thermal (temperature gradient slope-free atmosphere)	same	same	Blowing in the afternoon of the valleys in the mountains and at night from the mountains into the valley	In the daytime - light winds which do not contribute to cooling of the urban environment designed from the city to the mountains. In the evening they are directed from the mountains to urban areas and to effectively remove heat from the heated surface during daylight hours. At this time, they can reach

Wind	Genetic characterization		Morphological characteristics		Generally accepted definition of the wind	Urban planning assessment
	Printing feature	The main feature of the disturbance of circulation	Spatially kinematic	Temporary		
						high speeds and the cooling effect on human
Glacial	Same	Periodic thermal (temperature gradient glacier - free atmosphere)	Same	Daily periodicity rate	Blowing day and night from the glacier to the valley	Cold winds are unfavorable, making demands windshield area
	Winds flow direction		Katabatic winds			
Dryer	Ridges	Mechanical aperiodic, the flow around the mountain barriers in the vertical plane	Downdrafts moderate force and a significant vertical thickness	Periodic wind	Warm and dry, blowing from the mountains	Favorable wind. Prevails in cities located in mountainous areas in winter and brings in urban areas increase in air temperature
	Strong katabatic wind					
Bora	Low ridges on the shores of the seas (lakes)	Mechanical non-periodic, with a flow constriction and vertical drops	Downdrafts large and very large forces and small vertical thickness	Wind periodically, sometimes worse at night	He cold is very strong with a high bank into the sea	Unfavorable wind at high speed. Prevails in the cold season. Reaches its greatest strength in the bays, open to the sea. Brings a lot of destruction of the city, located in bays
Stock	Long, ice and snow covered slopes		Reducing the speed with height			
Strong winds in the mountain passes	Narrowing valleys, mountain passes, the outputs of the narrow	Mechanical nonperiodic, by narrowing the flow in a horizontal or sometimes	Downdrafts large horizontal velocity and vertical low power and	Periodic wind	Strong blowing at the exit narrow mountain passes	Adverse wind for cities located at the exit of the valleys. Its rate decreases with

Wind	Genetic characterization		Morphological characteristics		Generally accepted definition of the wind	Urban planning assessment Local winds (at KI Semashko) altitude
	Printing feature	The main feature of the disturbance of circulation	Spatially kinematic	Temporary		
	gorges to the plain	vertical plane	small cross-section. Reducing the speed with height			



H_M	Areas					
	I	II	III	IV	V	VI
10 - 12	21	24	27	30	34	37
100	27	31	34	38	42	46
200	30	34	38	42	46	51
300	32	36	40	44	49	54
500	I 34	39	44	49	54	58

Note. For comparison, the Table. 6 shows the calculated wind speed at the wind vane (10 - 12 m), adopted in the regulations, according to K.

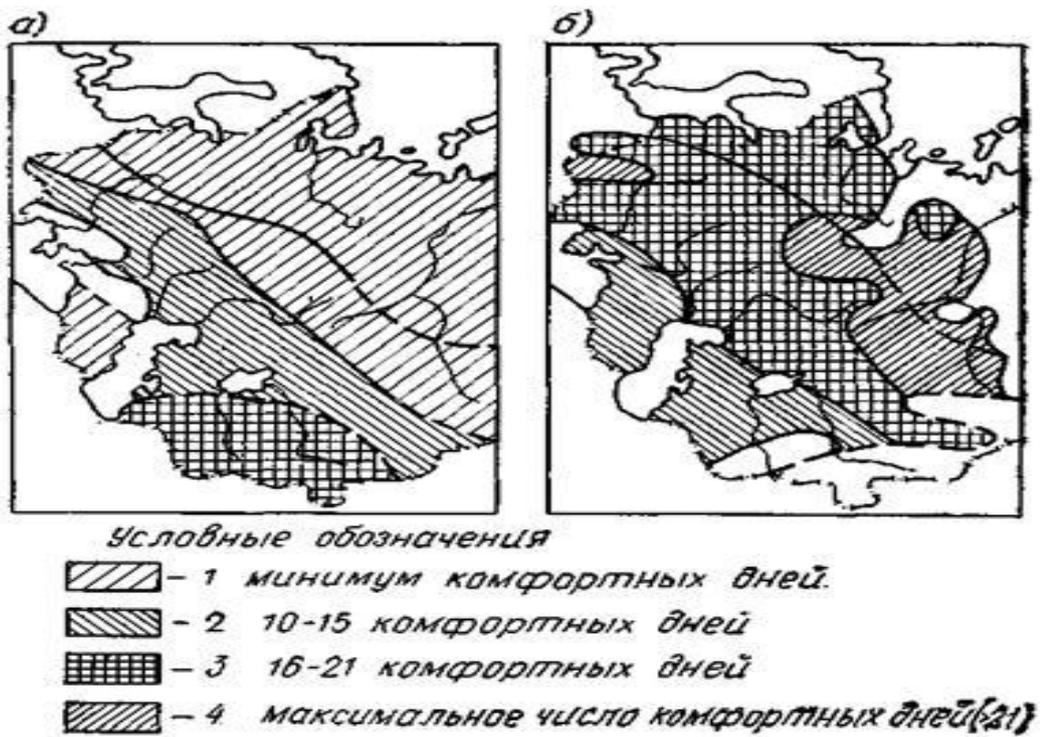


Fig. 4. Distribution Map repeatability comfort of warm feelings in plain areas of the Republic in June

a - in vivo; b - for protection against wind;

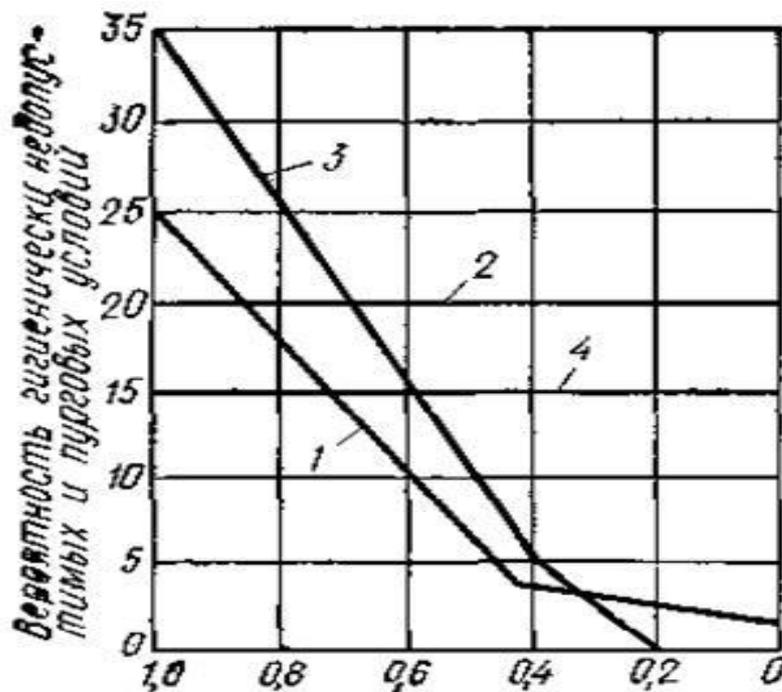


Fig. 5. The effectiveness of windbreaks

1 - severity of winter biothermic conditions; 2 - margin harsh winter conditions biothermic; 3 - conditions; 4 - margin conditions

Table 7. Coefficients of variation in wind speed in a hilly area, depending on the forms of relief (for wind speeds of 2 to 7 - 8 m / s) compared to the flat open spaces.

