

Intersectional junctions of the main roads in city SRN system (on the basis of Kyiv SRN system)

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Summary. Relevance: Issues of the concept of the street and road network (SRN), the role and place of transport planning junction in city SRN and the intersectional junctions of main roads at different levels in the SRN system are raised. The tasks of research: **consider** the concepts of SRN, road junction and main roads intersection at different levels. **The technique of research:** the typological technique of theoretical analysis for determining the role and the place of junction in the SRN system is implied. **The results of research:** It was established that intersections are built at different levels for the improvement of the traffic streams of vehicles and reducing the number of conflict points at the main roads junctions. **Conclusions:** intersectional junctions of the main roads in system of city street and road network is a source of transport and ecological problems of the city.

Key words: SRN, transport-planning junction, main road intersectional junctions at different levels.

GLOSSARY

Street and road network (SRN) – designed network of streets for vehicle traffic and pedestrians, public roads, internally quarterly and other driveways, sidewalks, pedestrian and cycle paths, embankments, squares, street parking with engineer-

ing and subsidiary facilities, technical means of traffic organization.

Road junction – complex transportation facilities at intersection or furcating points of urban road transport, which together fulfill operations on transit, distant and local transportation of passengers and cargo. At the crossing points or junctions of two or more types of urban transport focal points of the transport system are formed, where the interaction of these modes of transport is made.

INTRODUCTION

The special feature of big cities is a high mobility of the population, which is achieved through dynamic transport. At the same time the sections load of street and road network of transport depends on the local scale of individual districts as well, as their functional profile and planning structure. Main roads and local streets can be singled out as part of Ukrainian cities SRN [1, 9-11].

Streets and roads categories are set according to the classification: main roads, where the main stream public transport moves - citywide and district; local streets - the street, residential roads, indus-

trial and storehouse and public utilities zone roads, driveways.

The degree of the road network development is determined by its length and density, which is measured by the ratio of the roads length to the area of the urban area (km / km²). This indicator shows the degree of the street and road network development in the whole city, and in separate districts.

While examining Kyiv SRN system it was ascertained that streets and road system consists of main streets of citywide significance – 8%, the streets of district importance – 14%, and the streets of local significance, representing about 78% of all roads combinations. The total length of Kyiv street network is more than 1.6 thousand kilometers. This indicates that the low development of main streets of citywide and district importance [2-4, 14].

Main roads intersection is the most critical element in the formation of traffic jams, because it is a major factor in reducing speed and safety at SRN. Bandwidth of squares and crossroads that form road and transportation junctions on main roads of the city eventually turns deflated. A need in the search for a solution appears. Solution which ensures the correspondence of the bandwidth to characteristics of streams that intersect at the junction. At the main roads' junctions the intersections are built at different levels for the improvement of the traffic streams and reducing the number of conflict points. Usually there are no vehicle streams intersections at one level, only confluence maneuvers are available, furcating and weaving of streams. Junctions at the one or different levels should be designed in accordance with the categories of streets and roads that are intersected or adjoined, taking into account prospective intensity of transport and pedestrian traffic [8, 12, 17, 20].

BASIC MATERIALS SUMMARY

The rapid process of automobilization is including more and more cities every year, automobile fleet is growing, which is in-

creasing the burden on the road network of the city. The growth of automobilization and volume of traffic results in the increasing in traffic intensity, which favours the occurrence of transport problems in a city with historical buildings. Particularly problems are shown at the focal points of the street and road network – junctions, where increased transport delays rise, jams appear. All these factors provoke decrease in speed connections, unjustified fuel overspending, worsening of environmental conditions. The problem becomes more complex in city central areas, and in areas of old buildings that are typical of narrow roadway, short quarterly sections between intersections and considerable intensity of pedestrian traffic.

Transportation planning system consists of a number of interrelated elements such as street (citywide main roads of continuous motion, citywide main roads of controlled movement, roads of regional importance, residential streets and roads in the industrial and storehouse and public utilities zone roads, driveways), traffic junctions (unregulated traffic, forcibly controlled traffic, self-regulating traffic (circular motion) and the traffic at different levels), bridges and tunnels.

