

МРНТИ 67.29.29:67.07.31Т.К. Samuratova¹, F. Maslov²^{1,2}L.N.Gumilyov Eurasian National University, Astana, Kazakhstan
(E-mail: ¹samyratovatk@mail.ru, ²farxad.maslov@bk.ru)**Principles for the formation of mobile housing**

Abstract: The article discusses the design of recommended residential cells (for settling single and family contingent living) that make up the residential area SWC, the most important is the determination of their spatial dimensions and planning structure. Spatially - anthropometric correspondence is characterized by the correctly chosen parameters of the room based on the anatomical features of the human body, its size, mass, physical strength, movement capabilities and features of the use of various equipment.

Key words: mobile housing, design factors, functionally-spatial organization, SWC, transforming furniture, overall dimensions, living quarters.

Depending on social, technical and aesthetic concepts, each epoch defined the architectural space in its own way. Currently, architectural space is a physical space, determined by many factors, such as the functional process, construction, orientation along spatial axes, light, color, texture. All factors, except for the functional process, can be combined into such a concept as anthropomorphic geometry. Based on this, architectural space is defined as a functional process, formalized by means of anthropomorphic geometry [1]. All these factors are too different and incomparable, which complicates the problem of developing the spatial dimensions of the premises of a mobile home and defines it as complex.

Man as a complex biological organism and social personality determines a huge range of requirements for housing, ranging from relatively harsh, biologically based (to the composition of the air environment or heat exchange conditions) to more dynamic and socially determined (to size, proportions, appearance, equipment, etc.). In this regard, the requirements for housing should be determined on the basis of data from many human sciences, ranging from physiology, hygiene, epidemiology, and ending with social psychology, gerontology, aesthetics, economics, etc. This, when solving this problem, requires compliance with spatial organization mobile home complex set of factors.

In this case, we will talk about the spatial - anthropometric, physiologist - hygienic and psychologist - aesthetic conformity. Spatially - anthropometric correspondence is characterized by the correctly chosen parameters of the room, based on the anatomical features of the human body, its size, mass, physical strength, movement capabilities and features of the use of various equipment. Physiologist - hygienic compliance is determined by the peculiarities of the functioning of the senses (vision, hearing, charm or touch) and the selected parameters of the microclimate of the room (temperature, pressure, composition of the atmosphere of the room, etc.).

Psychologist - aesthetic conformity, i.e. the highest emotional satisfaction of a person from the perception of habitat space and mainly from visual and auditory perception, as a rule, is achieved by harmony and proportionality, plasticity, color, satisfaction with functional purpose, etc.

Analysis and consideration of all these factors in determining the spatial dimensions of a mobile home become particularly relevant, firstly, due to the unusual environment and lifestyle in a mobile home, and secondly, the mass production of such a home, where every mistake, incomplete accounting hygienic, psychological, physiological and social requirements for housing on the part of the residents are transformed into a large and almost unavoidable defect, the consequences of which will affect health for a long time property, human well-being [2]. The listed groups of factors affect the spatial dimensions of the premises *MSC*.

The existing recommendations and documents defining the design conditions and standards of a mobile dwelling are developed in more detail for cultural and residential premises [3, 4, 5, 6, 7], and for dwellings, a constant value of the area norm is adopted, as a rule, regardless of the set functional processes carried out in them and the number of people living (that is, without taking into account the established criteria for evaluating the functional - spatial organization of a mobile home).

In this regard, to determine the optimal size of the living area of a mobile home, it is necessary to investigate the spatial criteria for its assessment. The results of the analysis of the size of a dwelling of mobile types of dwellings for this purpose, depending on the number of people living in it, reveal a tendency to decrease the norm of living space per person. In addition, the following peculiarity is determined:

with an increase in the number of people living in the same room, more than 6 people the norm of space per person practically does not decrease.

These results characterize only the general tendency to decrease the norm of living space depending on the number of living people without taking into account the composition of the functional processes carried out in the living cell. To this end, possible acceptable variants of a set of compatible functional processes in it, starting with a minimum, were identified. As shown by the results of a full-scale survey of a mobile expeditionary-type dwelling, for living cells the most characteristic and most frequently encountered option is in a living room: sleep, storage of personal belongings, hobby classes, study (self-education).

Another factor affecting the rate of living space in a mobile home is the type of equipment and furniture used:

- a) cabinet furniture (single beds);
- b) built-in furniture (bunk beds);
- c) transforming furniture (single beds);
- d) transforming furniture (bunk beds).

