SEPARATE PRINCIPLES OF SPATIAL PLANNING IN THE BORDER REGIONS ON THE EXAMPLE OF MEGHRI COMMUNITY

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Abstract: *The paper aims to apply such principles of territorial planning in border areas and regions under the threat of war, which will allow to meet the primary needs of the population under relatively peaceful conditions and, in emergency situations, will reduce the vulnerability of territories and populations. To solve this problem, the issues specific to the border regions and principles of their classification were studied, which were found both in international documents and in scientific publications. In the example of the Meghri community of Syunik Marz, RA, such factors directly related to spatial planning, such as geographical location; natural, economic, and cultural resources; territorial placement of settlements; population; and infrastructure, were investigated. To solve the problem of access to public services, the infrastructures for providing the primary needs of the population were selected and categorized according to access levels. The study's findings led to recommendations for using these spatial planning concepts, which will guarantee that all the residents in the community's settlements have access to services.*

Keywords: *border region, settlement, security, road network, infrastructures, access to services.*

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Introduction

There are references to the issues of border regions and ways to solve them both in documents adopted by various international organizations and in scientific publications. The official documents touch upon issues related to interstate relations as demarcation, delimitation, and recommendations for solving related problems[1], the political and legal responsibility of states for border security and border regime issues, international standards of human rights, particularly of refugees, free movement of people, goods, services, and investments, terrorism prevention, economic cooperation in border zones[2], regulation of cargo transportation on borders by land, air, and waterways[3], etc.

The frameworks of the studies related to the problem are broad and diverse. They can refer to the formulation and interpretation of the term “border” itself (Boundaries, Borders, Frontiers), the historical and geopolitical features of their formation [1], the origin and consequences of borders [2], and the reasons for the border formation and changes between the empires and states in different historical periods [3], the opportunities and limitations of border regions [4], the state policies and investment directions related to their development [5], problems of infrastructure placement in border cities [6], people’s perception the problems, and the classification of borders as a gap and as a communication opportunity based on interactions [7,8].

However, if we try to generalize the different provisions made in official and scientific publications on border regions, we should note that the main border-related issues are determined at the level of relations

[1] Delimitatsiya i demarkatsiya gosudarstvennykh granits: aktual'nyye voprosy i sposoby ikh resheniya.The Organization for Security and Co-operation in Europe, 2017 (in Russian). https://www.osce.org/files/f/ documents/2/ 8/363471.pdf

[2] Konventsiya v oblasti bezopasnosti granits i pogranichnogo rezhima. The Organization for Security and Co-operation in Europe, 2005 (in Russian). https://www.osce.org/files/f/documents/a/6/70205.pdf

[3] Mezhdunarodnaya konventsiya o soglasovanii usloviy provedeniya kontrolya gruzov na granitsakh. United Nations, 1982 (in Russian).

between bordering countries. Accordingly, scientific publications are dominated by the classification principles put forward by Van der Velde and Martin [7] back in 1997, according to which border regions can be:

- separated from each other (alienated) because of military operations, political, religious, cultural, ethnic, and other conflicts,
- coexisting with a certain economic and cultural contact,
- interconnected, with as much full cooperation in the economic, social, and cultural spheres as is possible in the case of functioning borders,
- integrated - with the free movement of people, goods, investment flows, and ideas.

Leaving aside the last three options, we should note that the isolated regions had different manifestations in different historical periods, from Hadrian's Wall and the Great Wall of China to the Berlin Wall and the "Trump" wall built between the United States and Mexico. The main problems were the protection from tyranny, the security of the state or populations in border regions, as well as restrictions on the movement of people. However, regarding frozen conflicts and hostilities, we are dealing with either the concept of "border" in its accepted meaning, but "floating" borders, or more accurately, contact lines, which can shift regularly and endanger the security of the people living in the border regions.

Similar manifestations continue to exist in various parts of the world (Syria, Palestine, Israel, Eastern Ukraine, Central Asia, South Caucasus, etc.), causing constant tension among the residents of border regions, disrupting normal life activities, obstructing economic development, and, in some cases, causing humanitarian disasters. Studies on specific issues of border regions are also published in Armenian scientific publications [9,10,11], but there are no studies on the principles of spatial planning - concerning population security.