Landform	The coefficients of the winds blowing to the axis of the ridge or valley		
	parallel	perpendicular	angle
Open flat area	1,0	1,0	1,0
Open tops of hills (Δh more than 50 m, the slope of more than 10°):	1,3 - 1,4	1,4 - 1,5	1,4 - 1,5
The upper part of the windward slopes of the hills			
Atop a small sloping hills (Δh less than 50 m, the slope of less than 10°). The upper third of the windward slopes of the same hills	1,0 - 1,1	1,1 - 1,2	1,1 - 1,2
The average of the windward slopes open	1,0 - 1,1	1,0 - 1,1	1,0 - 1,1
Windward slopes of a small hill, facing the valleys	-	0,9 - 1,0	0,9 - 1,0
Leeward slopes of hills (Δh more than 50 m, the slope of more than 10°)	От 0,9 - 1,0 в верхней части до 0,6 внизу склона		
Leeward slopes of hills (Δh less than 50 m, the slope of less than 10°)	0,6 - 0,7	0,6 - 0,7	-
The bottom of the valleys, ravines, gullies, open to the wind, if the wind is blowing from the bottom up through the valley	1,0 - 1,2	0,6 - 0,7	-
The bottom of the valleys, ravines, gullies, parallel to the wind when it blows down the valley from above	-	-	0,7 - 0,8
The bottom of the small, enclosed basins	0,4 - 0,5	-	-

Table 8. Coefficients of variation in wind speed in different conditions of the relief compared with an open flat area (2 m).

Landform	The coefficients of the winds blowing to the axis of the ridge or valley	
	3 - 5	6 - 10
Open flat area	1,0	1,0
Open tops of hills:		
Δh more than 50 m	1,45	1,15
Δh of less than 50 m	1,35	1,1
Windward side slopes 3 - 10° :		
top part	1,25	1,1

Landform	The coefficients of the winds blowing to the axis of the ridge or valley	
	3 - 5	6 - 10
midsection	1,05	1,0
Bottom part	1,0	0,95
Parallel, wind steep slopes 3 - 10 °:		
Top part	1,15	0,95
Midsection	0,95	0,85
Bottom part	0,85	0,76
Leeward slopes steep 3 - 10 °:		
Top part	0,85	0,85
Midsection	0,85	0,86
Bottom part	0,75	0,65
The bottom of ravines, valleys, ravines:		
Windy	1,15	1,05
Not windy	0,75	0,65
Closed	0,6 and less	
Hills with flat tops and gentle slopes steep 1 - 3 °:		
Top, the upper part of the windward and leeward slopes	1,3	-
Middle and lower parts of the slopes	1,0	-

Table 9. The wind speed at a height of 2 and 10 meters, depending on the forms of relief, expressed in relation to the speed in the open level ground.

Landform	Height, m		Feature slopes
	2	10	
The top of a steep hill	1,4 - 1,6	1,3 - 1,4	Slope angle of 12 °
Windward and parallel wind			

Landform	Height, m		Feature slopes
	2	10	
hillside:			
Top	1,3 - 1,5	1,2 - 1,4	The upper part of the slope below the top 5 - 10 m
Middle	1,1 - 1,2	1,1	
Bottom	1,0	1,0	Increasing drop of slopes 6 - 12 °
The top of a gentle slope	1,1 - 1,2	1,1	The steepness of the slope 7 - 12 °, the difference in height of 10 - 50 m
Windward slopes			
Hill			
Top	1,2	1,1	The middle part of the slope below the top 10 - 20 m. Uniform drop of slopes 8 - 10 °
Middle	0,9	0,9	
Bottom	0,6	0,7	
Dell	0,9	0,9	Decreasing the fall of slopes 3 - 6 °
Ravine	0,5 - 0,6	0,6 - 0,7	Slope gullies, steep 3 - 4 °

Table 10. Coefficients of variation in wind speed under construction in complex terrain.

Landform	Slope, deg	Coefficients wind speed direction	
		North south	North south
The northern slope:			
Top part	0 - 10	0,9 - 0,8	0,7 - 0,6
	10 - 20	1,0 - 0,9	0,6 - 0,5
Bottom part	0 - 10	0,7 - 0,6	0,5 - 0,4
	10 - 20	0,8 - 0,7	0,4 - 0,3
The southern slope:			
Top part	0 - 10	0,7 - 0,6	1,0 - 0,9
	10 - 20	0,6 - 0,5	1,5 - 1,4
Bottom part	0 - 10	0,5 - 0,4	0,9 - 0,8
	10 - 20	0,4 - 0,3	1,1 - 1,0

Landform	Slope, deg	Coefficients wind speed direction	
		North south	North south
The western slope:			
Top part	0 - 10	0,8 - 0,7	0,7 - 0,6
	10 - 20		
Bottom part	0 - 10	0,7 - 0,6	0,6 - 0,5
	10 - 20		
Eastern slope:			
Top part	0 - 10	0,7 - 0,6	0,8 - 0,7
	10 - 20		
Bottom part	0 - 10	0,6 - 0,5	0,7 - 0,6
	10 - 20		
The tops of the hills	-	1,1 - 1,0	1,0 - 1,1
Flat watersheds	-	1,1 - 1,0	1,0 - 1,1
River valleys latitudinal stretch	-	0,5 - 0,6	0,5 - 0,6
River valleys trending	-	1,5 - 1,4	1,5 - 1,4
River valleys trending protected from the windward side	-	1,0 - 0,9	1,0 - 0,9
Sea coast	-	0,9 - 1,0	1,0 - 1,1
Capes	-	1,2 - 1,1	1,2 - 1,1
Well-protected areas	-	0,6 - 0,5	0,6 - 0,5

A method for constructing maps of the aeration regime territory under development master plan for the city.

Analysis of the wind regime of the projected area is made using the card aeration mode, which serve as the basis for two schemes: the distribution of slopes on exposure and slope angles of terrain.

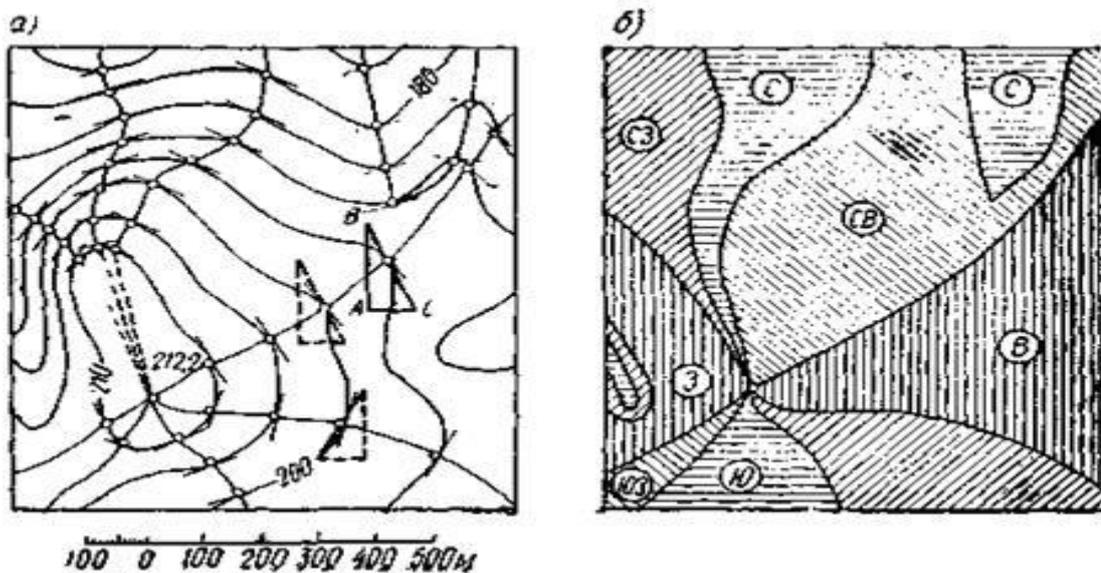


Fig. 6. Mapping Schema slope exposure

a - the construction of contour plot different slopes; b - scheme of slope exposure

As an example, consider the process of mapping the aeration regime for land areas, including one hill.