The most important indicator of main road section as transportation planning system is its capacity, which is determined by engineering and planning structure of intersection, road transport passing organization, planning scheme and its geometric parameters, accepted traffic organisational chart.

Choice problem of engineering and planning decision on intersections junction of the main roads is reflected in scientific publications, models of SRN, but remains extremely difficult because of the specifics of each particular group of urban intersectional junctions formed historically and a great amount of contradictory factors that should be considered while seeking optimal solution of the problem. Despite the engineered methods that are aimed at increasing traffic and degree of intersections' loading, increase of the capacity of SRN and traffic safety, the multicriterion problem can't be solved by any of

the known methods because of the significant weight of individual parameters for each junction. Capacity increase of urban SRN in most techniques can be achieved either through construction and reconstruction measures, or through the introduction of a number of organizational measures such as the distribution of traffic, the introduction of intelligent traffic light control that acts on the intersectional junctions of main roads and so on. It is known that the use of architectural and planning measures requires, in addition to significant investments, quite a considerable period of time to complete, so their implementation is part of general reconstruction of SRN. Arrangements are also limited both the hardware and algorithmic aspects, but for some time they allow the serious problem of junction overload in the SRN to be reduced due to less costs.

Despite the low advancement of main streets system of citywide and district significance, Kyiv SRN has more than 100

junctions which accumulates the stream of road transport, which in turn leads to environmental worsening in surrounding areas of these main road intersections. Therefore, the study of the junction in the SRN system is the most productive because of reducing environmental pollution of the city on the whole. Traffic streams are concentrated at the junctions, traffic conditions change, and so the ecological load on the territory adjacent to the junction increases greatly [5-7, 9].

Having regard to the fact that functional public transportation and streets are unified engineering and technical system, intersections of city streets and roads, where traffic and pedestrians' streams are mainly concentrated, should be considered as part of this system in the form of road and transportation junctions.

The type of junction is selected depending on its functional features, characteristics of communication lines in the junction, the