States typically use the civil or "passive" protection toolkit, which includes the placement of shelters in structures for various purposes, lighting, rapid response systems, rescue operations, population evacuation, and first aid measures to ensure the normal life of the population in the regions under the constant threat of war. These measures are necessary and may somewhat reduce the level of vulnerability of territories and populations, especially during the hostilities.

Decent living standards in peaceful circumstances and the development of a system of public services that will give the populace some level of confidence in the future, however, are incredibly vital in the regions in question for preventing the inevitable pattern of emigration in such circumstances.

This paper assesses the problems of urban development factors affecting people's safety in war-prone areas, considers the characteristics of the territorial distribution of the network of settlements and infrastructures, and develops such principles of mutual connections and relations, which will ensure the availability of services for residents of all settlements in relatively peaceful conditions, and during operations will reduce the level of vulnerability of territories and the population, creating prerequisites for ensuring an adequate quality of life in these regions.

The study was conducted on the example of the realities that have been developed in the Meghri region in the south of the Republic of Armenia as a result of the 44-day war unleashed by the Republic of Azerbaijan in 2020.

The following aspects essential to the area were examined and assessed to meet the study's goal:

1. the geographical location, natural, economic and cultural potential,
2. inter-settlement relations, especially the territorial settlement and population,
3. existing infrastructure for the provision of public services and their distribution in the human settlements network.

Administrative and topographic maps of the region, the Meghri community website, and information provided to the author by community staff regarding the existing infrastructures in the community were used for the study.

Materials and Methods

General information about the region

In Soviet times, Meghri was the center of an eponymous administrative district. During the independence in 1995, 13 self-governing units (communities) were formed here[4]. In 2016, within the framework of the community consolidation program in the region, one community was formed in the center of Meghri, which included 15 settlements[5].

The community's population is 11.769, and over 80 percent of the population lives in Meghri and Agarak. The administrative area is 659.9 square kilometers[6].

Geographical location

Meghri region has exceptional geopolitical and strategic position, that is why it has been subjected to various conquests in different historical periods.

The region is not only a crossroads of important north-south and east-west infrastructures, but also an island that remains in proximity to transboundary regions with different historical, religious, and cultural values (Fig. 1).

It borders with the Islamic Republic of Iran from the south along Araks River, with the Republic of Azerbaijan from the east and with the Nakhichevan Autonomous Republic, which is part of the Republic of Azerbaijan and does not have a common border with it from the west (why this region became part of the Republic of Azerbaijan is a question of research in another area - let's say that in 1915 the number of Armenians in the Nakhichevan region was 55572[7], in 1926 - 11276[8], in 1989 - 1858[9], in 2009 - 6[10]).