To chart the distribution of exposures taken on the slopes or right-angled triangle with angles of 45° (for the isolation of slopes on the four exposures) or a triangle with angles of $22^\circ 30'$, $67^\circ 30'$ and 90° (to highlight slopes eight exposures) and moves to the top basis so that the legs are always remained parallel to the direction north - south and east - west. Contours in the points of contact of the hypotenuse of a triangle made serifs. Point of tangency are connected in the direction of the adopted slope exposure and the resulting contours of the slopes obtained the appropriate exposure (Fig. 6a), which are allocated different shading (Fig. 6b).

In the case of level ground and relative depressions, flat watersheds and vertices they must also be marked on the diagram.

The second stage of work is charting angles bow area on a separate copy of the topographic base.

The incident angle of the slope may be calculated using the formula:

$$\text{tga} = h/i,$$

where h - height of the cross section of the relief horizontals;

i - Inception (distance) between the contour lines.

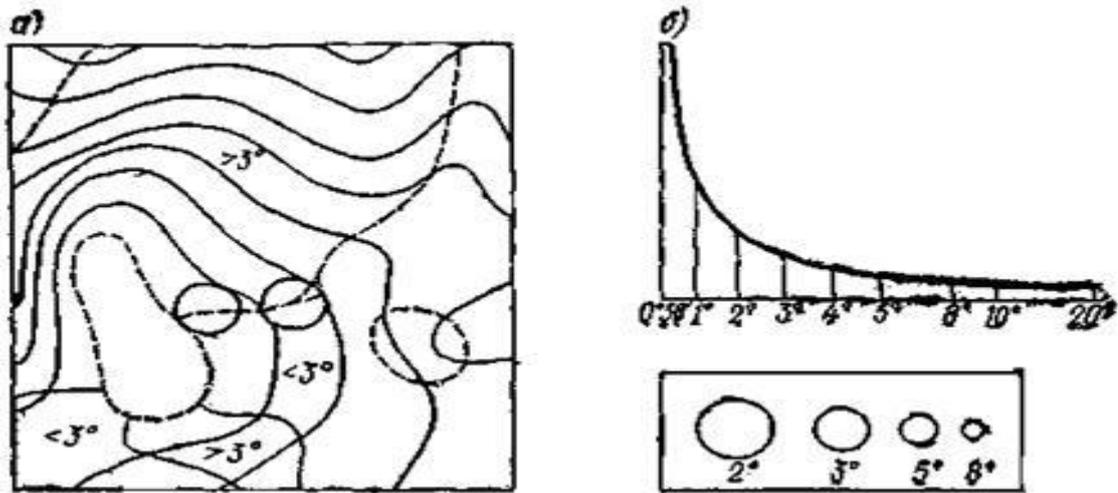


Fig. 7. Mapping Schema angles

a – scheme for constructing contour plots of different slopes; b - plot hole; in - a device to map angles.

In order not to make such calculations and facilitate determination of the slopes the earth's surface, below the bottom frame of large scale topographic maps (1: 100000 incl.) Is placed scale stiffness. On it graphically can immediately determine the incidence angle of the slope, anywhere. Before attempting to map the terrain angles, we need to develop a legend indicating the gradation angles of the Earth's surface. The scale may be different. "Slopes is recommended to allocate up to 2 °, from 2 to 8 °, 8 to 12 °, from 12 to 18 ° C and binding. 18 °. If necessary, more detailed images of the angles of inclination of the earth's surface serves another range: 8 ° - intervals of 1 °, 12 ° - with an interval of 2 °, then at intervals of 3 °, etc.

After the legend developed, using the scale on the map mortgaged to draw the line sections with appropriate angles of inclination of the earth's surface. Almost at the same time you can use the meter or copied on a scale stencil mortgaged. Stencil is placed on a topographic map and move along the horizontals, beating the necessary boundary (Fig. 7).

Graphically, the averaged slope can be transmitted in the form of a straight line connecting the top and bottom of the valley watershed.

Mapping angles of slopes are relatively simple, if there are already laying card lengths slopes (replacement card thickness dissection) and relative elevation (depth dissection). They are ready to immediately give the value of h and i , and the angle is calculated according to the formula. These maps for the CIS partially developed. S.S.Sobolev made a map of the average slope of the surface of the European part of the CIS; therefore, when building ETC can use ready-made cards angles areas.



Fig. 8. Map of the wind regime of the territory. Wind speed in the coefficients.

1 - $K = 1,5$; 2 - $K = 1,3$; 3 - $K = 1,2$; 4 - $K = 1,1$; 5 - $K = 1,0$; 6 - $K = 0,9$; 7 - $K = 0,8$

In addition to the above map-scheme can be made quantitative measures of relief; with the total area of the district, km², is taken as 100%, and it is calculated with respect to the percentage of areas under different landforms and slopes of varying steepness. ("Guidelines for the production of micro-climatic surveys during the survey." Gidrometeoizdat, 1969).

Obtained outline map slope exposure and elevation angles are combined. In the final figure marks the boundary slope exposure and transition boundary slopes, all slopes divided into three parts: the upper, middle and lower.

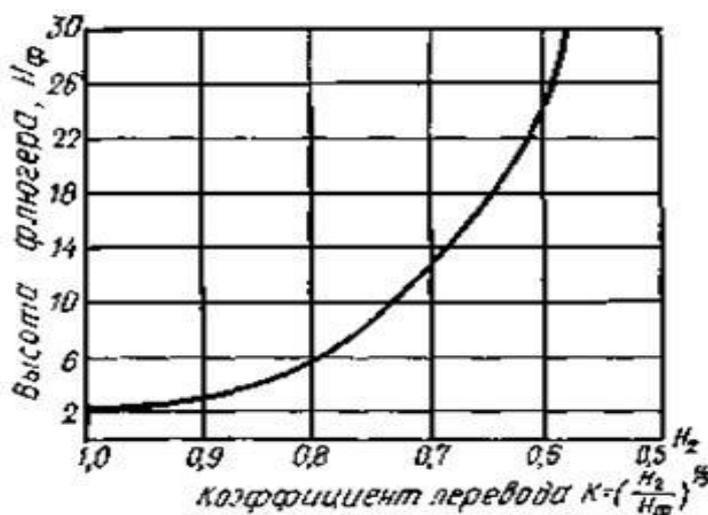


Fig. 9. Reduction of wind speed at a height of 1.5 - 2.0 m above the ground H₂ relative to the wind speed at the height of the wind vane weather station RF

Table 11. Data conversion of wind speed obtained in terms of the weather vane weather station, to a height of 2 m.

Wind speed, m / s		Wind speed, m / s	
By weather vane	At a height of 2 m	By weather vane	At a height of 2 m
1	0,7	9	6,0
2	1,3	10	6,7
3	2,0	11	7,3
4	2,7	12	8,0
5	3,3	13	8,7
6	4,0	14	9,3
7	4,7	15	10,0
8	5,3	16	10,7

To map the aeration get wind conditions characteristic of the analyzed territory of "Handbook of Climate" or from the nearest weather station observations materials. In this case, it is first necessary to take into account wind speed and direction, characteristic of the most uncomfortable period of the year (in most areas of our country is that of winter).

