Strengthening National Capacities for Urban Planning, Housing, Energy Efficiency and Disaster Risk Reduction

Workshop

Urban Planning and Development of Master Plans
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Yerevan, Armenia
Structure

- Hierarchical structure of planning system
- Energy efficiency and disaster risk reduction issues in urban development documents
- Examples of applying energy efficiency approaches in several towns of the Republic
- Anticipated concepts, projects and student proposals
Hierarchical Structure of Planning System.............
Levels of Spatial Planning:

- **Global – conceptual level**, which predicts the problematic segments and target guidelines,

- **National level** – Urban Development Strategy for the issues relating to coordinating and implementing activities, developed by the authorized body and including the system of strategic guideline principles in accordance with national peculiarities.
Implementation Model of Global Level Ideology

1. Main factors and structural elements
2. Urban management
3. Forecasting – planning - design
4. Insurance of regulatory – legal framework
5. Formation of financial – investment environment
Implementation Activities of National Level Ideology

The specific purpose of developing spatial planning documents is the definition of areas in accordance with their significance, the development of engineering, transport and social infrastructures on the assumption of the interests of the population in combination with other social, economic and environmental factors ensuring sustainable development of the territories.

The document expresses analysis of the territory, indicates issues and integrated development ways, rationalizes development options providing details for activity-related provisions, defines implementation stages, sets the list of key factors of natural and man-made hazards causing emergency situations and proposes ways to solve the identified problems.

The next phase is the detailed and functional zoning of urban areas which determines functional zones and regulations for their utilization through land-use and development rules based on the provisions of the construction documents of the previous phase.
Hierarchical Structure of Urban Design / Implementation Instruments for Designing Spatial Planning Levels

- RA resettlement project
- Regional planning projects
- General plans of communities
- Zoning projects
Schemes of Spatial Planning Levels
LIST OF BASELINE INFORMATION NEEDED FOR THE DEVELOPMENT OF DRAFT GENERAL PLANS OF the RA URBAN COMMUNITIES (SETTLEMENTS)

The list of baseline information materials for the RA urban settlements’ general plans includes:

1) seismic zoning and macro-zoning maps approved in the manner prescribed by law,

2) geotechnical zoning (conditions) map, as well as other information on geological conditions (including from Republican Geological Fund SNCO),

3) data on previously approved urban planning project-related and land use documents,

4) data on natural, historical and cultural monuments, as well as on their draft conservation areas and locations,

5) data on environmental condition, specially protected natural areas and on their conservation areas (if any),

6) data on the public use green areas, landscapes and recreational areas,

7) data on linear facilities in the area,

8) topographic sketch of the area.
9) cadastral maps (including the cadastral plans of build-up and unbuilt areas, real estate cadastre information on thematic layers),

10) land use maps,

11) other information on actual land use and subjects of ownership, as well as other data of the real estate cadastre,

12) data on the current situation of residential, public and industrial building, utilities, transport and engineering infrastructures,

13) information on the conditions of environment and natural resources, sources of natural and man – made emergency situations, civil defense, fire protection and sanitary conditions of the area,

14) copies of state and local government decisions on community development,

15) data on natural, health, recreational and other resources.
As for the drawings of the graphic part’s topographic surveys, **geotechnical, seismic micro-zoning**, cadastral and earthwork plans are used as basic plans.

**Planning of the comprehensive evaluation of the area (risk and boundary plans) demonstrate:**

a. cartographic documents on geotechnical zoning and seismic micro-zoning,

b. outlines of the mines registered in the Republican Geological Fund which are defined by mining allotment act, as well as tailings boundaries (if any) designed in operating mine projects,

c. areas unfavorable for land use or other construction purposes due to natural and man – made hazards.
Energy Efficiency and Disaster Risk Reduction Issues in Urban Documents
<table>
<thead>
<tr>
<th><strong>Fundamentals of Energy Efficient City Development in Harmony with Nature and with Minimal Risks in Urban Development Documents</strong></th>
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</thead>
<tbody>
<tr>
<td>Balanced and rational use of resources without harming the environment: resource extraction should come short of the renewable in its volume, as well as state-of-the-art technologies should be used in order to increase the environmental performance indicators and for their efficient utilization,</td>
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<tr>
<td>Utilization of new, alternative renewable resources,</td>
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<td>Integration of nature protection and urban development,</td>
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<td>Meeting the main human needs,</td>
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<td>Minimizing natural and man-made hazards threatening the population, through urban development,</td>
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<td><strong>Protection of ecological integrity,</strong></td>
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<td>Throwing out the currently used energy and resource-intensive technologies maximally polluting the environment for the benefit of modern energy efficient technologies with minimal environmental impact,</td>
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<td>Transition to new management structures and methods which could ensure more effective resource and environment protection.</td>
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Energy Efficiency Improvement Activities in City Planning Documents

