ECOLOGICAL PRINCIPLES OF URBAN DESIGN

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Abstract: *For the first time in the Republic of Moldova were developed two Practical Codes - one for the design of green buildings, the second for greenery. The codes contain a series of design principles in the field of urbanism, which must be the basis for the elaboration of urban planning documentation for projects with low impact on the environment. The principles are set out below in a structure based on several requirements, which will have areas of applicability depending on the type of urban planning documentation developed (PUG, PUZ or PUD).*

Keywords: PUG, PUZ, PUD

1. Introduction

The ecological design codes CP A.07.08:2020 and CP B.01.01-2020, developed for the first time in the Republic of Moldova, aim to transform the construction sector at the local and national levels thru solutions and measures taken into account during the development of urban planning documentation, in order to achieve the following goals:

a) Improving the health and well-being of the citizens of the Republic of Moldova;

b) Protecting and restoring water resources;

c) Protecting, enhancing, and restoring biodiversity and ecosystems at local and national levels;

d) Promoting sustainable and regenerative cycles for material resources;

e) Designing urban complexes in harmony with the environment.

The aforementioned practical codes list a series of urban planning design principles that should be the basis for the development of urban planning documentation for projects with a low environmental impact. These principles are presented below in a structure based on several requirements. Each requirement will have a scope of applicability depending on the type of urban planning documentation prepared (Master Plan, Zonal Urban Plan, or Detailed Urban Plan). Thus, depending on the field, there are principles that are applicable only to the preparation of urban planning documentation such as the General Urban Plan (GUP), the Urban Zoning Plan (UZP), or the Detailed Urban Plan (DUP), all together or only some of them.

Each requirement aims to encourage and implement specific development strategies at the local or national level.

2. Methodology

Green public spaces. For the Urban Planning Document (PUG), Urban Planning Zone (PUZ), and Urban Planning Detail (PUD), the designer will include measures in the urban planning documentation for community access to green public spaces, including at least one of the following requirements:

- Ensuring a minimum of 6 m² of green public space per person, calculated within the boundaries of the analyzed territory.

- Locating 90% of the units built at a minimum walking distance of 800 m from public green spaces.

For areas with a dominant commercial or industrial function:

Green areas will constitute at least 5% of the total area of the territory analyzed. The following green areas will not be taken into account: Green islands smaller than 200 m², separated on all sides by road traffic; green spaces less than 15 m wide that are part of the road protection zone.

Conservation of the natural environment. For the Master Plan, Zonal Urban Plan, and Detailed Urban Plan, the designer will include the following provisions in the urban planning documentation:

- 30% of the existing natural relief will be preserved, rehabilitated, and consolidated using the existing vegetation in the respective area.

- The existing relief will be emphasized by the project's esthetics.

Tree-lined pedestrian walkways. For the GUP, ZUP, and ZUD, the designer will include in the urban planning documentation at least one pedestrian alley with trees planted on both sides. The total length will be at least 100 m.

Reducing the public parking footprint. For the Urban Planning Document (PUG), Urban Zoning Document (PUZ), and Urban Development Document (PUD), the designer will prioritize underground parking with vertical density in the urban planning documentation.

3. Results and discussion

Sustainable urban expansion. For the Urban Development Plan (PUG), Urban Zoning Plan (PUZ), and Urban Development Plan (PUD), the designer will include development principles within (where applicable) and near the existing urban fabric, which already has public transport infrastructure and engineering networks laid out. The newly designed urban areas will be directly connected to the existing urban fabric, avoiding built-up urban islands. The planning process will take into account the possibility of connecting to the existing engineering infrastructure using the shortest route possible (no more than 1 km from one of the necessary engineering infrastructure networks: water supply, sewerage, electricity, gas).

Natural disaster prevention. For the Local Urban Plan, the designer will avoid specifying built-up areas on land at risk of flooding and landslides.

Pedestrian paths and bicycle lanes. For the Master Plan, Detailed Urban Plan, and Detailed Urban Development Plan, the designer will include pedestrian paths for access to nearby facilities with a minimum width of 1.5 m and two-way bicycle lanes with a width of 2 m in the urban planning documentation.