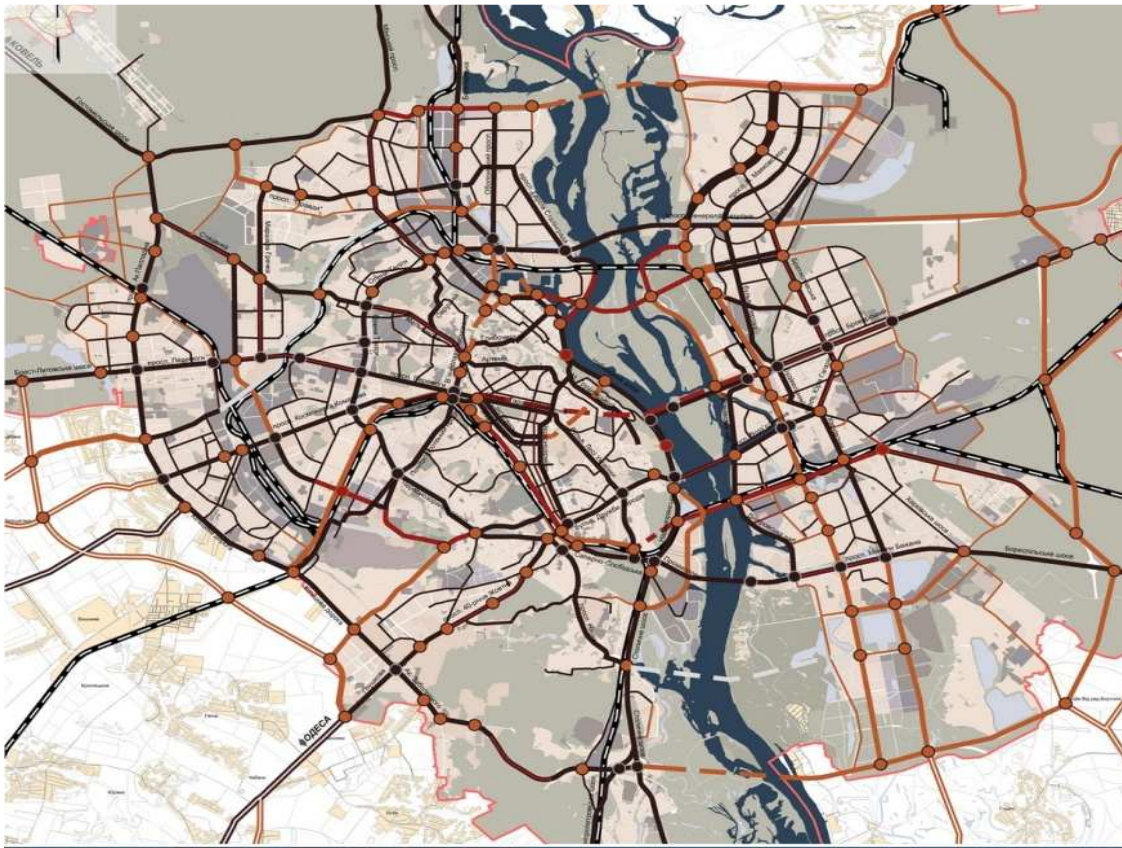


Fig. 1. Kyiv street and road network

availability of free territory for the construction of the intersection, the size and composition of the traffic streams due to driving directions and presence of pedestrians.

Creating conditions that ensure the pedestrians and public transport safety with traffic organization at the intersection of streets and roads (induced delays would be reduced as much as possible due to such organization) represents a multifaceted problem that has no clear solution. Its solution is achieved by the implementation of complex of planning, engineering, technical, organizational and regulatory measures.

Planning decisions include: planning of the street and road network, tracing of streets and roads, their designing in plans and profiles, designing of intersections of streets and roads at the same and different levels, traffic segregation due to driving directions, segregation of pedestrian and traffic streams among themselves and so on.

Engineering and technical measures include: appropriate decision on road surface, drainage system, lighting, artificial structures that provide comfort and traffic safety.

Organizational measures should include: efficient operation of all transport modes, high operational characteristic of street and road network of the city.

The implementation of one or another principle of the traffic organization of transport and pedestrians streams at the junction coupled with planning conditions are specialist's objective when searching for the optimal solution of the given junction.

Street and road network of the city is examined not as separate junctions, but as whole junction system of urban transport intersections. By the example of Kyiv city street road network system with a graphical display of concentration of vehicle stream on the main road network and accumulation at the intersectional junctions of main roads is shown [18, 19].

In Kiev the most loaded road intersectional junctions of urban main roads are at the intersections of the main radial directions and a large ring road. Other junctions are formed at the crossroads of citywide main roads and streets of district significance (Fig. 1) [9, 16].

One might say that the formation of intersection junctions of main roads is natural process of city development. Analyzing and projecting them, we are able to operate with those city elements that are most significant for its development and above all should become the object of the study of urban development and ecological perspective [13, 15].

Besides the obvious advantages for traffic, intersectional junctions of city main roads at different levels allow to reduce the impact on air pollution level 4...10 times. In the beginning of 21st century design solutions for optimizing the intersections of main roads are specified largely due to sanitary requirements. At low aeration properties of the territory comparison criteria of variants of engineering and designing of intersectional solutions based on estimates of conventional vehicles emissions are used. Pollution of main roadside territory from intersections of main roads at different levels is due to the positive (change of speed limits, the elimination of downtime, lifting one of the main streams on the pier) and negative (over mileage of left-handed streams; slope due to the difference of heights 6...7 m between directions) factors. Intersections of city main roads at different levels are divided into several main types according to traffic organisation of left-handed streams: cloverleaf; incomplete cloverleaf; trumpet; roundabout; loopback; combined. Their environmental effectiveness depends on driving conditions, but "cloverleaf" with the overpass is considered as the best (Fig. 2).

