

# Chapter 5

## Urban Development

The aim of this chapter is to identify opportunities and propose avenues in the framework of urban development and territorial planning. This is directed not only at providing better public health conditions for inhabitants, but also at improving environmental management as much as possible and integrating environmental considerations in all major socio-economic processes in regional, urban, city and district frameworks.

This chapter presents an investigation of the interrelationships between urban and environment fields, as well as a discussion of urban construction, and is focused on the protection of health in cities and other settlements (protection of the lithosphere, hydrosphere, atmosphere, and biota from negative impacts of urban areas and urban buildings).

In modern conditions, the ecological factor in urban development – i.e. analyses, forecasts, and synthesis of all components of the urban environment – should be stronger. A new approach should be elaborated for a rational approach to nature protection and urbanization, taking into consideration the conservation of potential capacities of the ecosystem.

Environmental impacts in Armenia are mainly determined not by the increase of the population, but rather by territorial dislocation. Armenia is characterized by a high level of urbanization – 66.8% of the population in 1998. For example, in the Ararat Valley the density of population exceeds 190 inhabitants per square kilometer, and in districts of urban agglomerations and in some densely populated villages it is 100 to 500 inhabitants and more per square kilometer. The city of Yerevan has a population of 1.2 million.

**Table 2.5.1 Urban population as a percentage of total**

1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
68.1	67.7	67.5	67.3	67.0	66.9	66.8	66.7	66.6	66.6	64.2

*Source: National Statistical Agency of RA;*

Urban areas are not a large share of total national territory.

Research shows, however, that large cities, especially urban agglomerations, have an impact on the environment extending 50 times more their own radius. Especially strong are urban impacts on soils, reservoirs, air basins, and growth. The main factors in the level of the anthropogenic pressure on the environment in the framework of urban areas are: the size of the urban agglomeration, the density of the population or of buildings, the economic characteristics of the urban area (industrial branches, level of development of public health functions), and the microclimate.

While providing a high level of housing and cultural and welfare facilities, large cities and urban agglomerations at the same time are notable for their high concentrations of industry and high densities of population, which lead to considerable pollution of the environment, imbalances in the labor force, irrational commuter movements, construction on valuable natural landscapes, etc.

City growth leads to higher vehicle numbers, polluting the urban-industrial environment even more and raising the noise level of surrounding settlements.

Increasing building densities (typical for large cities) not only significantly lower dweller comfort but also lead to overcrowding and epidemiologically unsafe contacts.

**Microclimate.** The key description of the urban environment is the microclimate, whose conditions are mostly determined by anthropogenic impacts and first of all by pollution; effects include the level of illumination, quantity of solar ultraviolet radiation, humidity, and frequency of fog.

One of the important components of the microclimate, with a significant influence on human organisms, is the temperature of the air. Average annual air temperature in a city is several degrees higher than outside. Overall, heat energy released by a large city like Yerevan is significant and reaches up to 5% of solar energy flowing into the city.

The level of ultraviolet radiation decreases in cities (this has a negative impact on people – heightened tiredness, irritability, metabolic diseases and so on). Bacterial air pollution rises. The relative humidity goes down. There are more windless days, atmospheric pressure and wind velocity is lower in cities, which leads to stagnation, severe contamination of the urban-industrial environment and increased morbidity of population with respiratory diseases.

The main pollution centers in Armenia are found in several cities, particularly industrial centers (Yerevan, Alaverdi, Hrazdan, Vanadzor, Ararat, etc.). Important sources of urban pollution in Armenian cities include motor vehicles, old municipal infrastructure, and low capacity (or lack of) sewage treatment plants.