Differential analysis of the norm of living space of a mobile dwelling according to options for a set of functional processes carried out in a dwelling, and the type of equipment and furniture used, as well as depending on the number of living people, confirmed the trend identified above and, moreover, gives empirical indicators of the area norm per person for each option used furniture and equipment.

When comparing these options, a decrease in the rate of living space per person depending on the type of equipment used (from stationary equipment to transforming) is clearly seen. Moreover, the difference in performance between the options for a set of functional processes with a single-tier arrangement of furniture is more contrast than with two-tier and transforming.

The obtained indicators of the area norm per person reveal the general directions in their development, but, as shown by the results of a full-scale survey, they were developed without taking into account ergonomic and anthropometric requirements and therefore cannot be recommended for use in design practice. In this connection, there arises the need for design and experimental development of variants of layouts for residential premises of a mobile dwelling (for a specific set of functional processes, but different variants of the furniture used,

taking into account these requirements) as the next step in determining the normative indicators of living space.

The planning qualities of a dwelling are assessed by the possibility of rational organization in it of various household processes. The part of the room intended for the implementation of the domestic process is called the functional zone, which as a spatial element of the room is the basis for the formation of the space-planning solution of a living cell [8].

The parameters of each functional area are characterized by anthropometric data and ergonomic requirements. The anthropometric characteristics of a person determine the spatial dimensions and shape of the equipment used in the domestic process (for example, seating, lying, various labor processes, etc.), as well as the parameters of the required free space inside the zone to approach the objects placed in it equipment. The low variability of a human biological type predetermines the relative stability of anthropometric and ergonomic requirements and, accordingly, the relative stability of the parameters of each functional zone (if household processes are constant). Optimization of the spatial parameters of each functional area is expressed in finding comfortable sizes that ensure the freedom and convenience of the implementation of a particular domestic process.

Dimensions of everyday objects depend on the specifics of the process itself. They are influenced by both the individual characteristics of the individual and the general level of the material, cultural and social development of society, as well as the capabilities of technology. Therefore, the creation of various types of equipment for the home should be based on deep sociological research, studying the living conditions of people, taking into account the level of technological development in order to determine the role and place of the new thing, its relationship with the environment with the highest degree of reliability [9].

In the expeditionary type *SWC*, due to the specifics of the organization and operation of such a dwelling, the influence of the technical process and the development of a trend towards the integrated use of household items, appliances, equipment and media, their compactness and miniature size, the dimensions of the equipment should be reduced to the optimum. The optimal parameters should be determined taking into account anthropometric and ergonomic data, the nature and type of the functional process, which allows you to

select those anthropometric measurements that are decisive (for example, height, if the height of the doorway is set, or foot length when determining equipment dimensions with foot levers etc.).

In modern housing, certain types of equipment correspond to the identified groups of functional processes [12]. Physiological processes (sleep, washing, eating, etc.) are the most stable. Both the content of the process and the method of its implementation remain practically unchanged, as they are related to the physical characteristics of the person. The parameters of storage tanks take the most diverse forms and change their size depending on the items for which they are intended.

When determining the parameters of a functional zone, in addition to the optimal set of equipment and its dimensions, it is important to establish comfortable values of free space inside the functional zone (for ease of operation when using equipment, for organizing a free approach to all items of equipment and capacity). Therefore, the characteristic anthropometric dimensions of the human body are taken into account to determine both the dimensions of objects and equipment, and the size of the passages between them, the area around the equipment necessary for its proper operation, etc. On the basis of generally accepted data of anthropometry in the *USSR* [10, 11, 12], the overall dimensions of equipment and functional areas of residential premises (for various variants of the furniture used) are compiled.

For a normal recovery of human strength, in addition to observing the duration of sleep (equal to 7–8 hours), it is necessary that the spatial dimensions of the sleep zone correspond to the implementation of this process. The sleeping space is formed by the sleeping area and the storage space for bedding. The dimensions of the sleeping area (beds, cots, etc.) are determined by the physical dimensions of the person sleeping or resting in a free posture. Studies in the field of determining the optimal dimensions of furniture in a stationary permanent home reveal the optimal size of a bed (200×80 cm) that can satisfy a person of any height. For the conditions of short-term stay in a mobile expeditionary type dwelling, beds of 190×70 cm can be used, which will be used to equip the cabin of the crew of ships or compartments of railway cars.

In the expeditionary type *SWC*, to save living space in accordance with the listed requirements, you can use the sleeping

place as a seat (when storing bed linen in a special container and when fitting the mattress of the bed with a decorative fabric that is durable and easy to clean), as well as arrange bunk beds, as a result, the height of the lower tier should be equal to the height of the seat (ice 42 - 45 cm), and the plane of the second tier - at a height of 155 - 160 cm.