• In order to increase energy efficiency in cities, we propose modernization and replacement of outdated electrical grids,

• As for innovative approaches, we propose (alternative) utilization of renewable natural energy for buildings and structures’ energy supply. It includes application of solar cell batteries, wind engines (turbines), biogas both in already constructed buildings and in buildings to be constructed,

• As for prospective energy efficiency activities, we propose heat insulation of the facades of already constructed buildings through special cases. This activity also helps give aesthetic appeal to typical dull-looking buildings,

• Installation of control systems for triplex windows, as well as for heat and light regulation in residential and service areas,

• As for historic buildings, external thermal insulation cladding will be done from inside.
GORIS CAVE VILLAGE

CURRENT STATE OF THE CAVE VILLAGE
When Organizing Areas’ Urban Development

Activities aimed at ensuring energy efficiency are implemented through optimum planning arrangements, dimensional solutions and by constructing energy efficient residential and public buildings.

The system of interconnected energy saving urban development activities includes introduction of the following requirements:

• To exercise the principle of constructing energy efficient buildings with favorable position when organizing the planning units,

• To ensure building compactness of planning units by regulating the build-up density,

• To consider windbreaks during new build-up of towns and when establishing residential complexes to reduce heat losses,

• Applying building extensions through reducing potential heat loss surfaces (which is applied to some extent in settlements, even in the framework of historical build-up of Goris),

• Extensive use of underground areas for placing objects not needing natural lighting.
• During the existing open build-up reconstruction to review the segments causing drafts, through creating semiclosed spaces.

• During constructing/reconstructing each segment to take into consideration the ecological and climatic data of the territory: temperature-moisture regime, solar radiation, amount of light radiation, main architectural and dimensional solutions aimed at energy saving,

• Ensuring thermal equilibrium throughout the buildings by choosing the efficient variant of orientation when taking into consideration the direction of the prevailing winds,

• Considering buildings with pipe culvert planning solutions in the scope of build-up for windbreak purposes,

• Maximum consideration of apertures in facades of both favorable and unfavorable orientation.

• Applying external thermal insulation cladding by translucent constructions with highly efficient insulation.

• Maximum use of natural lighting.
Disaster Reduction Issues

The Level of General Resettlement Project
The Level of Spatial Planning Project
Seismic Risk Reduction Issues

Baseline data needed for seismic risk evaluation

1. Checking the number of storeys both in (high-rise residential and low-rise private) buildings,
2. Inventory of multistorey residential and public building types and significance,
3. Determining the level of emergency in the stock of buildings in disrepair,
4. Determining the average population density,
5. Determining the number of people living in buildings in disrepair,
6. Identifying the fire-prone areas in the city.
Spatial Seismic Microzonation Map

Условные обозначения
Ожидаемые максимальные ускорения в зонах (в долях г)

0.32
0.40
0.44
0.48
0.48*

Пригодны к строительству после применения инженерных мероприятий
Map of Buildings’ Damage Level and Seismic Risk of Collapse
Fire Danger Map of the Area
Casualties Risk Map
Distribution Map of Different Buildings in Disrepair
Scheme of Emergency Situations and Disaster Reduction Activities
Factors activating geological processes:
River flood plains, where every year floods damage premises,
Steep (>30°) slopes, where deforestation for the purpose of irregular build-up and abrupt slopes have caused landslides.

Activities required for engineering preparation works:
- Carrying out afforestation works in flood hazard river basins,
- Repairing and cleaning riverbed mudflow accumulations, coastal areas and mudflow tunnels,
- Riverbank strengthening works,
- Constructing riverbed hydrotechnical structures,
- Prohibition of deep cut slopes,
- Gradual cleaning of slip-hazard build-up areas from structures and carrying out tree planting works.
Energy Efficiency Issues

Structure of the Utilization of (Available) Energy Resources

At global level

- Oil
- Gas
- Coal
- Nuclear energy
- Hydro-geothermal-solar-wind
World Energy Balance Predictions until 2100

(according to EPIA data) European countries account for 81% of the alternative energy market.
There are a series of factors in the RA territory facilitating the development of alternative energy.

