Courtyards Should Be Green Today

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Abstract. The article raises domestic space organization issues. Courtyards are considered as available recreational space in the structure of urban development affected by the environmental, spatial, physical and technical aspects of yard space. Special attention is paid to the improvement of the quality of the living environment. Phytoecological environment is seen as a way to improve the qualitative characteristics of residential development. The options proposed for modern residential development include indoor type courtyards. In the described embodiment the construction of the environment anthropogenic characteristics are decreased in comparison with the traditional type of buildings.

1. Summary
In the article an analysis of the reasons for formation of hostile environment in the yards during the urbanization of the area is given. Also, some issues of outbuildings-construction are considered with the necessity of improving the ecology of the area, including planting the greenery, taken into account.

2. Introduction
A modern courtyard is a polyfunctional area meant for complex employment by the population [1]. In the first place, it is meant for recreational, leisure and economical needs of the population. In accordance with the present standards of outbuildings-construction it is necessary to take into account the planting of greenery, construct playgrounds for children and sport areas intended for mass employment [2-4].

However, nowadays courtyards often become hostile man-made environment over a variety of factors [5]. This tendency is true not only for overpopulated cities, but also for towns and regional centers.

Hence, it is necessary to reconsider the current principles of yard-territory-construction [6-8].

3. Subject, tasks and methods
The subject matter of the study are courtyards in Moscow (urban area with population density of 4910,43 per km²) and Tula of Tula Oblast (as an example of an administrative center with population density of 3804,43 per km²).

The scope of the study are the principles of courtyards-formation as part of the system of ecological land-development of the modern architectural urban area [9].

The aim of the study is the research of reasons for ecological deterioration of the habitable area and the composition of a list of recommendations for changing the principles of constructing the urban area and for improving its ecology.
The studying methods include:

- Field observations with employment of photographical fixing of buildings;
- Survey of the population in form of group questionnaire;
- Systems analysis of reasons for formation of hostile ecological environment in the courtyards;
- Experimental design and integrated assessment of the solutions.

4. Results and Discussion

Most unfavorable ecological state of the area is explained by a variety of reasons:

1. Lack of well-equipped parking lots in the vicinity of the residential constructions.

Dew to global motorization courtyards become places for public parking. As an example, we take two average courtyards in Moscow: 1 – system construction of 5-9-storey buildings of the year 1970, calculated number of flats – 100; and 2 – panel construction of 25-storey houses type tower of the year 2013, calculated number of flats – 432. With help of approximation by linearization the number of cars parked in the yards at different time of day was calculated:

Case 1: 9:00–18:00 on weekdays – 17; 18:00–9:00 on weekdays – 75
Case 2: 9:00–18:00 on weekdays – 52; 18:00–9:00 on weekdays – 156.

The reason behind this is the fact that the standards of providing parking places are out of line with reality [10]. During the construction of parking places in courtyards the standards for the distance between parking lots and house windows are not observed. According to the standards the distance should be at least 10m for 10 or less cars, at least 35m for 101-300 cars, which is difficult to fulfil under the present conditions of the costs on urban land and the lack of territorial resources and in some cases fairly impossible.

In most courtyards parking lots were and still are undeveloped areas, cars are often parked on lawns, which worsens quality and esthetic characteristics of the latter. Figure 1 show typical spontaneous parking in the yards of apartment houses. An example gives a new micro-district (the project commissioned in 2014-2015) in the Tula city center. However, it is important to point out, that not only the standards of building parking lots, but also those of planting greenery were not kept during the development of the area, except for the lawn, which became unfit due to wrong employment. The tendency is explained through the lack of parking places.

In this case, lawns are just another source of air-pollution and not means of improving ecology in the area necessary in the conditions of worsening ecological environment.

2. High air-pollution.

A problem of modern courtyards is air polluted by all-the-year-round dust. Constantly shut windows are the trouble of most modern apartment houses.

It looks like this problem befalls inhabitants of historical districts: the pavement’s width here makes approximately 1m. This is fit for walking, but there are no means of protecting the buildings. Streets overladen with cars and lack of (not only esthetically, but also from ecological point of view) well-organized parking lots leave no other option but to park the cars along the unprotected pedestrian zones.
Historically, city streets were meant for airing. Today, however, a street is mainly a man-made environment.

Cars’ exhaust is the first reason for environmental worsening [11]. It consists of heavy metals (lead), toxic components (carbon monoxide, nitric oxides, hydrocarbons, aldehydes), carcinogens (soot, benzopyrene), which cause respiratory and oncological diseases. Staying in an environment rich with exhaust for a long amount of time leads to immunodeficiency. In some cases, exhaust has led to mass poisoning within the inhabitants of the houses situated in the vicinity of parking lots.

According to observations on soil being polluted by toxins, including heavy metals, arsenic, fluorine, made in 2014.

Puddles are a strong accumulation of exhaust components. Dew to great external heating of road surface evaporation of extra water is observed, whilst heavy elements stay. In the airing process dry corrosive elements are being flown up with the hot air and carried by air flows. In this case, they get inside buildings through open windows (figure. 2).

In this situation it becomes necessary to put conditions and split-systems, not only for comfortable temperature and humidity inside, but also as compensation for impossibility of a natural airing of the apartments on account of unfavorable environment.