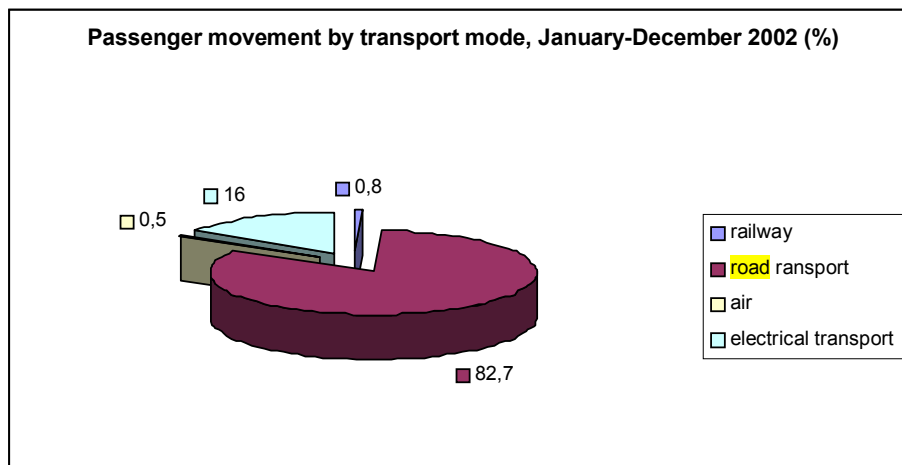
Without proper organization, in city centers automobiles create additional noise and pollution. The location of industrial enterprises within cities, including poor locations with respect to prevalent winds, has a significant impact. Cities situated in ravines with bad ventilation and frequent low temperature inversions suffer the most. Such conditions are found in Yerevan, Vanadzor and some other Armenian cities.

Motor vehicles are the main source of air pollution. Their growing numbers and the increasing mobility of the population opens zones of natural landscape available for citizens but these processes promote road construction and rising recreational loads on the natural environment.

**Transport.** The transport system of Yerevan and its agglomeration includes railways and roads for local and intercity passengers travel and cargo transportation. International, Republican, city, and local roads connect Yerevan with its agglomeration, with the Republic and with foreign countries.

103.6% of passengers have to travel on motor transport. The road network in the agglomeration most likely will not undergo major changes in the future. The section of highway between Yerevan and Edchmiadzin is extremely overloaded (more than 3000 passengers per hour). It has been proposed to build an additional 13 km of high category highway in this stretch.

**Figure 2.5.1**



Source: National Statistics Agency of RA;

After the earthquake in 1988, and with the independence and blockade of Armenia, the importance of air transport increased and it played a major role in the vital functions of the Republic.

Government Resolution No. 610 of 10.04.2003 confirmed the General Project of Settlement of the Republic of Armenia, under which a rational transportation network is elaborated with an improved index of transport settlement availability. Current conditions and the future development of roads, railways and air transport are examined. In the mountainous conditions of Armenia, however, road transport for external and internal travel is considered primary. In addition, for the first time an experiment was carried out for the creation of new communications network and its economic feasibility (productivity of capital investments).

The new network consists of a North-South artery, composed of a northern and southern junctions, and East-West branches. Total length of network would be 1249 km. The average cost per kilometer of the network is 1.016 million US dollars.

The section Aparan – Yerevan – Vedi – Eghegnadzor – Sisian – Dastakert – Kajaran – Megri – Iranian border of the North-South artery would be especially productive, and for its construction the return on capital investment would be 10-14%. The segment Sisian - Dastakert – Kajaran is very important for the Republic of Armenia, as construction of this road will shorten travel by 100 km in comparison with the existing one, and the problem of going around the towns of Goris and Kapan will be resolved.

If later the road network exhausts its carrying capacity, there will be a need to build a railway. A new railway line is projected parallel to the North-South road. For the success of this railway, it would be necessary to connect it with Ninotsminda or Akhaltskha in the north and with the town of Soufyan in Iran to the south, here joining the Central Asia-Europe railway. In this case, it has also been proposed to build the 35 km Vanadzor – Fioletovo railway line. The project also includes a provision for the reconstruction of the local airports of Megri, Kapan, Goris, Sisian, Germuk, and the building of new ones in Berd and Noyemberyan.

Under the project, the road network would connect towns and cities, covering all settlements of low density zones, based on the road availability level and provide resources for their use.