- Climate conditions,
- Tariff (1 kWh power capacity reduces the annual cost by 5-15%),
- Environmental standards,
- Initiatives of local government authorities (regarding the utilization of solar or other renewable energy resources).
Examples of Alternative Energy Application in the RA Territory

“Lori 1” wind farm at Pushkin mountain pass (Lori marz, 2005) with 2,64 MW total installed capacity.

Local initiative: installation of one wind turbine.
Thanks to its geographical conditions, the average annual amount of solar energy flow per square meter of horizontal surface is about 1720 kWh, while for the ¼ of the country’s territory this number exceeds 1850 kWh/m².
### Sunshine duration, hours

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### Number of sunless days

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Analytical findings are summerized in the form of envisaged sustainable - smart urban development activities in the framework of spatial planning documents development for settlements.

Sustainable buildings:
- Establishing (reconstructing) energy efficient buildings,
- Effective arrangement of areas,
- Up to 30-50 % reduction in energy costs at the cost of reducing losses,
- Utilization of renewable (alternative) energy.

Sustainable water:
- Reduction in water consumption through saving each apartment’s drinking water use,
- Maintaining and improving water quality, as well as the opportunities of using rainwater for technical purposes.

Sustainable infrastructure:
- System of competitive communication lines,
- Improvement of internal networks,
- Withdrawal of the transit road from the town,
- Restrictions of motor traffic in the Old Town for the benefit of bicycle and electric transport vehicles,
- Establishment of pedestrian network,
- Upgrade and improvement of engineering infrastructure networks, establishment of smart (sensor) lighting system in public facilities.
The results of urban development should be subject to analysis after previously adopted timed intervals, comparing the achieved results with basic strategic guidelines (in reporting forms).

The mentioned should first determine the effectiveness of the implementation of development principles in the highest level, if necessary, make appropriate adjustments.
Examples of Energy Efficiency Application in the Cities of the Republic.............
Examples of Implemented Energy Efficient Urban Development Solutions in the Republic

In the RA, we can already name the first example of energy efficient green building – it’s the building of the International School in Dilijan city, which is soon to be completed. It intends to receive the environmental LEED certification.

• It’s being implemented through applying the highest international standards and technologies taking into account local characteristics, such as the relief, temperature-moisture and solar radiation regimes, total precipitation, etc.
• State-of-the-art technologies and materials have been used during the construction, the majority of which have not been previously used in Armenia. 1000 m³ of the building walls are designed to be covered with vegetation.
Energy Efficient Social Building in Goris
The walls, roof and the floor have been insulated with special insulation materials.
The originally planned 50cm width of rubble concrete walls have been reduced into 30cm reinforced concrete walls through applying the above mentioned insulating material, i.e. coating the walls with insulating layer.
Installation of insulting layers
Installation of energy efficient windows with special equipment, which provides ventilation without causing drafts and insect invasion.
Envisaged concepts, projects, student proposals
It’s planned to implement a technopark project in Gyumri town by applying the principles of green architecture.
A part of the energy used in the complex is generated by solar arrays.
Teamwork of the National University of Architecture and Construction of Armenia and the National School of Architecture of Saint Etienne, France
Modernizing a certain segment of Ajapnyak district of Yerevan (where there are a certain number of buildings in disrepair) through using energy efficient cases, increasing seismic safety of buildings, improving the plan structure, as well as through planting greenery.

Այդ վայրի կառուցվածքի մեջ գտնվող ճանապարհային աշխատանքների մեջ է ներառվում երկրաչափական առավելությունների խմբագրման: Այս խմբագրմանը կարող է անցնել այնպիսի փուլերով, ինչպիսիք են: Առաջինը էներգետիկի կարևորությունը, երկրորդը երկրաչափական առավելությունների խմբագրմանը, երրորդը շինարարական առավելությունների խմբագրմանը և չորրորդը ջրային պատճառների խմբագրմանը: Այս փուլերի ընթացքում կարող է անցնել նաև զբաղվածության խմբագրման:
Thank you for your attention.

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