In the final figure obtained after combining schemes slopes and angles of terrain shading highlights the various areas characterized by different regime of aeration, which use the correction factor for the relief (Table. 7 - 10), the data in the Appendix. 2. Using data from the weather station, we can get the absolute wind speed at which we are interested parts of the territory (Fig. 8).

Maps aeration needed to select the most comfortable terrain under the residential zone.

Table 12. The in and for calculating wind velocities at different heights.

Parameters	Height, m					
	2	3	5 - 7	8 - 14	15 - 24	25 - 30
<i>b</i>	0,1	0,2	0,3	0,4	0,5	0,6
<i>c</i>	0,05	0,1	0,1	-	-	-

The methodology of the calculation of the optimum wind speed zones using graphic-analytical method of calculation. Derived on the basis of our distribution patterns of wind flow in the building, depending on the elevation changes and the extent of the buildings when the wind direction at an angle of 90 ° to the facade were constructed graphs shown in Fig. 11 and 12 of the Appendix. 2, with which you can identify areas comfortable wind speeds in the territory of the planned development.

The calculation of the optimum wind speed zones using graph analytical we developed a method of calculation is as follows.

On the plane of the neighborhood graphically show the prevailing wind direction, which, for example, to make demands windshield area. Measure the length of the house, perpendicular to the wind direction. Divide the length of the house at its height, and the resulting value is plotted on the graph on the x-axis: L / H (y). From this point of restoring perpendicular to the intersection with the curve on the ordinate $1 / H$ (x), where we find the depth of the zone of optimal speeds. The resulting value should be deferred on the leeward side of the building. The shape of this zone will depend on the inclination angle of the wind to the building.

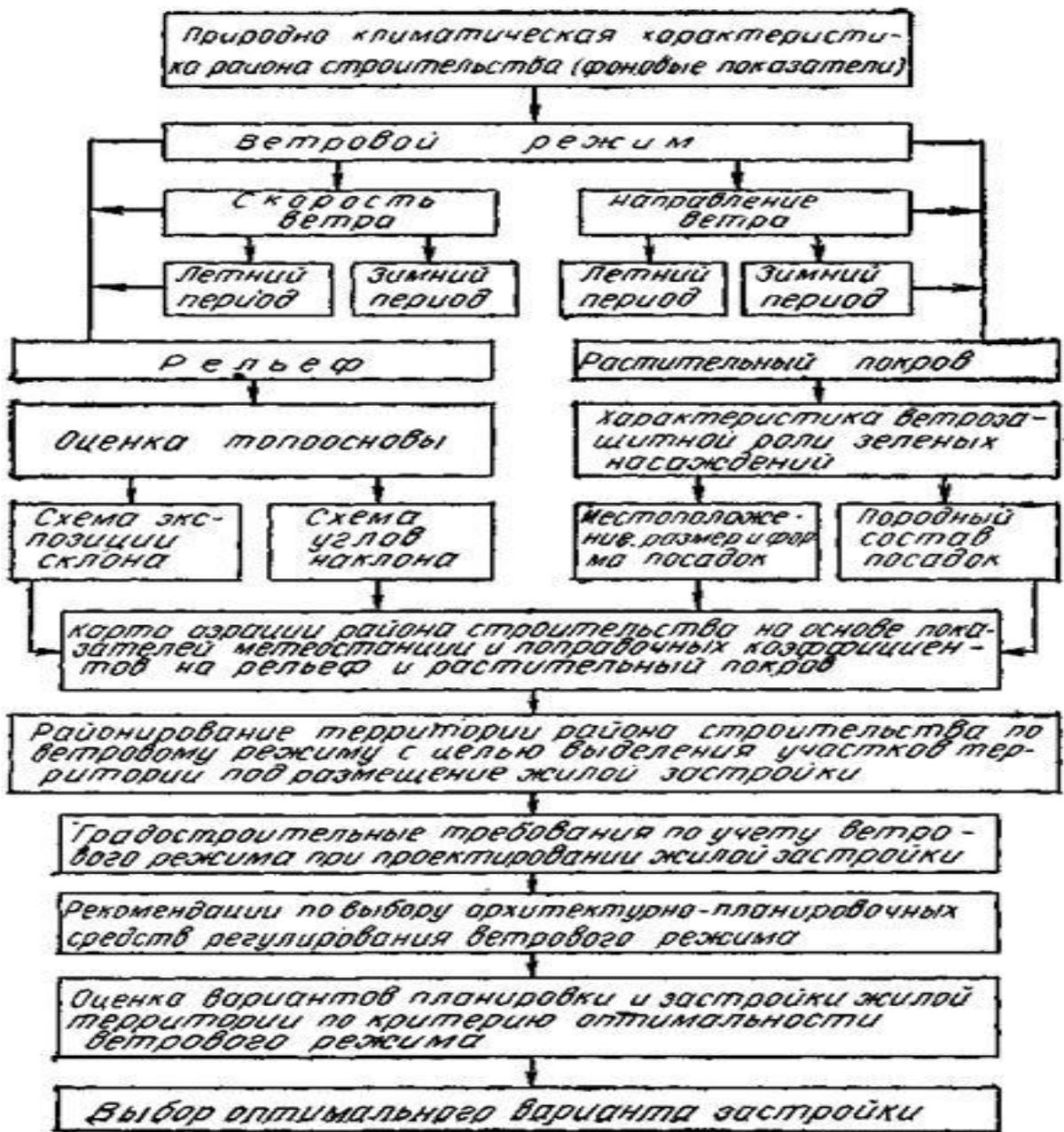


Fig. 10. The methodology of an integrated approach to recording the wind regime in the design process.

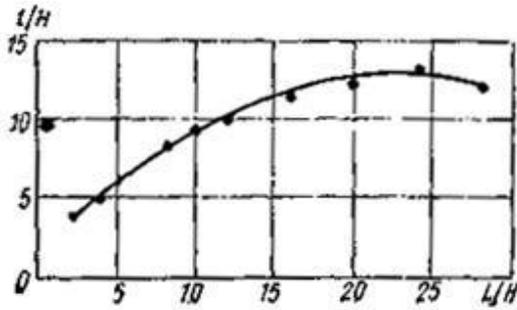


Fig. 11. The dependence of the depth of the zone of optimal speeds to the height of the house l / N ratio of the length of the house to its height L / H

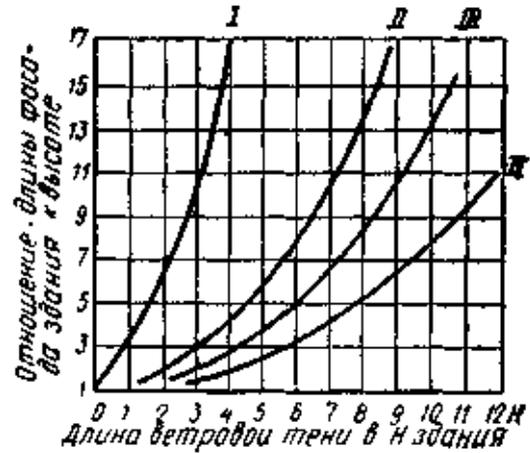


Fig. 12. Dependence of the length of the wind shadow of a separate building on the ratio of the length of the facade of the building to the height of the wind direction at an angle of 90° to the front. Decrease in wind speed.

I - на 70 %; II - на 60 %; III - на 50 %; IV - на 40 %

The calculation is performed with respect to each building.

Using these graphs can be determined zone, characterized by speed reduction, the free flow of 40 to 70%.