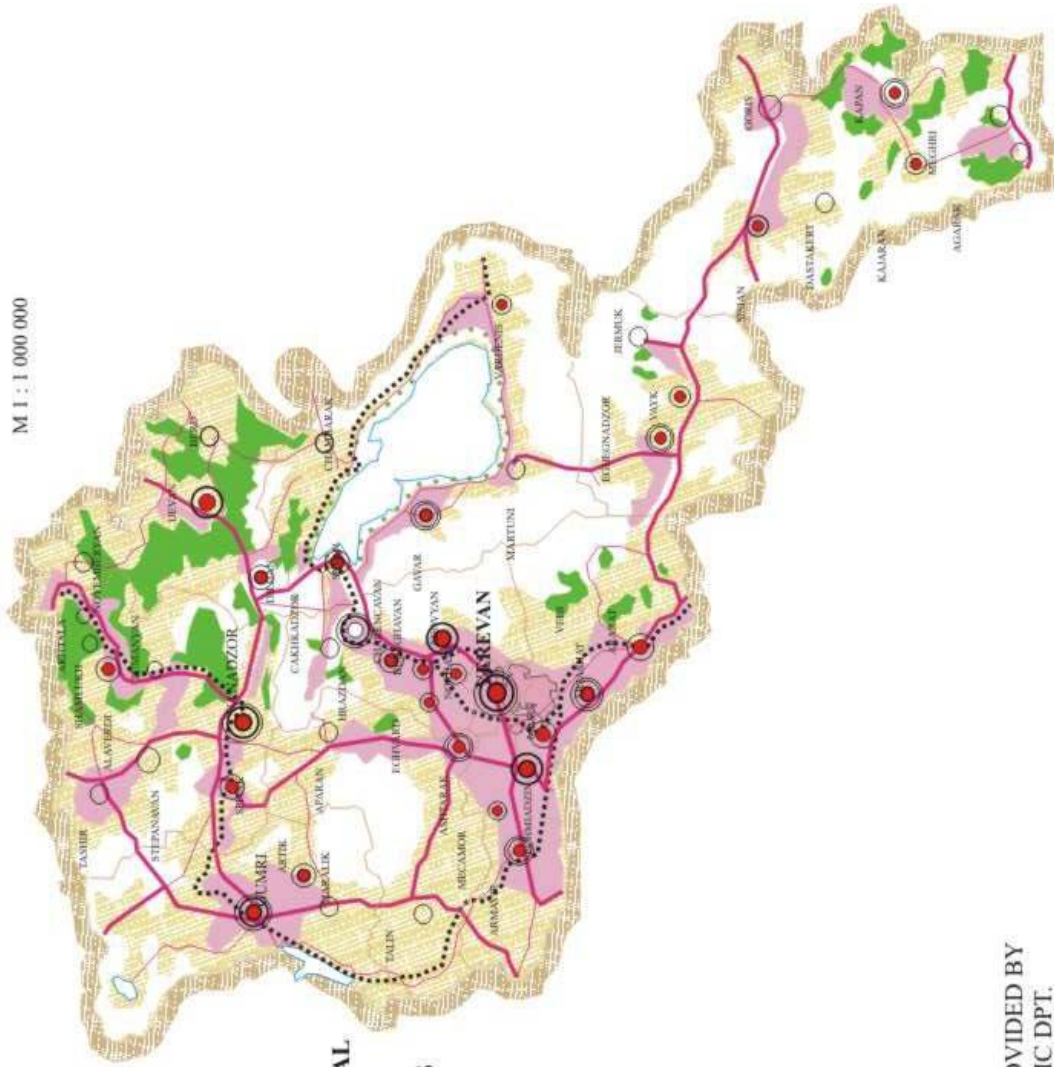
The proposed North-South transport communications corridor (motorway and railway) would be crossed by East-West branches on three levels, thereby increasing the accessibility and core importance of Marz-center towns.

***Interurban transport of Yerevan and city roads.*** The historical structure of Yerevan, located in complex topography that includes in particular the Hrazdan Ravine, which passes through the whole city from north to the south, has established city districts (with faltering nature) that in turn have determined the road network: both radial-circular roads and, within several areas, more complex patterns (rectangular, radial, circular and other planning forms). Transport between city districts occurs through the main radial roads. Travel between diametrically opposite areas goes through the city center. Existing roads and the absence of parallel, redundant motorways have led to significant traffic congestion, generated by inter-district as well as intra-district travel.

