Integrating multi-level traffic intersections into urban environment

Yu A Ivashenko
Faculty of Architecture, South Ural State University, 76, Lenin Avenue, Chelyabinsk 454080, Russia
E-mail: ivashenkoya@susu.ru

Abstract. The article deals with the problem of architectural and city planning attractiveness of large cities due to the growing population and increased traffic. The author focuses on the negative impact of constructing multi-level highway intersections in the city structure in the light of socio-ecological, emotional-psychological, artistic-aesthetic and cultural-religious aspects. The article solves the problems of urban areas by integrating multi-level traffic intersections. The construction of low-rise settlements in the zones with much gardening, forest areas near lakes and rivers compensates city unattractiveness. Apparently, the solution of the problem is the harmonious combination of public administrative zones of "point" construction with buildings of different types in combination with low-rise buildings of a country type. The effective combination is based on developing a good transport system, based on multi-level traffic intersections. We suggest combining these zones with a transport system, in which the structures and design of the city multi-level traffic intersections are combined with the structures and architecture of the high-rise building complexes of different types.

1. Introduction
At the present stage of the human society development, in big cities there is an intensive increase in population, territory and transport [1-3]. Statistically, in the future the number of cars will increase dramatically per 1000 citizens, which will lead to active developing multi-level traffic intersections. These factors will impact the area and planning structure in big cities. This results in negative consequences [4-8] that are classified on the basis of cause-and-effect characteristics.

2. Body
The article deals with the negative impacts of multi-level traffic intersections on the city structure in different aspects.

The socio-ecological aspect includes the following areas:
- transport “fatigue” and growth of transport zones, i.e. ecological disbalance in some city areas;
- polluted city areas;
- social and physiological diseases resulted from noise, infrasound, electromagnetic field;
- dividing areas on a social basis;
- the increased ecological and built-up density conflict;
- unevenness in developing areas;
policies of local authorities.

The emotional and psychological aspect includes:

- changed links in the system "nature-human-architectural object" in the form of alienation from nature, loss of spatial values, making barriers due to social factors, reduced accessibility and visibility of unique architectural structures;
- emerging impact of changing areas at the unconscious level in the form of area symbols and archetypes.

The artistic and aesthetic aspect includes:

- constructing twin-buildings from the point of view of their form and outside decoration;
- reducing architectural town-forming complexes resulted from built-up density;
- reducing the humanitarian and educational impact of architecture [9, 10, 11], which should be expressed in ecology of forms, image and the creative process to impact material, psychological and socially active level.

The cultural and religious aspects include:

- lack of religious centers in the urban area, combined with entertainment and relaxation areas;
- ignoring the principles of ancient architecture and designing religious buildings [12, 13].

The deeper insight into exploring the urban areas can reveal other negative factors related to population growth and increased traffic.

The article solves some problems of urban areas by integrating multi-level traffic intersections into it. The problem is that at present such multi-level traffic intersections are developed, firstly, by alienating the urban area from residential, administrative and public areas. Secondly, they are usually built in the existing housing, which adds an extra psychoemotional load decreasing their environmental friendliness and artistic and aesthetic impact.

Thus, we should think of harmonious introducing multi-level traffic intersections into the urban areas through their functional and aesthetic harmony with other architectural objects.

This "harmony" is a combination, in which various functions do not constrain each other, and the elements of architectural objects are not perceived as "alien" or "incompatible." The principle of combining public and residential areas were studied by O Mamleeva and A Vartapetova, [14], N Titova [15], N Mironova and V Iovlev [13,16], A Popova and S Ziganshin [17] A Yunitsky, Rudolf Arnheim and Omer Akin propose identifying zones of historical and cultural heritage linking various city areas [18-20]. These proposals can be used to integrate multi-level traffic intersections into the city areas.

This article proposes organizing city areas by combining multi-level traffic intersections with buildings of various types (Figures 1, 2)

Figure 1. Prospects for developing city areas with multi-level traffic intersections combined with buildings for different types.
Figure 2. Prospects for developing city areas with "point" construction of various types combined with multi-level traffic intersections and low-rise buildings and much planting.

This volume planning can be used in reconstructing the existing built-up areas, as well as in expansion of city areas. At the same time, the areas is classified into two types: "point" high-rise construction and low-rise country type buildings with much planting.

In "point" construction a central building is allocated. Its structure is combined with multi-level traffic intersections of the main roads. The nearest territories are also built up by buildings of various types. The proportions between the heights and the plans of these buildings should have "golden section".

The central building has the following features based on its functions:

- the underground part is used as parking facilities;
- the underground, the first and the second levels are used for multi-level traffic intersections with the roads coming around the central part;
- the other levels are used for offices and cafes;
- the top levels are used as living spaces.

The central building has a screen over the multi-level traffic intersections which functions as an isolation for sounds, exhausted gases and fires.

These screens as enlarged levels for office spaces have planting and relaxation facilities and small swimming pools.

Symbolically, the plan of the building has a "cross" form and with a step-by-step change of levels on some parts of it with increasing number of levels to the center. The cross form has a number of advantages: the increasing structure stability resulted from the acting loads, sound isolation due to the
absence of shared walls between the apartments, decreased heat consumption due to the reduced wind speed.

When designing the central high-rise building, it is possible to organize ventilating the inner space through the central part of canals (air ducts) connected both to internal premises, including the underground level, and to the outer area at the level of the ground, first or second levels.

Combining a multi-level traffic intersection with bearing elements of the central building puts the problem of their protection in case of a traffic accident. This problem is solved in two ways. The first one is using shock absorbers and the second one is using columns with external sheet reinforcement (concrete in cage when using reinforced concrete). The vibration protection is provided with knots that suppress oscillations.

The area around the central building is used not only for up and down traffic but also for constructing other structures: shopping malls, offices, entertainment and living spaces.

The low-rise structures with much planting are placed as “undercenter”. The area surrounding the “undercenters” has a ray form. There are public, cultural and religious buildings.

3. Conclusion
The effective impact has the following five aspects:

1. The proposed reconstruction of the existing urban areas and their expansion allows to increase their ecology in two directions: physico-biological and aesthetic-psychological.

2. Improving the socio-environmental issue includes reduced transport “fatigue” and the alienation of the city areas to create transport system. Besides, air pollution decreases and accessibility to buildings and structures of various types increases.

3. The psychological aspect is improved due to the following factors:

• the city area is perceived as a complex with different concentration of territories and spaces with decreased sense of alienation from nature;

• the visual perception of the city area from different altitude levels (the level of the earth surface in the areas of country construction and the level above the earth surface in the areas of “point” construction) creates a sense of free space and relief (variability) of natural objects.

4. Improving the artistic and aesthetic aspect is creating “point” construction as a combination with its own individual forms and decorative design using symbols and types of architectural areas. Due to the city free areas, visual accessibility of architectural compositions is provided, from all the levels, which improves the humanitarian and educational influence of architecture.

5. Increasing the transport system harmonization with architectural objects in the city area can be reached in the following:

• elements of road structures of multi-level traffic intersection should be perceived as a natural extension of architectural objects, for example, as "tree roots";

• the forms of transport structures are mainly curvilinear with a minimum right angles and with the creating impressions of movement and development as observed in natural objects.

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