Access to active recreation facilities. For the Zonal Urban Plan (PUZ) and the Detailed Urban Plan (PUD), the designer will include at least two of the measures detailed below in the urban planning documentation for residential complexes:

1) Children's playgrounds located a maximum of 50 m from the entrance to residential units;

2) Sports facilities (outdoor fitness, football fields, basketball, tennis courts, ping-pong, chess, etc.) within a maximum distance of 100 m from the entrance to the residential/accommodation units;

3) Ensuring a standard of 0.5-0.7 m² of playground space or sports facilities per inhabitant.

In the case of other urban complexes, a minimum of 1.5 m² of active recreation facilities must be provided for every 1000 m² of built-up area.

Preserving the spirit of the place. For the Urban Planning Documents (PUGs), the designer will include measures in the urban planning documentation to avoid excessive contrasts (street grid, height regime, and function) generated by the planned urban areas in relation to the existing urban fabrics in the vicinity.

For Zonal Urban Plans (PUZ) and Detailed Urban Plans (PUD): The urban planning documentation will be based on a study (in written or drawn form - analysis

plans) regarding the urban context in which the designed objective is to be located.

The contextual study must necessarily include: 1) A study of historical periods and how they influenced the site plan and the spirit of the place;

2) Identification of cultural and historical landmarks around the project site;

3) Proposals for harmonizing urban planning solutions with adjacent urban fabrics.

Remediation of industrial sites. For urban plans, projects developed on decommissioned industrial sites are encouraged. In the case of decommissioned industrial areas, the designer will include decontamination measures, where applicable, and area revitalization in the urban planning documentation.

Development of the public transport system. For the Master Plan and Zonal Urban Plan, the designer will include measures in the urban planning documentation for the location of a number of public transport stops at a distance between 500 m and 1000 m. Bus lanes will be separated from the rest of the traffic lanes.

Compatible complementary functions. For the Master Plan (PUG), Zonal Urban Plan (PUZ), and Detailed Urban Plan (PUD), the designer will include various complementary functions (commerce, services, public catering, education, etc.) in the urban planning documentation to cover as wide a range of the population's needs as possible. The complementary functions will be compatible with the proposed dominant function.

For residential complexes: the provision of at least 5 different complementary functions.

For other types of urban complexes: the provision of at least 3 different complementary functions. Complementary functions will be located at a maximum distance of 400 m from the neighborhood center.

Charging points for electric transport. For the ZUP and ZUD, the designer will include in the urban planning documentation public parking spaces equipped with charging stations for electric cars with a minimum power of 5 kW. At least four public electric vehicle charging points will be provided for every 100 parking spaces.

An open and connected community. For the Urban Planning Document (PUG), Urban Zoning Plan (PUZ), and Detailed Urban Plan (PUD), the designer will include in the urban planning documentation connection routes between the analyzed site and adjacent areas thru pedestrian paths, bicycle lanes, underground and overground pedestrian crossings, and roadways. This will encourage joint activities and connections with the rest of the locality thru various types of transport networks.

Access to civic and public spaces. For the Master Plan, Zonal Urban Plan, and Detailed Urban Plan, the designer will include the following measures in the urban planning documentation:

1) Placing rest benches along the pedestrian paths. Benches must be placed at least 50 meters apart, covering all pedestrian routes within the area.

2) Establishing at least one meeting place for community members (e.g., a resting area around a body of water, an amphitheater with an outdoor stage, etc.).

3) Ensuring open spaces that improve community engagement and public health, in proximity to residential and office areas.

Reusable structures. For the Zonal Urban Plan (PUZ) and the Detailed Urban Plan (PUD), the designer will include the following measures in the urban planning documentation:

1) In the event of the presence of disused or abandoned buildings on the site territory - the preservation of at least one existing building on the site territory (if the structure is in good condition). The developed area of the reused building(s) will be as large as possible, but not less than 200 m2.

Note: The building(s) are to be reused/rehabilitated and repurposed for a specific purpose.

2) Encouraging the extension of the lifespan of buildings and the conservation of existing material resources. Reducing construction waste during demolition.

Avoiding environmental damage from the production of new materials and on-site transportation in the case of new buildings being constructed on the sites of old ones.