The existing main roads have, in fact, exhausted their normal carrying capacities: if Azatutiun Avenue has a load that is 92% of carrying capacity (the least congested road), Baghramyan Avenue has one at 165% (the highest loading). The average index of functioning capacity on city roads is about 115%, which is inadmissible. Taking into account current economic reforms, in the near future the transport conditions will be more complicated.

Buses, minibuses, trams, trolleys, and the Metro provide city transportation. Currently, significant changes are occurring in the structure of public transport: namely, there is a rapid reduction in electrically powered transport (such as trams) and an increase in the number of minibuses. The reduction in electrically powered transport is undesirable both from environmental and social points of view.

URBAN-ECONOMICAL SETTLEMENT OF RA TERRITORIES



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**LEGEND**

**TERRITORIAL ZONES BASED ON URBAN ECONOMICAL SETTING**

- intensive settling
- week settling
- unfavorable for settling

**TERRITORIAL ZONES OF NATURAL BALANCE**

**FORESTS, PRESERVES, RESERVES NATIONAL PART "SEVAN"**

- CITY SETTLEMENTS
- CAPITAL OF RA
- MARZ CENTERS
- CITIES

**COMMUNICATION WAYS**

- interstate significance
- republican significance
- railway

**BORDERS**

- state border
- Marz border



BASED ON THE INFORMATION PROVIDED BY CJS "ARMPROEKT", AND SCIENTIFIC DPT.

Transport system planning foresees a network of routes that will relieve congestion in the central part of the city by means of a ring road, from which radial routes will connect outlying districts with the center. The details of ring and other roads will be defined more precisely, naturally, in the work for the new General Plan of the City.

**Functional zoning.** Cities and urban agglomerations, industry and population are located irregularly across the territory of Armenia, which in some cases leads to excessive anthropogenic burdens (Yerevan agglomeration, the Valley of Ararat), breaking the environmental balance in quite vast regions.

Yerevan agglomeration has already greatly exceeded its demographic capacity; thus, the development of systematic actions for the improvement of the environmental situation is especially pressing.

The existing planning structure and functional zoning of Yerevan agglomeration, Yerevan city and other big cities of Armenia already do not correspond to the objectives of the sustainable development of natural and urbanized landscapes; they need radical regulation. The network of protected territories in the region is insufficient to preserve the biosphere's gene pool and the most valuable natural landscapes, and also to satisfy the public's growing recreational demand. The solution to this problem requires a review of the methods and directions of urban planning and development, as well as the development of sustainable agriculture and forestry in the central and other parts of the region with high density of population.

These problems can be resolved, through both the General Scheme and the Settlement Plan for the Republic of Armenia, via different economic, technological, ecological and architectural planning actions; among these, proposals for regional urban-ecological macro-zoning have great importance. The main elements of these macro-zoning proposals are the following:

- step-by-step elimination of irregular settlement;
- improvement and development of city and rural settlement networks, taking into account prospects of economic development and population growth;
- rational use of natural resources;
- allocation of industrial and civil construction, agriculture, transport and recreation; and
- resolution of environmental conflict situations.

An important arrangement in the process of town-planning and economic zoning is the regulation of all types of economic activity, taking as a basis environmental problem solving and the preservation of the ecological balance.

For urban planning and economic settlement, the territory of Republic Armenia is divided into the following zones:

- high-density settlement,
- low-density settlement,
- recreational and environmental areas;
- areas unfavorable for settlement.

Areas unfavorable for settlement comprise 16.7% of Armenia's territory.

In urban planning activities directed at the gradual elimination of irregular settlement, the primary objective is the organization of boundary zone areas, development of poorly settled zones, improvement of road and engineering infrastructure, and the protection of natural resources.

These proposals (contained in the Scheme for Project Settlement of the Republic Armenia) are important not only for the maintenance of the ecological balance of the region but also for more active functioning of local, natural town complexes and their natural zones. So, for example, the environmental effectiveness of branch system of squares and boulevards in the central part of Yerevan city is directly related to the state of the recreation area in Hrazdan River

Ravine, which passes through the city, Tcitsernakaberd Park, Yerevan Lake Park, forested park belts on the Nork and Saritagh Plateaus, and the green massifs of the Botanical Park. In turn, the suburban forest massifs – buffer green zones (which in the concept for the General Plan of Yerevan City will, possibly, be created in the southwest, south and northwest parts of Yerevan) – and other open territories must be connected to more extensive zones of stable ecosystems. This is necessary for a better distribution of anthropogenic burdens, for the conservation of water reservoirs and flows, for the free migration of animals, and so on.