INTERSECTIONAL JUNCTIONS OF THE MAIN ROADS IN CITY SRN SYSTEM
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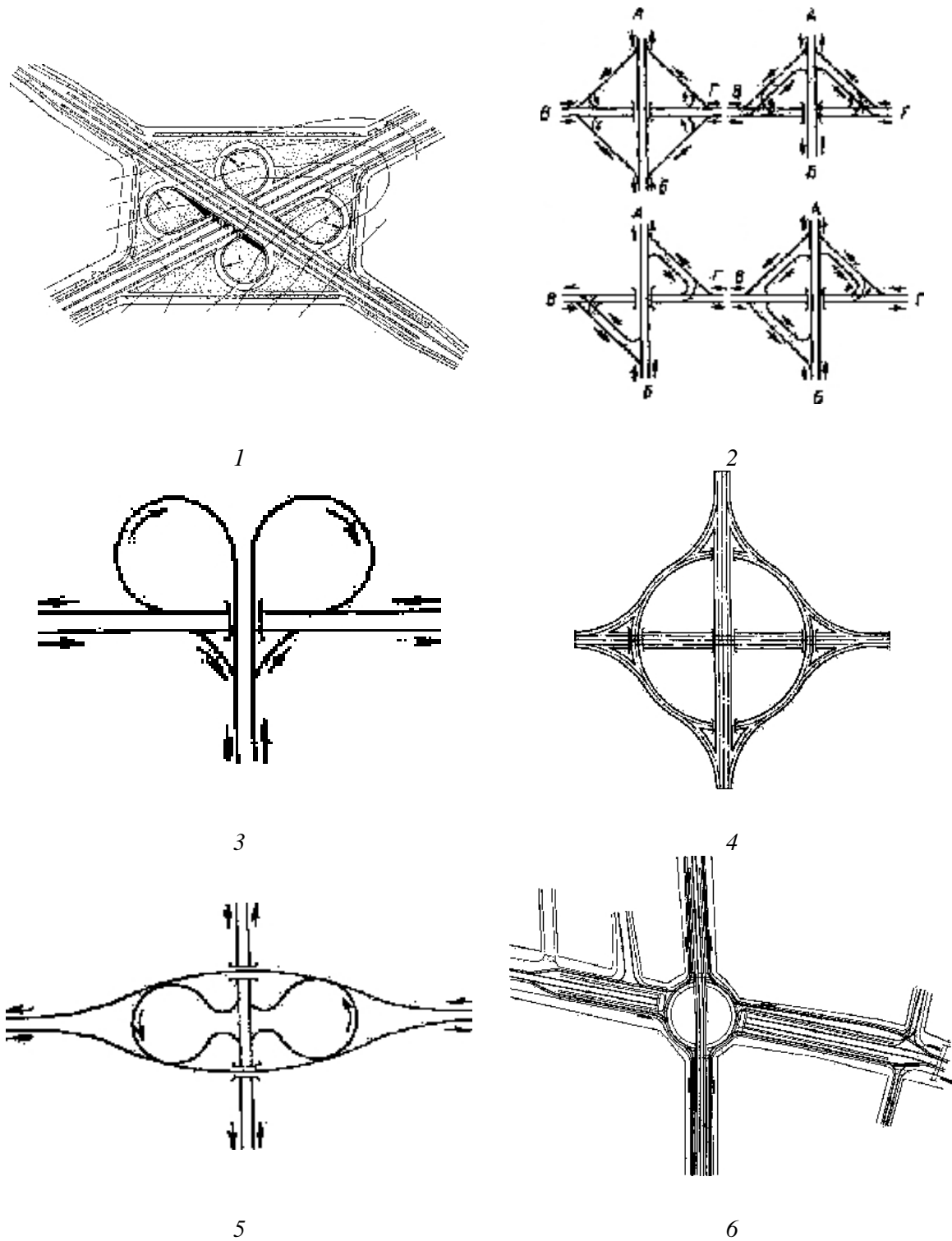


Fig. 2. Intersection types of city main roads at different levels:

1 – “cloverleaf”, 2 – “incomplete cloverleaf”, 3 – “trumpet”, 4 – “roundabout”, 5 – “loopback”,
6 – “combined”