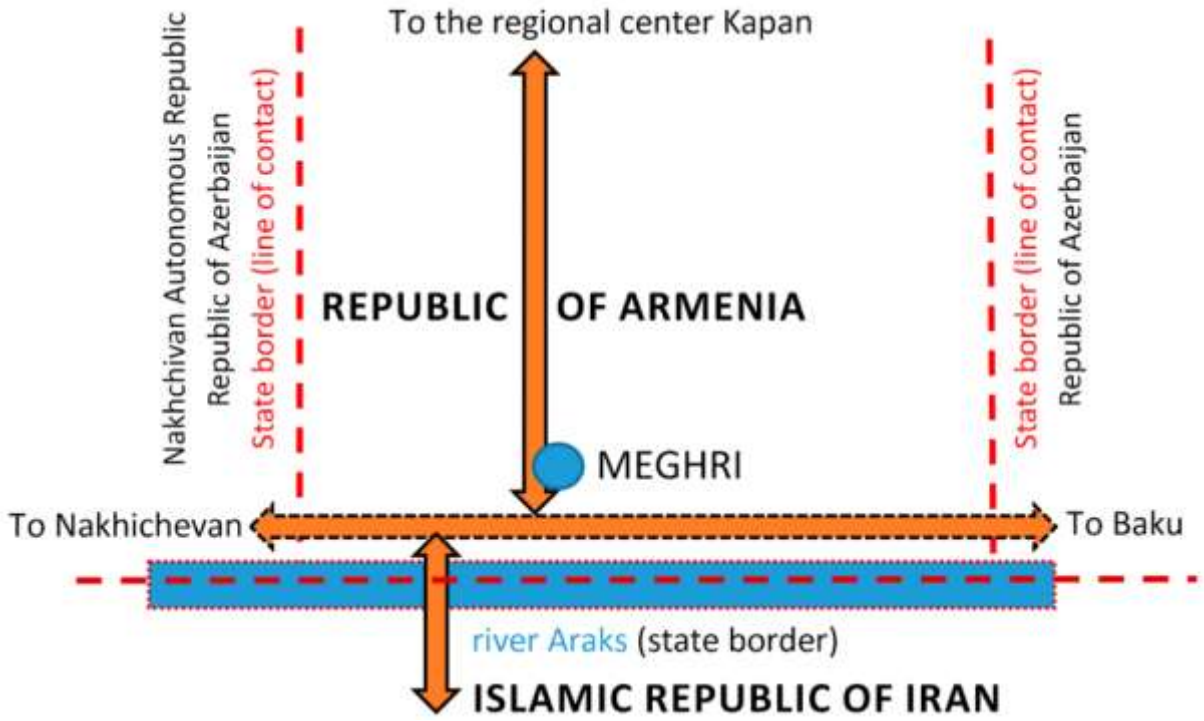

Fig. 1. *Geographical location of the Meghri community*

[4] Bulletin of the National Assembly of the Republic of Armenia, 9, 1995.
[5] Official Bulletin of the Republic of Armenia 2016.07.01/51(1231) (in Armenian).
[6] Meghri Municipality. https://www.meghri.am/
[7] Caucasian calendar for 1916 . https://www.prlib.ru/item/417321
[8] All-Union population census of 1926. http://www.demoscope.ru/weekly/ssp/rus_nac_26.php
[9] All-Union population census of 1989. http://www.demoscope.ru/weekly/ssp/resp_nac_89.php?reg=70
[10] http://pop-stat.mashke.org/azerbaijan-ethnic2009.htm

We can point out that Meghri serves as the single land connection between the Republic of Armenia and the Islamic Republic of Iran and generally with the outside world. The roads and railways in east - west direction have not been in operation since the Artsakh-Azerbaijani conflict began.

The Zangezour mountains dominate the region's western part, while the Meghri mountains dominate the northern and northeastern parts. The lowest point (374 meters above sea level) is in the eastern part of the state border on the river Araks, and the highest is the Parakan (Sisakapar) top of the Zangezur mountains (3826 meters above sea level), which speaks of different landscape and climatic manifestations on this small area, from dry subtropical to cold mountains[11].

Economic, natural and cultural potential

This region has both metallic (gold, molybdenum, copper, iron) and non-metallic (granite) minerals[12]. A copper-molybdenum plant, operating since the 19th century, is located in Agarak city. The gold concentrate is also mined in the region. Building materials, furniture, canning, bakery, and confectionery industries are available in the city[13].

As in other rural areas of the RA, agriculture is one of the key factors of life support and survival here as well, but with fragmentation and a few agricultural lands owned by citizens, agricultural activity is not a product but a social factor. "Arevik" National Park, "Boghakar" and the southern part of "Shikahogh" State Reserves are in the community's territory, which are rich in unique fauna and flora, including species registered in the Red Book[14].

The area is rich in monuments of historical and cultural heritage. According to the state list of immovable historical and cultural monuments in the region, there are 17 defensive monuments (fortresses, towers, etc.) built from the 1st thousand BC to the XIX century, and the remains of 28 settlements from the XIX century, 34 simultaneous cemeteries, 22 churches built in the 10th and 18th centuries, ten mills and six bridges built in the 17th and 19th centuries, as well as khachkars of different periods, secular buildings, etc[15].

Natural, economic, cultural, recreational, and other resources can serve as the most vital development factors in the presence of human resources and the formation of the living environment necessary for the normal functioning of these resources. The proper territorial distribution of settlements and population, as well as the infrastructure's territorial allocation for the proper functioning of people, is vital.

Territorial distribution of settlements and population and transport connections

Fig. 2 shows the schematic representation of the territorial allocation of the region's settlements and inter-settlement relationships. The distance from the community center is shown by the internal number next to the names of the communities (in kilometers), and the higher number indicates the time it takes to traverse that distance (minutes). It is worth mentioning that the two settlements do not have a permanent population (Tkhkut and Aygedzor). Like these settlements, Tashtun, Lichk, and Nrnadzor villages have a somewhat isolated position.

At the same time, except for Meghri, Shvanidzor, Lehvaz, and Vardanidzor, practically all settlements in the community are in a dead-end situation and are not provided with alternative transport links with the outside world.