The use of bunk beds, of course, reduces the level of comfort of living, but given the time of stay, as well as the fact that such dwellings are usually inhabited by young people who can easily use beds of this type, we can recommend them to save space.

In this regard, it is necessary to provide appropriate accessories that make it easy and convenient to use the second tier (stairs or folding stools) [13]. In the case of a two-tier berth solution, the height of the room must be at least 2.7 m, and such bed constructions are necessary, which can be either two-tier or single-tier at the request of the residents. The storage capacity for bed linen should be provided for at least $0.11 m^3$ with internal dimensions (75x50x35) [12].

The use of transforming beds, besides the listed advantages, has a disadvantage: the bed rigidly fixed in a certain place of the room does not give variable placement of furniture and equipment and, moreover, requires a large expenditure of materials on the frame and transformation nodes. The design of such furniture should be collapsible to ensure its transportation and assembly. In addition, due to the intensive exploitation of its individual elements, the need arises for increased mechanical strength. But despite this, the specificity of the composition of living in mobile expedition villages (mostly young people) allows the use of transforming types of furniture.

The area of one sleeping place consists of the area of the bed, bedside table for bed linen and the working area required for laying the bed and cleaning the bed linen in a storage tank equal to 60 cm across the front of the bed and the bed it self or other bed storage container.

Depending on the type of bed used, the sleeping space will be different. So, with a single-tier bed with a cabinet for bed linen, it is equal to $(200 \times 80) + (80 \times 40) + (60 \times 240) = 3.36 m^2$, i.e. $3.4 m^2$.

When using bunk beds with bedside tables for bed linen in a double cell, the area of the sleep zone per person will be $(200 \times 80) + (80 \times 40) + (60 \times 240) = 3.4 : 2 = 1.7 m^2$.

In the case of using single-tier transforming beds, where there is no need to use a capacity for storing linen, the size of the functional area for sleep is $(200 \times 80) + (60 \times 200) = 2.8 \text{ m}^2$.

It is also possible to use bunk beds of a transforming type, then the area of sleeping space per person is $2.8 : 2 = 1.4 \text{ m}^2$. If the bed size is $190 \times 70 \text{ cm}$, the areas for sleeping will be smaller.

For functional processes, classes of interest (study, self-education) need a table. The required size of the table plane is equal to $80 \times 60 \text{ cm}$ according to the norms, and the height must be at least 75 cm . In addition, for the normal implementation of these processes, it is necessary to equip the working space with shelves (for books, tools, etc.). In order to save space, tables can be built-in and transformable, and shelves can be hung freely anywhere on the wall. A semi-rigid working chair is also required. Thus, the space for these processes consists of the actual area of the table and the area required to move a chair: $(80 \times 60) + (80 \times 75) = 1.1 \text{ m}^2$.

When morning gymnastics is performed in a residential area, its dimensions are determined not only by the actual sleeping area and the place to practice, but also by the place for the person doing the gymnastics, i.e. it is necessary to take into account the size of the optimal, so-called “motor” space of a person [14]. However, in expeditionary complexes, such a process as morning gymnastics can be carried out from the living room to the rest room.

The dimensions of the entrance zone are determined by the width of the door leaf and the area occupied by a person at the entrance and exit, and accordingly will be equal to $0.9 \times 1.1 = 0.99 \text{ m}^2$ [12].

A place to store linen and clothes is usually equipped with a wardrobe (built-in or stationary), the width of which is determined by the size of the clothes stored in it. The internal transverse width of such a cabinet should be at least 58 cm , and the external size, respectively, 60 cm . The longitudinal size of the cabinet in a stationary dwelling is 80 cm , and for the equipment of the crew of a sea-going ship - 45 cm .

The analysis of the practice of creating a living space of a mobile home and their design and experimental development from the standpoint of meeting the requirements of anthropometry made it possible to obtain differentiated scientifically based indicators of the size of the living space of an expeditionary type *SWC*, recommended

as standards for designing a mobile home (for different versions of furniture used, the number of people and terms of stay of people in them, Table 8).