Recycled and reused materials for infrastructure. For the Zonal Urban Plan (PUZ) and the Detailed Urban Plan (PUD), the designer will include the following measures in the urban planning documentation:

1) Encouraging the reuse of materials from demolitions in new outdoor landscaping: pedestrian paths, parking lots, roadways, street furniture, etc.

2) At least 50% of the material used for outdoor landscaping must come from recycled construction waste.

Stormwater management. For the Urban Planning Document (PUG), Urban Zoning Plan (PUZ), and Urban Development Plan (PUD), the project will include open-type retention basins in the urban planning documentation for collecting rainwater. Rainwater will be collected in an organized manner and discharged into artificial basins equipped with vegetation and infiltration elements.

Energy performance of buildings. For the ZUP and ZUD: the designer will include the following measures in the urban planning documentation to encourage energy consumption optimization and reduce maintenance costs throughout the urban complex, as follows:

1) The building envelope elements must have at least the following thermal transfer coefficients, including the correction of values to compensate for the thermal bridge effect: - Exterior walls must have a U value ≤ 0.24 W/m²K (± 0.02);

- The exterior walls of the plinth related to the basement or semi-basement must have a U-value of ≤ 0.24 W/m2K (± 0.02);

- The floor separating the heated space from the cold attic or exterior space must have a U-value of ≤ 0.20 W/m2K (± 0.02);

- The floor separating the cold basement from the heated upper space must have a U-value of ≤ 0.30 W/m2K (± 0.02);

- The windows must have a U-value of ≤1.30 W/m2K;

- Doors must have a U-value of ≤ 1.80 W/m2K;

2) The measure applies to a minimum of 80% of the Total Developed Area of the urban complex buildings and is rounded up to the next building with a margin of 5%.

3) The calculated Total Developed Area will not include buildings that are architectural monuments or buildings that do not have an internal heating system.

Energy efficiency of outdoor lighting networks. For the ZUP and ZUD, the designer will include energy-efficient lighting fixtures for outdoor network lighting in the urban planning documentation.

Reducing light pollution. For the ZUP and ZUD: the designer will exclude the use of spherical lighting fixtures from the urban planning documentation, using only downward-directed lighting fixtures. A minimum level of nighttime lighting will be used in accordance with national legislation. Facade lighting will be avoided as much as possible.

Urban heating. For the Urban Development Plan (PUG), Urban Zoning Plan (PUZ), and Urban Development Plan (PUD), the designer will include in the urban planning documentation the connection of buildings to the city's heating network. The urban complex will be fully supplied with heat from the centralized urban heating system.

Management of municipal and similar waste.

For the Urban Planning Document (PUG), Urban Zoning Plan (PUZ), and Detailed Urban Plan (PUD), the designer will include municipal waste platforms in the urban planning documentation that allow for sorting solid waste into at least four categories (paper/cardboard, plastic/metal, glass, residual) and the proper disposal of hazardous waste such as: lighting fixtures containing mercury or other hazardous substances, batteries, and electrical and electronic equipment.

Innovative solutions. For the Urban Development Plan (UGP), Urban Zoning Plan (UZP), and Urban Development Plan (UDP), the designer will include innovative measures in the urban planning documentation, such as:
- Large-scale use of renewable energy sources - photovoltaic parks, wind turbines installed on building roofs, etc. - which in total can cover more than 5% of the urban complex's energy needs;

- Achieving superior energy efficiency performance thru thermal insulation of building envelope elements, obtaining thermal transfer parameters superior to those indicated in the section "Energy Performance of Buildings";

1) Converting disused industrial complexes into social-cultural complexes or residential areas, preserving a large portion of the existing buildings;

2) Providing multi-story public parking on the borders of the historical centers of localities, thereby encouraging walking in areas with potential for tourist attraction;

3) Rehabilitation and valorization of a natural water basin located within the study area.

4. Conclusion

CP will establish principles and methodologies based on which sustainable, green buildings that comply with ecological principles can be designed, while also being energy-efficient constructions.

This Code of Practice can serve as the basis for an ecological building assessment and certification program, similar to the European BREEAM and DGNB, and the American LEED, which have been used worldwide for over 25 years.

The benefits of certifying buildings according to environmental standards are enjoyed by all participants in the construction process: from developers, investors, designers, contractors, and undoubtedly the final beneficiaries of the building and their employers.

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