[11] Meghri Municipality. https://www.meghri.am/

[12] Armenian National Atlas, vol. A. "Geodesy and Cartography" State Non-Commercial Organization (SNCO), Yerevan, 2007. https://www.cadastre.am/news/atlasA

[13] Meghri Municipality. https://www.meghri.am/

[14] Syunik Regional Governor's Office. http://syunik.mtad.am/nature/

[15] Annex 9 of RA Government Decision No. 385-N "On approving the state list of immovable monuments of history and culture that are considered state property of the Republic of Armenia and are not subject to expropriation", dated 15.03.2007. Official Bulletin of the Republic of Armenia 2007.05.04/23.1 (in Armenian).

Our studies have shown that the dead-end location of settlements has a significant impact on their crowding [12]. In the Republic of Armenia, the population of dead-end rural settlements is 30-80% lower than the population of villages with alternative external connections, regardless of the location. The mentioned factor is of particular importance in the border regions, as it will determine the effectiveness of the evacuation of the population in emergency or war situations.

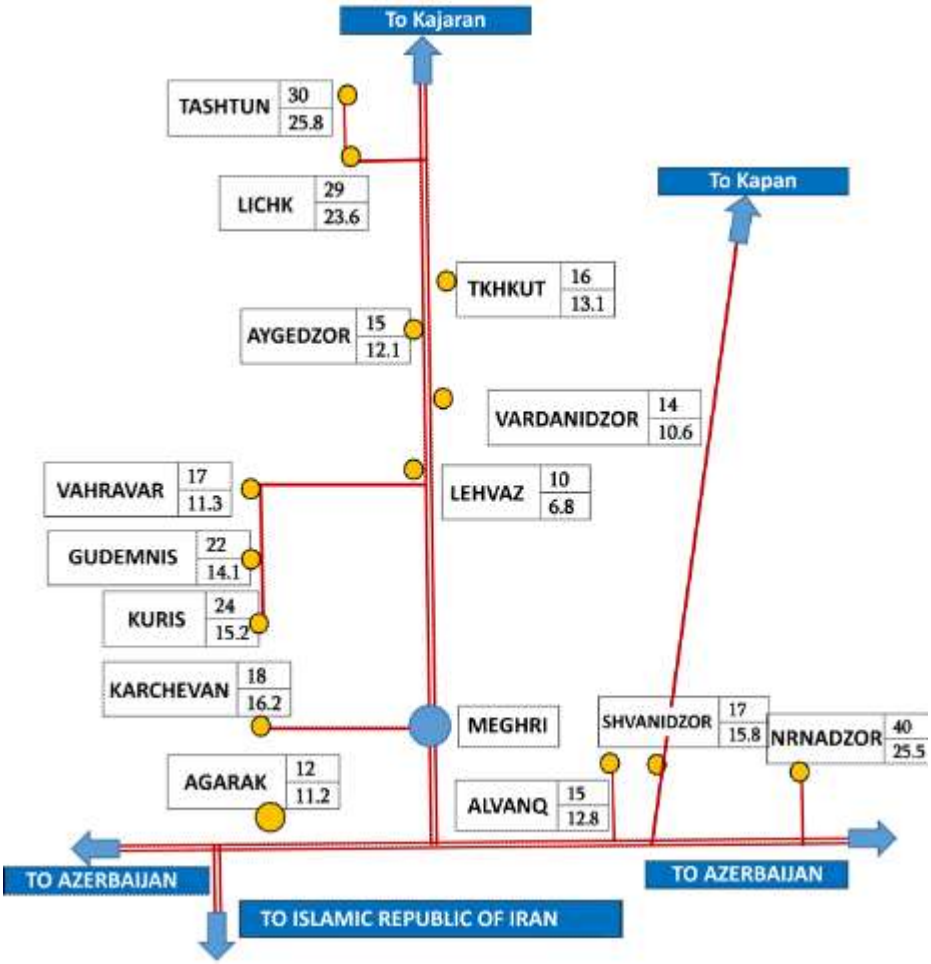

Fig. 2. *Territorial distribution scheme of the Meghri community*

This factor affected population dynamics, particularly in small villages (Fig. 3).

From 2001 to 2021, the population reduction was not observed only in the settlements next to the national and interstate roads (Vardanidzor, Lehvaz, Shvanidzor), which also have alternative transport links[16,17,18].