Figure 3 shows an elevation of a dwelling house in the center of Moscow. Air conditioners situated in a chaotic manner on the elevation indicate unfavorable conditions inside the apartments and badly influence esthetical characteristics of the building. Lately a great deal of attention has been given to the appearance of streets, avenues and even courtyards. At the same time, air conditioners change their appearance to the worst.
During the struggle to improve the appearance of buildings in many big Russian cities, including Moscow, standards were suggested, which prescribed to get authorization for placing any technical devices (air-conditioning units, antennas, etc.) on the elevation. However, after 2010 summer heat waves those standards were canceled because of an emergency. Still by modern building design places for air-condition-units (bays, loggias, baskets, concealing bars or jalousie) or a strong system of forced draft are provided.

The described situation is typical not only for people, who have their windows face highways. This also troubles people living in flats with rear windows. The reason is lack of well-developed nearby territory.

Citizens’ well-being and ecological state of environment correlate with each other: environmental worsening of urban area is confirmed by an increase in sickness rate, including display of irritability, aggression, an increase in cases of psychosis, chronic fatigue, high blood-pressure, heart diseases, asthma, exacerbations of chronic ailments. Hence, it is necessary to improve the environment by widening the pedestrian zones, mechanically clearing away products of development and organizing a strong system of planting greenery, which is historically a mean of improving ecology and quality of the area. It is necessary at that to choose the plants correctly (fit for growing in a hostile environment and with improved dust-capturing qualities) in order for the scheme to be most productive [12].

3. Unorganized dumps.

It is typical for nearby regions and regional towns. This leads to noticeable esthetical as well as ecological worsening of quality of habitable environment. Domestic waste dumps are ideal for vital activity of various parasites and pests. They include rats, mice, cockroaches and other insects.

There are cases of burning construction waste due to inability to remove and transport it and often due to impossibility of doing so, which is explained by the fact that such dumps are unauthorized and not suited for storage. Thus, the inhabitants of nearby houses breathe in not only putrilage, but also combustion products. Not without reason those areas where city dumps are situated on the leeward side are considered to be the most unsuitable for living.

One of main solutions to the problem in Moscow is the program of reconstruction of city space “My street”, which main aim is to improve comfort of central streets of the city.

“My street” program is a set of activities for improving the environment and the level of living. However, this program takes into account only the changes for the front line and does not provide for changes in the courtyards. Also, the program does not touch upon bedroom communities, which do not belong to historical buildings. The reconstruction activities aim more for preserving historical characteristics of town-planning buildings, than for improving ecological ones. Thus, the realization of “My street” program is necessary, but at the same it is not enough from ecological point of view.

In cities of regional significance and other districts similar programs are put into practice, but they are insufficient and do not show desired effect.

5. Conclusions

On the basis of the above-mentioned we can state, that it is reasonable and necessary to construct closed courtyards and form a natural-urban area there.

Nowadays some big development companies already make pilot building designs for micro-districts on the basis of constructing houses with closed courtyards. Thus, with the above-listed negative factors taken into account, the quality of the environment improves significantly, the building is considered to be of a higher class and its competitive ability on the market rises. Figure 4 show projects for construction in a micro-district with buildings of different functionality.

Closed courtyards involve limited entry on the territory and a parking lot (excluding technical services) [13,14]. It is reasonable to provide an underground parking lot with a cleaning system and air-conditioning. In this case, the courtyard’s territory would be constructed on an artificial basis — a platform [15]. In the design of a dwelling house, it is necessary to provide crosscutting entries, which would allow the inhabitants to reach both the street and the closed courtyard. It is also reasonable to situate the balconies on the rear side of the house.
However, when designing such a construction it is necessary to use an integrated approach for building, which considers the present surrounding buildings, geometrical parameters of the constructed house and the height and climate of the area. This is connected with the issue of illumination in the courtyard and that of the apartments on the lower floors. The lack of natural light and insolation considerably degrades the quality of the apartments, narrows possibilities of their employment and change their market value [16-18].

Well-organized landscape of a courtyard gains considerable relevance. It is necessary to create space for several zones in the courtyard-design:

- Children’s playground (this includes baby towns, street furniture of different design, playgrounds with special paving);
- Sports zone (sports grounds, cycle tracks, jogging tracks, etc.);
- Park zone.

Park zone should be a polyfunctional environment, which includes an organized recreational and leisure space and helps environmental cleanup.

Thus it is necessary to consider its development in the following aspects:

- Esthetic
  The planting of greenery must follow the standards of landscape and visual perception of the inhabitants on different high levels, on the ground as well as from windows of different floors. It is also necessary to consider the blooming season to sustain esthetic characteristics throughout the year.
  Hence, it is necessary to form elaborate landscapes using different decorative elements: paving, light, vases and containers.
  The plants should be chosen according with their compatibility for group plantings of different forms (biological as well as visual), and the possibility of their growth in unfavorable man-made conditions.
  Height of plants should also be taken into account because of their influence on the insolation of the lower floors. Therefore vertical greening of the elevation gains relevance.

- Ecological
  In this aspect it is reasonable to plant greenery, which has high cleaning ability, which includes:
  Dust-holding quality[19];
  Regulation of temperature and humidity of the area;
  Decontaminating properties [20].
  Maximum effect is observed by conifer trees (fir-tree, pine, larch, fir). At the same time during summer leaves of bird cherry tree and false spirea provide phytocides and suppress development and viability of bacterium, salmonella, staphylococcus.
  A courtyard is an area fit for forming a high-quality polyfunctional recreation of mass employment. However, under the conditions of hostile environment it is reasonable to form a green recreation.
Therefore, it is necessary to use an integrated approach while designing it, which would take into account both visual perception of the area and conditions for greenery to grow.

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