Table 1: Norms of living space (m²) of expedition type SWC

Type of furniture and equipment	For the number of people living in the living room			
	1	2	3	4 or more
Cabinet furniture (single beds)	$\frac{6,8}{3,9}$	$\frac{5,8}{3,5}$	$\frac{5,6}{3,3}$	$\frac{5,4}{3,2}$
Built-in furniture (bunk beds)	—	$\frac{4,2}{2,5}$	—	$\frac{3,8}{2,4}$
Transforming furniture (single beds)	$\frac{5,1}{3,2}$	$\frac{4,4}{3,0}$	$\frac{4,3}{2,8}$	$\frac{4,2}{2,7}$
Transforming furniture (bunk beds)	—	$\frac{3,6}{2,7}$	—	$\frac{3,4}{2,4}$

• In the numerator - data for long-term stay, in the denominator - for short-term.

The method used above for determining the size of the residential area of an expeditionary type *MLC* can also be used in the development of the dimensions of premises for other purposes. In the process of further development of the problem of organizing a mobile home, it is advisable to expand sociological research based on the practice of operating a mobile home in order to take into account the requirements of psychology and aesthetics, as well as the peculiarities of lifestyle and habitat. For this, it is necessary to combine the efforts of many specialists in various fields of science - sociologists, psychologists, physicians, designers and many others.

References

1. Рожков Г.Б. Архитектурное пространство как объект прогнозирования. – Киев: КИСИ, 1970. – 231 с.
2. Леру Р. Экология человека – наука о жилье. - М.: Стройиздат, 1970. – 66 с.
3. Предварительные рекомендации по проектированию общежитий, расположенных в инвентарных зданиях. - М.: Стройиздат, 1974. – 12 с.
4. Грязнов А.В. Справочник по жилищно-коммунальному хозяйству на стройках. - М.-Л., М.-Л.: Гонти, 1938. – 432 с.

5. Лазарева В.Г. Смотреть типы населенных пунктов. Типологические принципы. – В кн.: Новые виды жилья. - Л.: Гонти, 1972. – 112 с.
6. Онуфриев В.К. Рекомендации по проектированию стандартов для жилых и сервисных учреждений мобильных населенных пунктов на Крайнем Севере. – В кн.: Материалы V Всесоюзной конференции по обмену опытом в строительстве в суровых климатических условиях. Красноярск, Тюмень. - 1968. - Т.3. - № 4. – 215 с.
7. Положение о жилом полевоом городке для работников предприятий и организаций Министерства строительства предприятий нефтегазовой отрасли. - М.: Стройиздат, 1973. – 70 с.
8. Перспективы развития жилищного строительства в СССР. –М.: Стройиздат, 1970. – 180 с.
9. Шемшурина Е.Н. Рекомендации по габаритам бытовой техники. – М.: Вниитэ, 1968. - 235 с.
10. Атамали Ф.В. Эргономика. Справочные материалы. – Баку: Азернешр, 1968. - 181 с.
11. Звездина Т.И., Блашкевич Р.Н., Мерханов Б.М. Инструкция по выбору планировочных параметров квартиры. – М.: Стройиздат, 1969. – 86 с.
12. Инструкция по выбору планировочных квартиры (в зависимости от их назначения и использования). – М.: Стройиздат, 1969 - 71 с.
13. Курочкин Л.А. Основные принципы проектирования жилой ячейки студенческого общежития. – М.: Стройиздат, 1972. – 210 с.
14. Зефельд В.В. Геометрические характеристики предметно-пространственной среды человека. – В кн.: Проблемы сенсорной изоляции. - М.: Вниитэ, 1970. – 204 с.

Т.К. Самуратова¹, Ф. Маслов²

¹²Л.Н. Гумилев атындағы Еуразия ұлттық университеті, Астана,
Қазақстан

Жылжымалы үйлерді қалыптастыру принциптері

Аннотация: Мақалада ұсынылған тұрғын үйлердің жобасы талқыланады. Ең бастысы олардың кеңістіктік өлшемдерін және жоспарлау құрылымын анықтау болып табылады. Бұл жағдайда ғарыш туралы - антропометриялық, физиологиялық-гигиеналық және психолог-эстетикалық сәйкестік туралы мазмұндалады. Кеңістікті - антропометриялық сәйкестікте адам денесінің анатомиялық ерекшеліктері, мөлшері, массасы, физикалық күші, қозғалу мүмкіндіктері және әртүрлі жабдықтарды пайдалану ерекшеліктері негізінде бөлменің дұрыс таңдалған параметрлері сипатталады.

Кілт сөздер: жылжымалы корпус, сындарлы факторлар, функционалдық-кеңістіктік ұйымдастыру, ЖҚК, жиһазды өзгерту, жалпы өлшемдер, тұрғын үй-жайлар.