Furthermore, in terms of demographics, the most worrying situation is in Vahravar, Gudemnis, and Kuris villages, where the population is 30, 24, and 35 people, respectively[19]. If the current trends of population decline continue, these villages could become completely depopulated.

The Meghri community's five-year development plan for 2022–2026 was published[20] while this article was being written. It was found that in less than two years, Vahravar's population decreased by 3 people and made 27. In Gudemnis and Kuris, where 2 and 8 people remain, the situation is significantly worse.

[16] Statistical Committee of the Republic of Armenia. https://armstat.am/am/?nid=743
[17] Road map of the Republic of Armenia and the Republic of Artsakh. https://cadastre.am/storage/files/2018.jpg
[18] Statistical Committee of the Republic of Armenia. https://armstat.am/file/doc/99527423.pdf
[19] Statistical Committee of the Republic of Armenia. https://armstat.am/file/doc/99527423.pdf
[20] Meghri Community Five-Year Development Plan for 2022-2026 https://www.meghri.am/Pages/DocFlow/Def.aspx?nt=1&dt=Projects

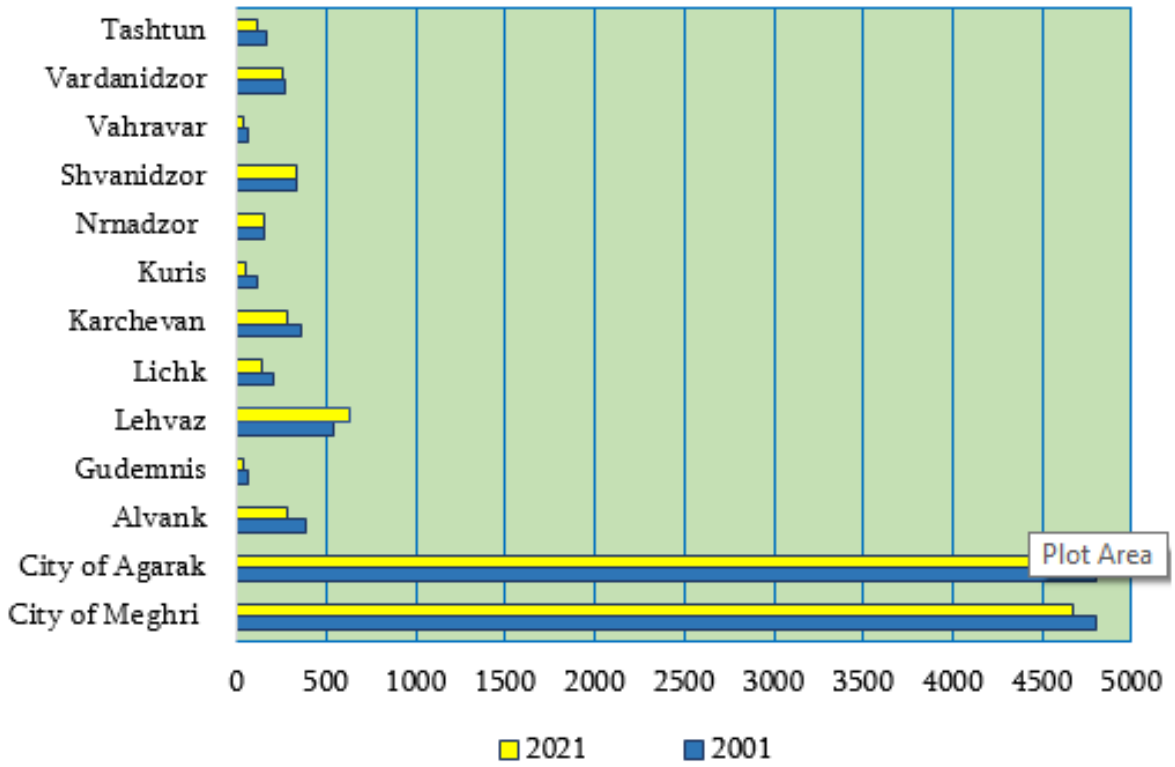

Fig. 3. *The dynamics of the population of the Meghri community in 2001-2021*

The solution to problems related to urban development is a necessary but not yet sufficient condition for the preservation of the most vital human resource in the region (and in general) and the cessation of emigration. To prevent the demographic catastrophe, let us touch upon some aspects of public policy (though not directly related to the subject of this study) in the following wordings.