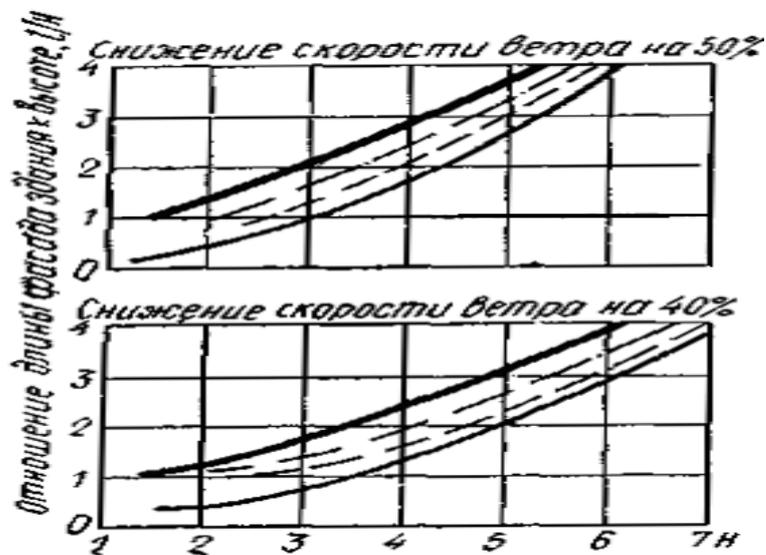


Fig. 13. The calculation of the length of the wind shadow behind the building at different slopes areas.

— - 0 %; — — - 10 %; - - - - - 30 %; — — — - 80 %

Table 13. Comparison of the depth zones optimum wind speed for the building of different heights and coextensive.

The length of the house, m	Floors, H	Building height, m	The depth of the zone of optimal wind speed, m
90	5	15	$7H - 105$
96	16	48	$4,5H - 216$
150	6	15	$9,5H - 144$
144	16	48	$5,5H - 264$

In complex terrain should use the graph in Fig. 13.

Description nomogram number 1

To construct a nomogram number 1 is used as follows working formula by which we can determine the optimal parameters for building comfort aeration:

$$K_m - K_s = [C(N-5)]^2 10^{-4} \left(\frac{H}{N} - 0,011H + 0,066 \right) \left(24,5 - 30 \frac{H}{L} \right)$$

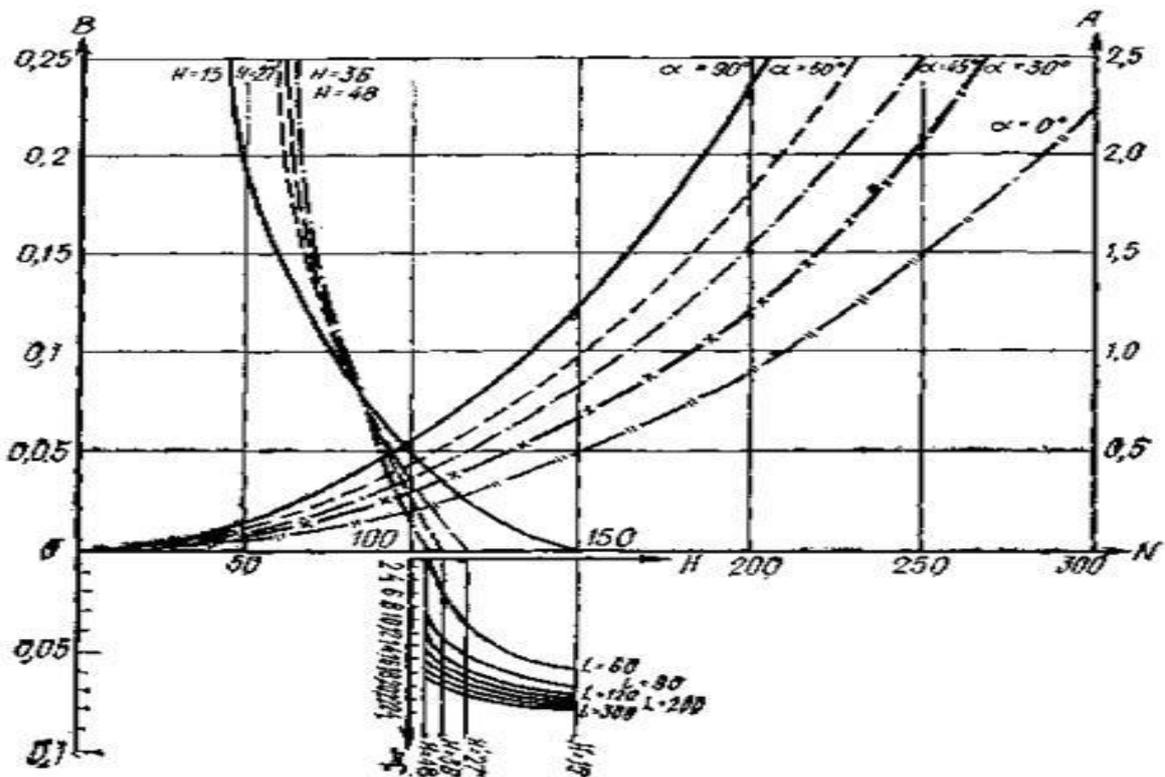


Fig. 14. Nomogram number 1, which defines the relationship between the wind speed in a residential area and building parameters.

We introduce the following notation for the factors on the right side of the formula:

$$[C(N - 5)]^2 10^{-4} = A(N);$$

$$\left(\frac{H}{N} - 0,011H + 0,066 \right) = B(N, H);$$

$$\left(24,5 - 30 \frac{H}{L} \right) = D(H, L)$$

Then $K_m - K_5 = A(N) B(N, H) L(H, L)$.

For the main axis of the nomogram number 1 take-axis N. construct a family of curves A (N) for different values of C axis but is applied to the right of the nomogram. Using the same axis N, as the abscissa, we construct a family of curves in the (N) for various values of axis H. As applied to the left side of the nomogram (see. Fig. 14). Calculation of the values of the parameters A, B and D of the above formula are given below. 14 and 15 adj. 2. Using this family of curves, we can find the values of A and B, for a given value of N.

D axis for a third factor determining the formula is carried out perpendicular to the axis N in the lower part of the nomogram. Member D does not depend on N, but is dependent on the H and L. As an argument of the axis H by means of horizontal axis coincident with the axis N undertaken or slightly below it. Reference points H (H = 15, H = 27, H = = 48 m, respectively, for 5-, 9-, 12 and 16-storey building) choose at the intersection with the axis H curves H (N).

In the coordinate system HD postpone the value D, calculated according to the formula for H = 15, 27, 36 and 48 m at certain values of the parameter L (length of the house). To construct the nomogram taken values L = 60, 90, 120 and 150 m.

Thus, to specify, for example, the value of H, D-axis we find the value of the third factor D (H) for this (or certain) values H.

The value of Km - K5 now easily determined by the product of these three factors.

Value K5, obtained from statistical processing of the experimental data (depending on the building height and wind direction thereto) are shown in Table. 16, and the average value of K5 on all floors - in the Table. 17.

Table 14. The calculation of the formula A member of the nomogram to number 2.