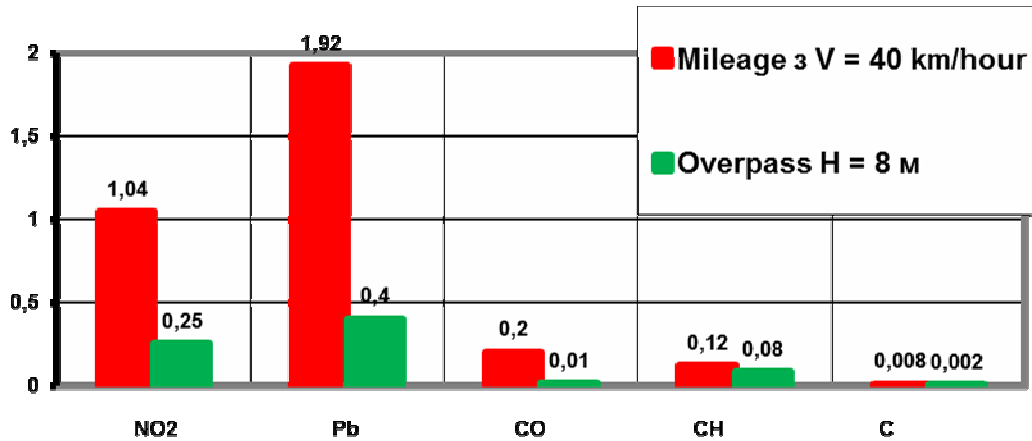


Fig. 3. The impact of the construction of the overpass on reducing the level of maximum one-time pollution of the surface atmospheric layer at a distance of 30 meters from the edge of the road at 4000 natural units / hour of traffic intensity

During the reconstruction of transport junction decisions that involve the need in repeat reconstruction in a given time are often made. Due to the positive impact on the living conditions of the population the value of intersections of city main roads at different levels is not so great.

Rationally designed intersection of main roads at different levels ensures compliance with hygiene norms at traffic intensity to 10,000 natural units/hour. The traffic of transport stream on the intersectional overpass of the city main roads at different levels

CONCLUSIONS

1. Main roads junctions as part of the city street and road network is a center of transportation problems in the city, formed as a result of increase in automobilization and road haulage volume, which in turn results in the increase in traffic intensity.

2. Transportation planning system consists of a number of interrelated elements such as streets, road junctions, bridges and tunnels.

3. Street and road network is seen as a system of individual driving and junctions of

is accompanied by decreasing in mass emissions by eliminating of maneuvers and their additional scattering when lifting the main stream above the ground (Fig. 3).

The intersection of main roads at different levels provides a significant reduction of mass emissions and concentrations of contaminants by eliminating maneuvers. It is possible, firstly, in proportion to reduction of mass emissions, and secondly, due to the additional dispersion of pollutants by driving the main stream at a certain height above the ground.

the city, and can be regarded as a separate junction in the city system of street and road network.

4. The maximum concentration of traffic at the junctions of street and road network of the city arouses the largest concentration of environmental pressure on adjacent territory of the junctions.

5. Main roads intersections are the most critical element in the formation of traffic jams. Intersections are built at different levels to improve the traffic streams of vehicles and reducing the number of conflict points at the intersection.

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УЗЕЛ ПЕРЕСЕЧЕНИЯ МАГИСТРАЛЕЙ
В СИСТЕМЕ ВДМ ГОРОДА
(НА ПРИМЕРЕ ГОРОДА КИЕВА)

Аннотация. Рассмотрен вопрос понятия улично-дорожной сети, роли и места транспортно-планировочного узла на ВДС города и узла пересечения магистралей в разных уровнях в системе УДС. Отмечено, что улично-дорожная сеть рассматривается не только как система отдельных перегонов и узлов города, но может рассматриваться и как отдельный узел в системе улично-дорожной сети города.

Ключевые слова: УДС, транспортно-планировочное узел, пересечение магистралей в разных уровнях.