The territorial distribution of infrastructures and the level of access to services

The level of access to public services is determined by the territorial distribution of settlements of various sizes, particularly in cities, because infrastructure for their provision cannot be provided in every settlement. The existence of infrastructure serving the primary needs of the population is vital in this sense.

Let us note, that when we refer to "primary needs," we do not mean the globally known set of indicators[21], which in the "Basic needs" includes food, primary healthcare, access to water and sanitation, safe shelter (including electricity), and basic education and quality health care are included in the "fundamentals of well-being". Moreover, it should be highlighted that this study bypassed the geographical distribution of infrastructures such as business, food, accommodation, and production facilities, the availability and effectiveness of wich are driven by the market and private sector investments. Problems related to the accommodation of higher education institutions, banks, notarial, and other services were also not studied, as we did not consider them as primary needs and access to which may exceed a 30-minute range.

Security, health, education, culture, and housing, as well as the infrastructures that provide emergency services to the latter, were considered the primary needs of the population. Among the primary needs, water and energy supply (electricity and gas) issues have a special place as mandatory components of livelihood. Without solving these problems, it is impossible to ensure the quality of life under any circumstances. In border regions, as a mandatory requirement, access to these services and alternative (reserved) possibilities of obtaining them should be considered.

[21] 2021. Social Progress Index / https://www.socialprogress.org/resources

Every settlement in Meghri has **electricity**. However, no settlement has a gas supply. Alternatives to the power supply are also nonexistent. Purchasing solar panels for kindergartens in Lehvaz, Shvanidzor, and Agarak is part of the five-year community development initiative[22]. However, this partial approach cannot be considered a complete solution to the problem, especially if we consider the fact that there are opportunities for wind energy use in the region[23].

The condition of the **water supply** cannot be considered sufficient either. Although the region is rich in water resources, the quality of drinking water is problematic. Due to the wear and tear of the water supply system, water losses reach large volumes, and frequent accidents lead to water pollution and deviations from sanitary norms. Like the daily regulation reservoirs, water supply networks need modernization or overhaul.

To clarify the scope of problems related to **population safety**, it should be noted that the traditional or "contact" methods for conducting wars are already being combined or even replaced by "non-contact" methods typical of "sixth generation" wars. In that case, non-traditional methods of warfare can play a crucial role (drones, the possibility of satellite positioning, infra and ultrasonic, electromagnetic, pulse, laser, and other types of weapons created using modern technologies) [13]. Therefore, modern technologies to counter the above weapons are of paramount importance, but this factor is the subject of research in another sphere. This research addresses the spatial placement of traditional civil or passive defense infrastructures directly related to spatial planning and aimed at population safety.

Access to health, education, sports, and cultural services, as required, was addressed based on the following principles:

a. Access components such as complete, up-to-date and reliable information about infrastructure, the availability of professional staff necessary for their provision, and the system of legal acts regulating the sectors have been bypassed. Only the availability of infrastructures and the time spent to use them were evaluated, in the case of individual infrastructures, also the possibilities of their alternatives,
b. Access of up to 15 min is mandatory in the case of the institutions under consideration for primary (polyclinic, outpatient) and emergency medical care, pre-school and primary schools, fire and rescue and emergency (water, power) services, civil defense facilities, and police,
c. 15-30 min of access is mandatory in the case of public schools, polyclinics, hospitals, health centers, clubs, culture houses or sports and cultural centers, and extracurricular institutions (technical, art, music, fine arts, sports schools, or educational centers),
d. Rcommendations on the territorial allocation of individual infrastructures will be presented by the principle of adding the "missing spheres".

The location of infrastructure for the primary needs of the population in settlements is shown in Fig 4.

Nrnadzor, Lichk, Tashtun, Vahravar, Gudemnis, and Kuris villages are the most vulnerable to public services. For the first three villages, the remoteness factor is problematic. For the remaining villages, the satisfaction factor of the population's basic needs and the complete lack of infrastructure is added to this factor.

Naturally, Meghri is practically provided with the main infrastructures that meet the primary needs of the population, and to some extent, also Agarak.