N	$C(N - 5)$	$C(N - 5) \cdot 10^{-4}$	N	$C(N - 5)$	$C(N - 5) \cdot 10^{-4}$
$\alpha = 0$		$C = 0,5$	$\alpha = 30^\circ$		$C = 0,59$
10	2,5	$6,25 \cdot 10^{-4}$	10	2,95	$8,7 \cdot 10^{-4}$
20	7,5	$5,6 \cdot 10^{-3}$	20	8,85	$7,8 \cdot 10^{-3}$
30	12*5	$1,56 \cdot 10^{-2}$	30	14,75	$2,17 \cdot 10^{-2}$
50	22,5	$5,0 \cdot 10^{-2}$	50	26,55	$7,05 \cdot 10^{-2}$
100	47,5	0,22	100	56,05	0,3
150	72,5	0,52	150	85,55	0,73
200	97,5	0,95	200	115,05	1,3
250	122,5	1,5	250	147,5	2,17
300	147,5	2,17	300	174,05	3,03
$\alpha = 45^\circ$		$C = 0,64$	$\alpha = 60^\circ$		$C = 0,69$
10	3,2	$1,02 \cdot 10^{-3}$	10	3,45	$1,19 \cdot 10^{-3}$
20	9,6	$9,22 \cdot 10^{-3}$	20	10,35	$1,07 \cdot 10^{-2}$
30	16,0	$0,25 \cdot 10^{-2}$	30	17,25	$2,97 \cdot 10^{-2}$
50	28,8	$0,83 \cdot 10^{-2}$	50	31,05	$9,64 \cdot 10^{-2}$
100	60,8	0,37	100	65,55	0,43
150	92,8	0,86	150	100,05	1,0
200	124,8	1,56	200	134,55	1,81
250	156,8	2,46	250	169,05	2,86
300	188,8	3,56	300	203,55	4,14
$\alpha = 90^\circ$		$C = 0,78$			
10	3,9	$1,52 \cdot 10^{-3}$			
20	11,7	$1,37 \cdot 10^{-2}$			
30	19,5	$3,8 \cdot 10^{-2}$			
50	35,1	0,12			
100	74,1	0,55			
150	113,1	1,28			
200	152,1	2,31			
250	191,1	3,65			
300	230,1	5,29			

Table 15. Calculation of parameters B and D of nomogram number 1.

Floors, H	Building height, M	$\frac{H}{L}$	$30 - \frac{H}{L}$	$24,5 - 30 \frac{H}{L} (D)$	$0,011H$	$0,011H - 0,066$	$\frac{H}{N} - 0,011 + 0,066 (B)$
5	15	0,25	7,5	17,0	0,165	0,099	0,151
9	27	0,45	13,5	11,0	0,297	0,231	0,219
12	36	0,6	18,0	6,5	0,396	0,330	0,270
16	48	0,8	24,0	6,5	0,548	0,462	0,338

The values of $[C(N - 5)]$ 210-4 for buildings of different heights will be:

5-storey building
$$[C(N - 5)]^2 \cdot 10^{-4} = \frac{K_m - K_0}{17 \cdot 0,151};$$

9-storey "
$$[C(N - 5)]^2 \cdot 10^{-4} = \frac{K_m - K_0}{11 \cdot 0,219};$$

for the 12-storey "
$$[C(N - 5)]^2 \cdot 10^{-4} = \frac{K_m - K_0}{6,5 \cdot 0,27};$$

16-storey "
$$[C(N - 5)]^2 \cdot 10^{-4} = \frac{K_m - K_0}{6,5 \cdot 0,338}.$$

Substituting in K_5 defined by the formula using the nomogram value $K_m - K_5$, determine the value of the maximum rate of wind speed for the reception building. Nomogram number 1 is applicable for determining the parameters of construction is not too large gradients of the coefficients of wind speed on the development area and, consequently, in the rupture between the linear buildings not exceeding 10 - 12H.

Description nomogram number 2

Statistical analysis of the experimental data reveals the influence of wind speed by a factor of highway width, building height and wind direction. As shown by graphical analysis, the coefficient of maximum wind speed K_m has no pronounced depending on these factors. Location same maximum wind speed ratio X_m , on the contrary, is strongly dependent on these factors. Thus, the influence of the width of

the line (or the distance between the two buildings), building height and wind direction is reflected in the location of K_m .

Table 16. Values K_5

N, m	H_M α°	$Z = 60 \text{ m}$			$Z = 120 \text{ m}$		
		15	27	33	13	27	35
	0	0,82	0,72	0,75	0,8	0,88	0,87
	30	0,68	0,67	0,4	0,74	0,7	0,58
45	45	0,66	0,78	0,48	0,72	0,73	0,62
	60	0,49	0,52	0,32	0,6	0,52	0,4
	90	0,2	0,1	0,15	0,2	0,15	0,15
	0	0,71	0,68	0,75	0,84	0,86	0,8
	30	0,57	0,67	0,43	0,73	0,71	0,63
60	45	0,53	0,72	0,43	0,71	0,73	0,6
	60	0,45	0,57	0,38	0,6	0,5	0,4
	90	0,1	0,1	0,15	0,15	0,2	0,2
	0	0,67	0,82	0,79	0,77	0,82	0,9
	30	0,56	0,73	0,57	0,65	0,72	0,63
90	45	0,44	0,71	0,55	0,64	0,72	0,59
	60	0,26	0,63	0,51	0,36	0,4	0,5
	90	0,1	0,2	0,25	0,1	0,2	0,25

Table 17. Values for the K_5 different localities at different wind direction to the facades of buildings.

Floors, H	Prick the wind direction to the facades of buildings, α°				
	0	30	45	60	90
5	0,75	0,53	0,50	0,38	0,28
9	0,7	0,67	0,55	0,5	0,2
12	0,7	0,48	0,43	0,38	0,18
16	0,74	0,48	0,35	0,35	0,31
For all storey	0,72	0,51	0,46	0,40	0,24

To construct a nomogram number 2 used the formula.

$$\frac{K_x - K_5}{K_m - K_5} = \frac{2,7(X - 5)}{(X_m - 5)} e^{-\frac{(X-5)}{X_m-5}},$$

Denoting $\frac{2,7(X - 5)}{(X_m - 5)}$ through $B(X, X_m)$ and the parameter $e^{-\frac{(X-5)}{X_m-5}}$