Historically, many environmental problems of urbanized territories occurred because of the imperfect system of land tenure zoning and poor urban architectural planning. Very often during the process of planning and construction, environmental considerations were disregarded. An even more uncontrollable situation can be observed now. Violation of the national General Plan – the main planning document – through the illegal construction of housing blocks, commercial buildings and cafés, often at the expense of green zones, is a common occurrence for Armenian cities and especially for Yerevan.

Tree cutting in parks, squares, and gardens has ended the main functions of green zones – air quality improvement and acoustic insulation, as well as recreational use by citizens.

As a result, the system of trees and plants in Yerevan, in which the continuity and harmony of planting with landscape features of the city could be observed, has been severely broken.

Before the energy crisis, public green areas of Yerevan city (not including micro areas) covered 1193 hectares. It was planned to enlarge this to 2215 hectares by 2010; the area per citizen would increase from 9.6 m<sup>2</sup> to 17.1 m<sup>2</sup>. Massive trees cutting in cities in winter periods over the past 10 to 12 years has also led to a significant worsening of recreational areas.

Today, as a result of these problems, the public green area per citizen has decreased to 4-5 m<sup>2</sup> (based on expert evaluations). Nevertheless, there has been a slight increase in private green areas.

**Table 2.5.2 Public green areas in cities, including micro districts, per person (m<sup>2</sup>/per inhabitant)**

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Yerevan	87,2	87,4	87,5	87,4	86,4	86,4	85,0	85,0	85,1	85,1	64,1
Vanadzor	43,1	43,2	43,1	43,2	43,2	43,1	43,2	14,7	14,7	14,8	23,7
Gyumri	8,4	39,9	39,9	39,8	39,8	39,8	39,7	39,7	39,9	39,9	16,2
Kapan	18,0	37,8	25,5	25,5	25,4	25,4	46,8	104,7	104,9	104,9	107,2
Alaverdi	27,6	27,8	27,9	27,9	28,0	28,3	42,0	42,3	42,5	42,7	61,4
Diligan	59,7	60,2	59,9	60,7	60,9	60,7	60,7	36,0	36,1	36,1	57,1
Gavar	52,4	52,2	51,9	51,9	51,8	63,8	63,8	63,8	64,0	64,2	82,6
Hrazdan	47,9	47,9	48,0	48,3	48,1	48,1	48,2	48,4	48,5	48,5	5,9
Abovyan	10,8	10,8	10,8	10,9	10,9	11,0	27,0	27,1	27,2	27,2	37,7

*Source: National Statistics Agency of RA;*

The violation of functional zoning and the reduction in green areas are becoming an irreversible process. The restoration of green areas, especially in the central part of Yerevan, is not realistic, because all possible green areas were planned in the city's structure a long time ago under the previous general plan.

For local areas – settlement regions, urban agglomerations, cities and urbanized regions – the loss of the ecological balance can become a real disaster, consequences of which will inflict huge damage not only to nature but also to the economic and social sphere.

In forecasting city development, it is necessary not only to consider all that has happened due to myopic urban planning, but also to consider social, cultural and environmental criteria, as

well as urgent economic needs, reaching rational co-ordination in accordance with the principles of sustainable development.

Page 89, Picture **Urban – economical settling of RA territories**

**Legend**

**Territorial zones based on urban/economic settlement**

- high-density settlement
- low-density settlement
- unfavorable for settlement

**Territorial zones of natural balance**

- forests, preserves, reserves
- Sevan National Park;

**City settlements**

- capital of RA
- Marz centers
- Cities

**Transportation network**

- roads of interstate significance
- roads of Republican significance
- railway

**Borders**

- national border
- Marz boundaries

Based on information provided by CJS Armproekt, and scientific dpt.