Т.К. Самуратова¹, Ф. Маслов²

^{1,2}*Евразийский национальный университет им. Л.Н.Гумилева, Астана, Казахстан*

Принципы формирования мобильного жилья

Аннотация: В статье рассматривается проект рекомендуемых жилых ячеек (для расселения одиночных и семейных контингентов). Наиболее важным является определение их пространственных размеров и планировочной структуры. В данном случае пойдет речь о пространственно – антропометрическом, физиолог – гигиеническом и психолог-эстетическом соответствии. Пространственно-антропометрическое соответствие характеризуется правильно выбранными параметрами помещения исходя из анатомических особенностей человеческого тела, его размеров, массы, физической силы, возможностей движения и особенностей использования различного оборудования.

Ключевые слова: мобильное жилье, конструктивные факторы, функционально-пространственная организация, SWC, трансформирующаяся мебель, габаритные размеры, жилые помещения.

References

1. Rozhkov G.B. Arkhitekturnoye prostranstvo kak ob'yekt prognozirovaniya [Architectural space as an object of forecasting] (KISI, Kiyev, 1970). [in Russian]
2. Leru R. Ekologiyacheloveka – nauka o zhil'ye [Human Ecology - the science of housing] (Stroyizdat, Moscow, 1970). [in Russian]
3. Predvaritel'nyye rekomendatsii po proyektirovaniyu obshchezhitiy, raspolozhennykh v inventarnykh zdaniyakh [Preliminary recommendations on the design of hostels located in inventory buildings] (Stroyizdat, Moscow, 1974). [in Russian]
4. Gryaznov A.V. Spravochnik po zhilishchno-kommunal'nomu khozyaystvu na stroykakh [Handbook of housing and communal services at construction sites] (Gonti, Mockow-Leningrad, 1938). [in Russian]
5. Lazareva V.G. Smotret' tipy naseleennykh punktov. Tipologicheskiye printsipy [See the types of settlements. Typological principles] V kn.: Novyye vidy zhil'ya [In book: New types of housing] (Gonti, Leningrad, 1972). [in Russian]
6. Onufriyev V.K. Rekomendatsii po proyektirovaniyu standartov dlya zhilykh i servisnykh uchrezhdeniy mobil'nykh naseleennykh punktov na Kraynem Severe [Recommendations for the design of standards for residential and service institutions of mobile settlements in the Far North] V kn.: Materialy V Vsesoyuznoy konferentsii po obmenu opytom v stroitel'stve v surovyykh klimaticheskikh [In: Proceedings of the All-Union Conference on the exchange

- of experience in construction in harsh climatic conditions] (Krosnoyarsk, 1968. T.Z. No4). [in Russian]
7. Polozheniye o zhilom polevom gorodke dlya rabotnikov predpriyatiy i organizatsiy Ministerstva stroitel'stva predpriyatiy neftegazovoy otrasli [Provision on a residential field campus for employees of enterprises and organizations of the Ministry of Construction of Oil and Gas Enterprises] (Stroyizdat, Moscow, 1973). [in Russian]
 8. Perspektivy razvitiya zhilishchnogo stroitel'stva v SSSR [Prospects for the development of housing in the USSR] (Stroyizdat, Moscow, 1970). [in Russian]
 9. Shemshurina Ye.N. Rekomendatsii po gabaritam bytovoy tekhniki [Recommendations on the dimensions of household appliances] (Vniite, Moscow, 1968). [in Russian]
 10. Atamali F.V. Ergonomika. Spravochnyye materialy [Reference materials] (Azerneshr, Baku, 1968). [in Russian]
 11. Zvezdina T.I., Blashkevich R.N., Merkhanov B.M. Instruktsiya po vyboru planirovochnykh parametrov kvartiry [Instructions for choosing the planning parameters of the apartment] (Stroyizdat, Moscow, 1969). [in Russian]
 12. Instruktsiya po vyboru planirovochnykh kvartiry (v zavisimosti ot ikh naznacheniya i ispol'zovaniya) [Instructions for choosing a planning apartment (depending on their purpose and use)] (Stroyizdat, Moscow, 1969). [in Russian]
 13. Kurochkin L.A. Osnovnyye printsipy proyektirovaniya zhiloy yacheyki studencheskogo obshchezhitiya [The basic principles of designing a residential cell of a student residence] (Stroyizdat, Moscow, 1972). [in Russian]
 14. Zefel'd V.V. Geometricheskiye kharakteristiki predmetno-prostranstvennoy sredy cheloveka [Geometric characteristics of the subject-spatial environment of a person] V kn.: Problemy sensornoy izolyatsii [In: Problems of sensory isolation] (Vniite, Moscow, 1970). [in Russian]