[22] Meghri Community Five-Year Development Plan for 2022-2026 https://www.meghri.am/Pages/DocFlow/Def.aspx?nt=1&dt=Projects

[23] Armenian National Atlas, vol. A. "Geodesy and Cartography" State Non-Commercial Organization (SNCO), Yerevan, 2007. https://www.cadastre.am/news/atlasA

Fig. 4. *Infrastructure serving the basic needs of the population in the settlements of the Megri community*

Results and Discussion

One of the main issues in the border areas is to ensure the **population's physical security**, which implies the availability of hiding places and bomb shelters equipped with means that meet the regulatory requirements for strength and reliability. Theoretically, the optimal option would be to include such opportunities in every building that can serve people, but from the standpoint of implementation, this appears improbable given the high expense and low social status of the beneficiary subject. The construction of centralized shelters, particularly in small communities, may appear to be the most effective solution, but here, the probability to locate them and vulnerability risks increase to a certain level. The most efficient way to construct a network of bomb shelters may be to make them accessible to relatively large groups of people in or near the objects of particular importance, ensuring people's placement in the shortest possible time and facilitating the solution of various organizational issues.

Among other means necessary for life support, in the shelters the provision of water and power supply with backup facilities should be considered mandatory. Given the industry specifics, we will refrain from offering targeted networking options. As passive defense measures, one can also consider the establishment of green fences and forest strips, limiting the visibility of rivals not only outside but also inside the settlements, as well as measures to cover the light of the structures from potential danger. Finally, with newly built facilities, it should be a mandatory normative requirement to provide shelters or hiding places, depending on the facility.

As we have already mentioned, in any border region, it is necessary to form alternative transport connections with the outside world, considering the problem of filling their "missing links" as a priority of

spatial planning. However, it is impossible to propose theoretically effective and practically complete options for solving the problem of dead-end villages in mountainous regions because of natural factors (broken relief and large slopes) and existing geopolitical realities. Nevertheless, it is possible to provide alternatives to external contacts that can partially mitigate this issue.

In particular, it is possible to solve this problem in the Meghri community with the scheme shown in Fig. 5. Accordingly, to fill the missing links on the highways, it is necessary to:

- modernize and overhaul Meghri-Karchevan and Karchevan-Kuris roads that were built but currently are unfit for operation, creating alternative connections for Gudemnis and Vahravar,
- to build a new road in the northern part of Tashtun, connecting it with the interstate highway,
- to build new highways that connect Nrnadzor-Shvanidzor and Alvank-Shvanidzor, giving these communities the option for external connections. It should be noted that the mentioned parts contain ground roads, which might be considered while creating design documentation.

Fig. 5. *Meghri region's alternative transportation link formation scheme*

It follows from the picture of the territorial distribution of infrastructures serving public services, presented in Fig. 4, that a relatively effective way of filling the missing links can be the formation of the following four bunches to ensure the primary needs (Fig. 6):

a. Shvanidzor bunch, providing up to 15 min of accessibility for the residents of Nrnadzor and Alvank. This option is possible only by constructing the Nrnadzor-Shvanidzor and Alvank-Shvanidzor roads shown in Fig. 3, because with the current road network, it is possible to reach Shvanidzor from Nrnadzor in 27 min.,

b. Lehvaz bunch, providing up to 15 min of access for residents of Vardanidzor, Vahravar, Gudemnis, and Kuris,
c. Meghri bunch, which will also include Agarak city and Karchevan village. From the standpoint of meeting basic needs, this bunch now can practically access all the services we consider primary,
d. Lichk bunch including Tashtun village. Note that providing access to services is a difficult task in this bunch from the perspective of economic efficiency. Nevertheless, it is possible to place infrastructures of at least minimum volume and quantity in Lichk, otherwise, the development prospects of these villages may be challenging.