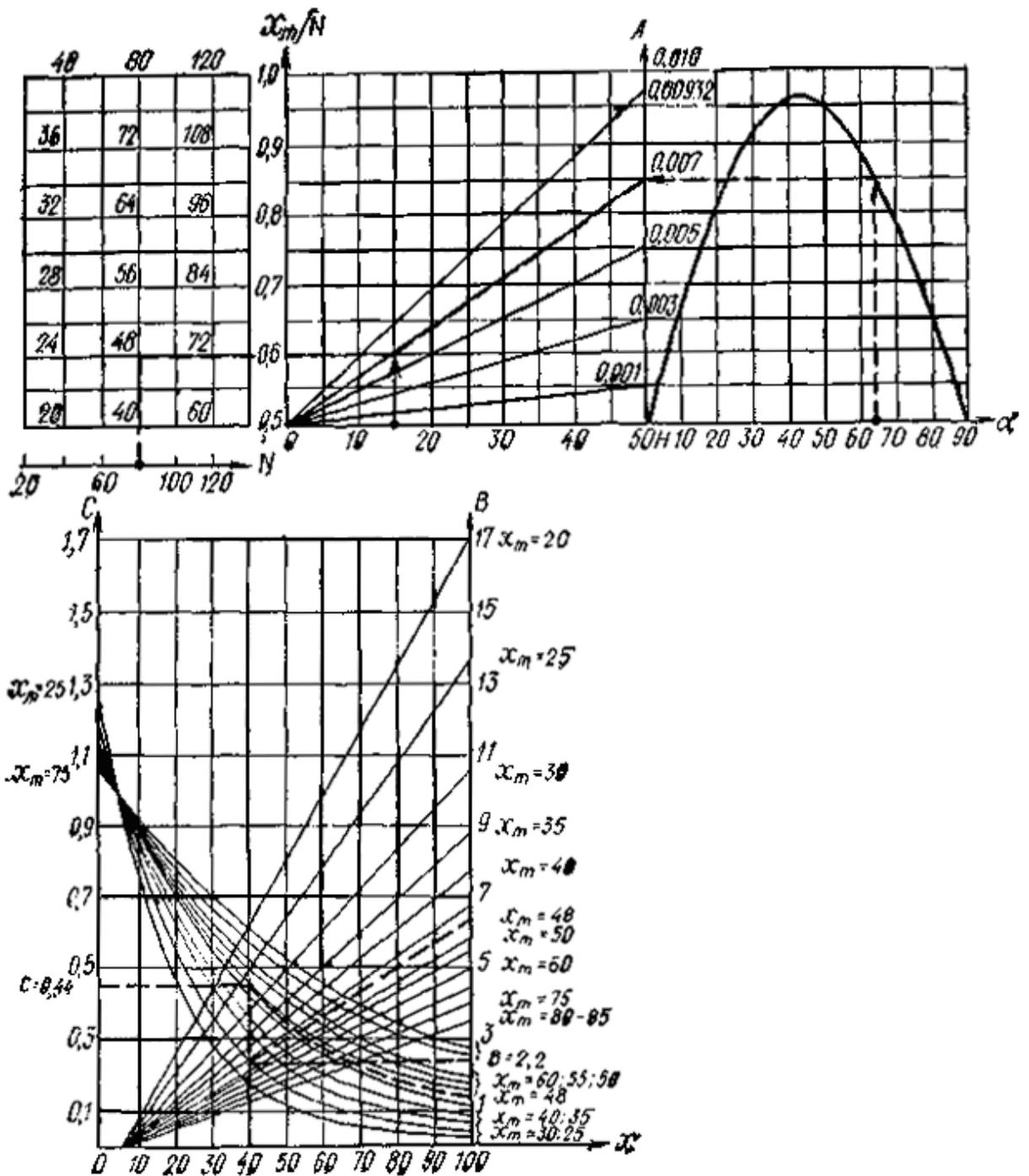


Fig. 15. Nomogram number 2 for a detailed analysis of the wind regime in the design of buildings.

$$\frac{K}{K_m - K_s} = B(X, X_m) \cdot C(X, X_m);$$

$$K_x = A \cdot X \cdot e^{-cX};$$

$$K_x = K_5 + \frac{2,7(K_m - K_5)(X - 5)}{[0,5 + 0,01(\sin 2\alpha \cdot H)(L - 5)]} e^{-\frac{(X-5)}{[0,5+0,01(\sin 2\alpha \cdot H)(L-5)']}}$$

by $C(X, X_m)$, we view a form suitable for graphical plotting:

$$\frac{K_x - K_5}{K_m - K_5} = B(X, X_m)C(X, X_m),$$

where X - the current coordinate;

X_m - parameter depending on the width of the line N , H height of the house and the wind direction α °.

Nomograph number 2 consists of two parts (Fig. 15). The first part is used to determine the specified parameters X_m building and integrates the three coordinates - axis α , H , N . The right-hand side of the figure is constructed function $A = 0,01 \times \sin 2\alpha$. The abscissa represents values of α , the vertical axis - the value A . A is adjacent to the axis of a graph of X_m / N (H), so that the value A corresponds to the axis X_m / N if $N \neq 50$. In order to find the values of X_m / N with $H \neq 50$, it is necessary to go down in a straight line X_m / N , corresponding to a given value of A , to a value of N specified. The corresponding value of X_m / N on the axis on the left.

A value of the coefficient depending on the wind angle α , hail, Development:

α , hail.	A
0.....	0.....
30.....	0,011.....
45.....	0,01.....
60.....	0,008.....
90.....	0.....

The grid on the left of the X -axis / N allows to immediately determine X_m in meters to get the value X_m / N for a given value of N . Thus, X_m defined.

Using the second part of the nomogram, we define $(KX - K5) / (KX - K5)$ for any value and meaning defined above X_m (ie graphically solve the above equation).

The value of B is on the axis in the right side of the nomogram, using the specified value X and a family of straight lines for different values of X_m .

The value of C is on the axis C on the left side of the nomogram using a family of curves C (X), the values for X_m .

Multiplying the values found for B and C, we obtain the value $(KH - K5) / (K_m - K5)$.

K_m value may be taken as 0.9 for all values of α except for $\alpha = 90^\circ$, where $K_m = 0,45$. K_5 value for buildings of different lengths are given in Table. 16 given to the nomogram number 1.

Thus, the optimal parameters of the building can be selected with the number one nomogram based on the use of factors of wind speed, and number 2 nomogram allows a more detailed analysis of wind conditions and determine the value of the coefficient of the wind speed at any point between the two parallel buildings.

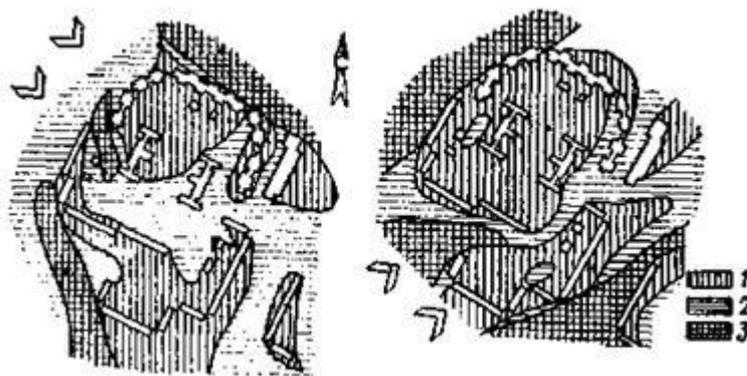


Fig. 16. Map of the territory of the projected construction of aeration obtained using computational methods.

$$1 - K = 0,1 - 0,5; 2 - K = 0,5 - 0,75; 3 - K = 0,75 - 1,0$$

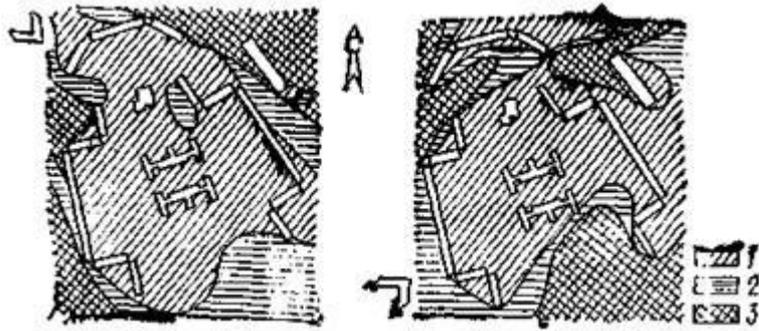


Fig. 17. Quantitative assessment in the wind tunnel.

1 - $K = 0,1 - 0,5$; 2 - $K = 0,5 - 0,75$; 3 - $K = 0,75 - 1,0$



Fig. 18. Blowing layout development in the wind tunnel in order to obtain a picture of the aeration area.

The result of evaluation of the aeration mode is the projected area map aeration building (Fig. 16).

Evaluation of the wind regime of the final construction can be obtained in the wind tunnel as a quantitative characteristic (Fig. 17) and sheathe picture aeration district (Fig. 18).

APPENDIX 3

REGULATION MEANS WIND AND THERMAL AND MODE

The most rational development of urban areas in terms of environmental protection can be carried out on the basis of the scheme area zoning district on temperature and wind characteristics (Fig. 19).