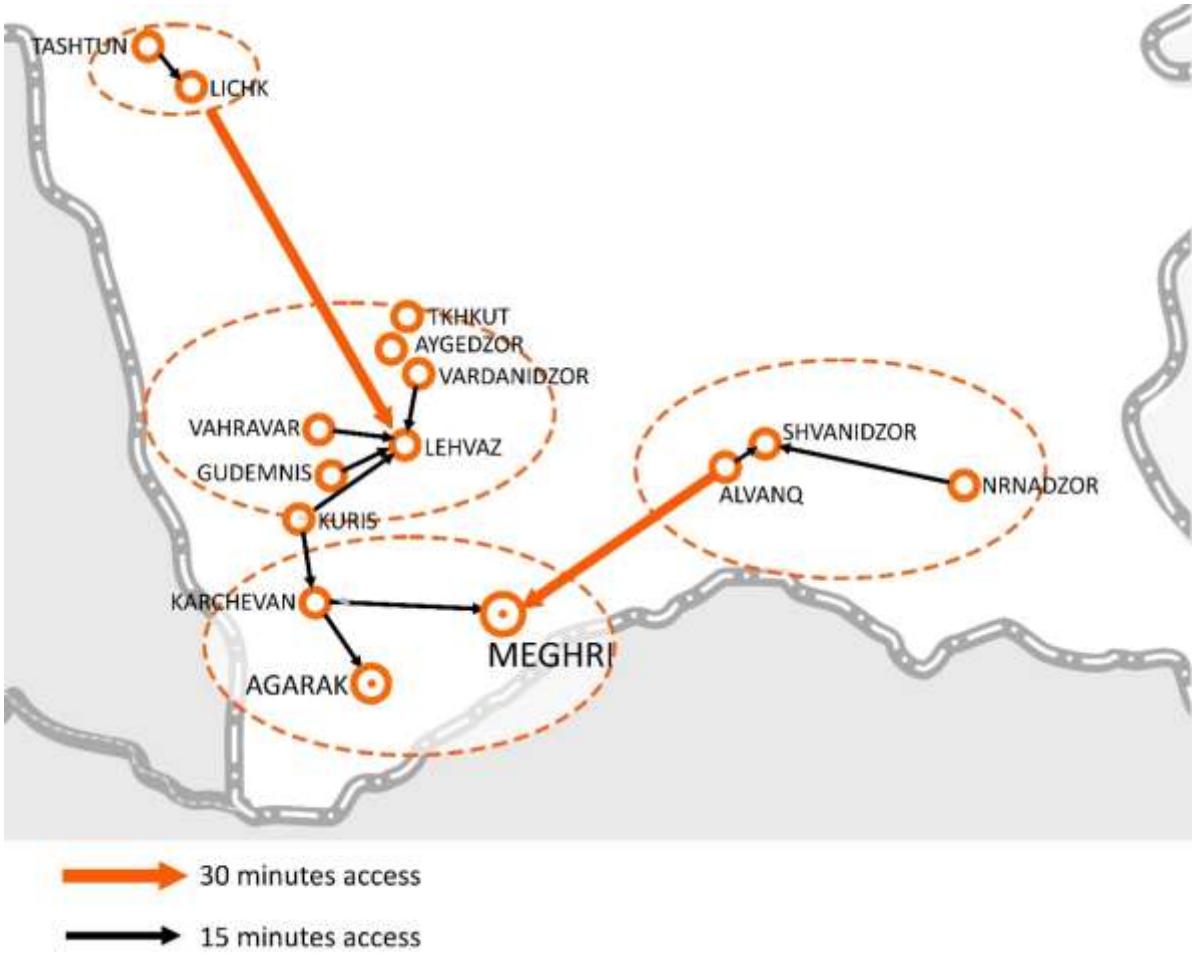

Fig. 6. *Proposed option for access to services serving the primary needs of the population*

In case of formation of the mentioned bunches, the problem of infrastructures assuming access of up to 30 minutes is also resolved by forming Meghri-Shvanidzor and Lichk-Lehvaz links.

Conclusion

The following concepts of spatial planning must be put into operation to ensure the security of the residential areas in border regions and other settlements where conflict is a continual threat:

1. Creating a network of passive protection infrastructures that will be available to all residents,
2. Creation of alternatives for external road transport connections for all settlements, excluding the cul-de-sac position of the settlements,
3. Designing a duplicated water and energy supply system,

4. Completing the missing links of the infrastructure necessary to meet the primary needs of the population requires merging them in certain settlements to ensure their access to the residents of all settlements, moreover:
   - Provision of up to 15 min of access to primary and emergency medical care, pre-school institutions and elementary classes, fire, rescue, and emergency (water supply, energy supply) services, civil defense facilities, and the police,
   - Provision of up to 30 min of access to schools, polyclinics, hospitals, health centers, clubs, culture houses, sports and cultural centers, and extracurricular institutions (technical, art, music, fine arts, sports schools, or educational centers).

With all this, as we have already mentioned, the application of the listed spatial planning principles is a necessary but not a sufficient condition for protecting the most important resource - people - and the prevention of population outflow. To solve this issue, it is also necessary to apply other sectoral measures of state policy, starting from exempting the rural population and business executives from all taxes, to subsidizing individual programs and applying grants.

The implementation of the mentioned measures is especially important for the Meghri community, considering its strategic importance.

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