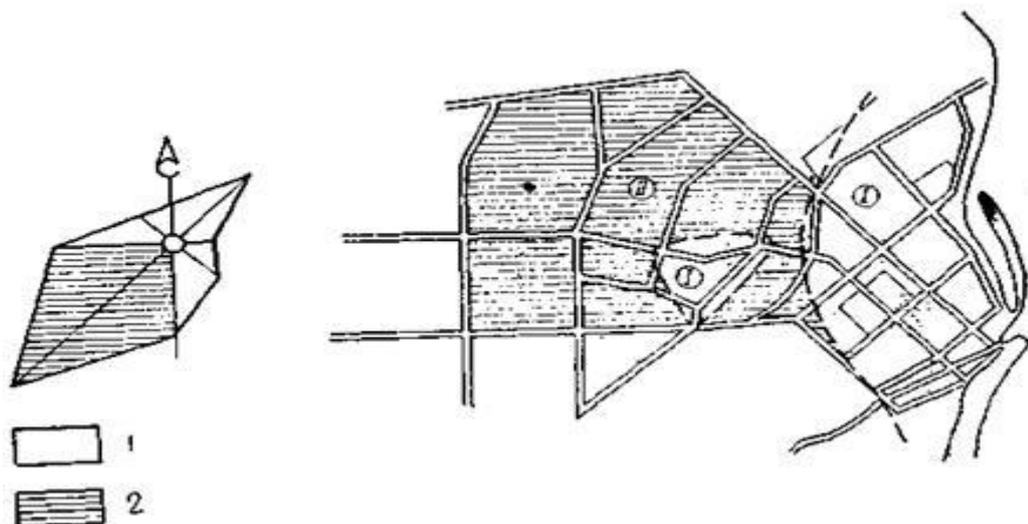


Fig. 19. Schematic map of zoning on temperature and wind regime for urban development

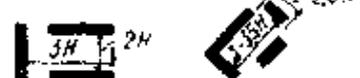
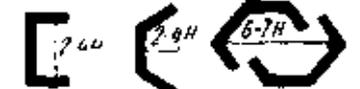
1 - comfortable area of the city; 2 - an area that requires regulation of the wind regime

Table 18. K value depending upon the length and height of the building.

Height, m	Length, m				
	40	80	120	160	200
12	0,5	0,75	1,0	1,1	1,2
16	0,5	0,7	0,9	1,0	1,1

Table 19. Options group of residential buildings of different configurations in order to windshield area.

Wind direction to the building	
Methods of construction	Coefficients wind speed

	0,4 - 0,5
	0,35 - 0,45
	0,35 - 0,5
	0,3 - 0,4
	0,25 - 0,35
	0,2 - 0,3
	0,2 - 0,5
	0,1 - 0,4

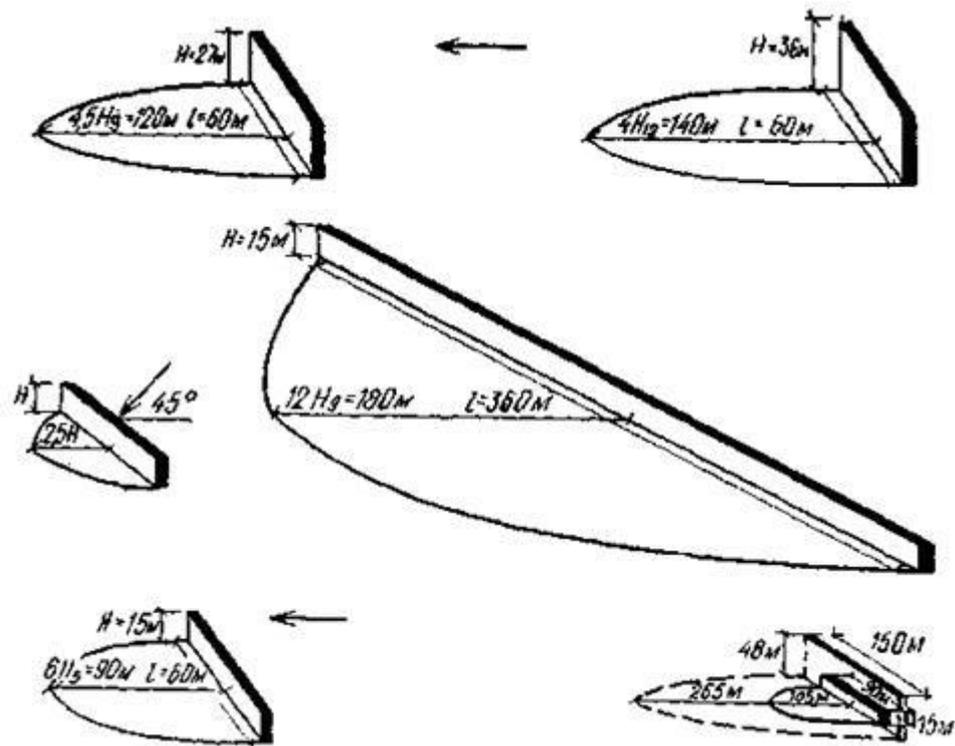


Fig. 20. Dimensions wind shadow zones ($K \leq 0,5$) depending on the parameters of buildings

Table 20. Options for groups of residential buildings of various configurations to enhance ventilation area.

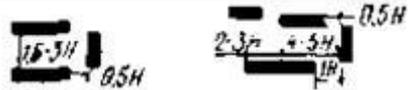
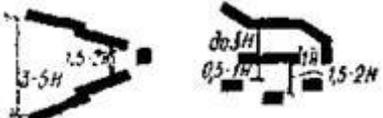
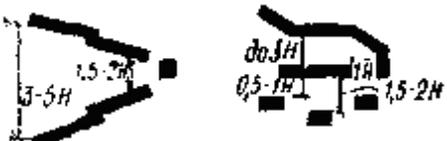
→ Wind direction to the building	
Methods of construction	Coefficients wind speed
	0,9 - 1,2
	0,75 - 0,95
	0,7 - 0,9
	0,6 - 0,8
	0,5 - 0,75
	0,45 - 0,65
	0,4 - 0,7
	0,4 - 0,5
	0,3 - 0,5

Table 21. Evaluation of the impact of different designs windproof bands alley type (for S.D.Sokolov).

I. Multi-part building			
Height of the bar relative to the height of the building ($H = 15 \text{ m}$)	Spacing between the band and the building, H	The average percentage reduction of wind speed	Notes
A. Windproof design strip			
1/4	1 - 5	5 - 10	differences 10 - 45 %
1/2	3 - 5	25 - 40	
3/4	1 - 3	10 - 15	
3/4	3 - 5	40 - 50	
3/4	1 - 3	15 - 20	
B. Blown stripes design			
1/4	1 - 5	35 - 45	Различия в пределах точности опыта
1/2	1 - 5	35 - 45	

I. Multi-part building			
Height of the bar relative to the height of the building ($H = 15$ м)	Spacing between the band and the building, H	The average percentage reduction of wind speed	Notes
3/4	1 - 5	35 - 40	
B. Openwork design strip			
1/4	1 - 5	45 - 55	Same
1/2	1 - 5	50 - 55	
3/4	1 - 5	45 - 55	
II. Acupressure building			
Interval, m	The average percentage decrease in wind speed		
	for planting strip	for planting strip in the presence of the building	
A. Windproof design strip			
45	55	24	
15	30	21	
B. Blown stripes design			
45	30	15	
15	25	15	
B. Openwork design strip			
45	60	15	
15	60	20	