Effectiveness of Basic Special Services as A Guideline for Programming Urban Nodes. Ariadne Thread Research

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Abstract. Creation of the urban nodes is a widely studied issue. In the era of intensive development of cities, that are affected by an urban sprawl, as well as areas exposed to degradation not only through human activities (areas of military conflicts) but also through natural factors (earthquakes), it is necessary to develop mechanisms for creating urban nodes that would be applicable for various environments. In the author's opinion, an important element in ensuring the safety of life in urbanized areas is the programming of urban nodes in a way, that make them create the security system. The research conducted by the author aims to diagnose the relationship between the needs of the inhabitants of a fragment of urban area and the concentration of functions at an important point of the program of the urban node and its architectural interpretation, with time fluctuations taken into account. The research discussed here is carried out within the 'Ariadne Thread' project, and is a new approach to urban node formation. The 'Ariadne Thread' is a pilot project whose first phase focuses on an attempt to integrate four major urban systems: signage, urban lighting, local telecommunication facilities, and security systems. Through the parameterization of the factors divided into categories, it will be possible to develop a mechanism of urban nodes' creation. A flexible and universal mechanism, which - depending on the established parameters - will be applicable in slums, shandy towns as well as areas devastated by natural disasters. In this paper, author describes the principle of creating this mechanism by presenting one of the parameters adopted as a criterion and guideline for programming, namely the effectiveness of the primary services, such as emergency services, fire brigades and police. Through the series of surveys conducted among departments of special service units, confronted with data and guidelines contained in regulations for their functioning, the author obtained a pool of parameters which are the guideline for the programmed node, showing what territory the given operational base can serve, which is the basis for developing quantitative parameters for the designed node. The author also draws attention to the principle of functioning of the already existing node, in situations of events that exceed its effectiveness or require rapid intervention in emergency situations, such as terrorist attacks. This will affect the operation of the various units, where additional large units will be needed. It will be necessary to develop a network of urban node connections by developing mechanisms for linking them to airports, helicopter landing sites and important external entities.

1. Introduction
The problem scope adopted for the research concerns uncontrolled, disordered and deficient intensive urbanization. Such a process hinders access to key elements of infrastructure, reduces the level of security, strengthens the negative effects of the uncontrolled spread of monofunctional housing, regardless of its quality. This does not apply only to strongly urbanized areas developing in an...
uncontrolled manner, nor is it limited to areas of pre-urban expansion of spontaneously created housing estates constructed from dispersed houses implemented by the economic system (individually). The phenomenon is also visible in areas affected by armed conflicts and natural disasters that have drastic effects on the organization of space. Also, slums, favelas or other substandard settlement units, autonomous or part of a larger team with different characteristics, are places where the urban life cycle needs to be improved or rebuilt and the conditions of functioning of both the community and individual units are improved as much as possible using organizational measures, infrastructure and technical and technological solutions.

![Figure 1: Favela, Medellin, Columbia. Photograph: R. Barełkowski [1]](image)

The issue of poor quality of urban space resulting from intensive urbanization in such diverse environments is a problem already in the mid-twentieth century, to which the author will refer, however the scope of research results directly from planned and programmed interventions, which are a current problem, hence contemporary interventions have been adopted from 2000.

The aspiration of the study is the derivation of an interventional formula of universal character, hence the areas studied by the author are contrasting environments of diverse character as well as different needs. Areas requiring various interventions and interferences in their structure, which interventions are conditioned by a geographical location, a factor disturbing the proper functioning of the environment and cultural conditions of the society inhabiting a given territory. Examples from different cultural backgrounds representing different social, economic, spatial, environmental (climatic) situations.

The starting point for the research is a single-family housing estate located in the northern part of the city of Szczecin, deprived of infrastructure and functions in appropriate proportions for its area. Szczecin is located in north-western Poland and borders Germany, which strongly affects social or commercial conditions. Thanks to its location, access to water bodies and proximity to the border, it is a great potential for production, industry and tourism. The city is struggling, however, like many Polish cities
with the problem of depopulation of the center and the city center at the expense of newly emerging and growing "urban dormitories" mainly in the form of single-family housing estates located on its outskirts.

Figure 2: Warszewo housing estate, Szczecin, Poland.

There are a lot of examples similar to the Warszewo housing estate in Szczecin, as the majority of housing estates currently being developed on the outskirts of cities are scattered shreds, deprived of infrastructure, which over time grow in commercial and service functions. The next are education facilities - with pre-school points and nurseries. Primary schools are a rarity. However, such basic functions as the police, fire brigade or hospital - medical care, are in vain. The service for new areas is to be provided by the applicable infrastructure and related location of these units, which do not fulfil their sub-statutory function, i.e. the safety function, to the extent necessary.

The next area selected for research, which disturbed structure requires intervention is Medellin in Colombia, struggling with the problem of urban sprawl. The favelas that exist in a huge area, the number and area of which are still growing, constitute a degradation factor for the city, create a dangerous structure that also disturbs the proper functioning of the society living in it. The problem of locating an urban node in this area is caused mainly by technical conditions, difficulty in reaching services through narrow streets or dense buildings. Intervention prepared for the specificity and character of the area in question is indispensable.

In slums or favela areas, as shown in the Medellin example, an additional problem arises - this area is devoid of technical infrastructure in the form of basic utilities. This generates the need to use independent and self-sufficient solutions, hence it seems to be an obvious application of renewable energy source systems as basic in shaping urban nodes. In the course of research, the author acknowledges that the use of photovoltaic systems will be the only possibility of proper functioning of the created operational base and node center.

2. Case study
Research conducted by the author is aimed at diagnosing the relationship between the needs of inhabitants of a fragment of urban area and concentration at some important point of the functional
program of the urban node and its architectural interpretation including time fluctuations and distinction to the type of facilities, in particular for permanent functions.

![Figure 3: Favela, Medellin, Columbia. Photograph: R. Barełkowski [1]](image)

![Figure 4: Warszewo housing estate, Szczecin, Poland. Google.com](image)
According to the author, it is important to find a functional dependence of the urban area on the management of research at the finish line, as a result of which the method of programming the urbanized environment will be developed. Currently, there are rapidly developing new urban tissues in Poland, lacking features, mainly functions including education, cultural centers and special services, and, on the other hand, are filled with less important functions, such as shopping centers. Most often, however, it is the lack of special units or insufficient number of them. The same applies to education. The huge demand for trade and service functions is noticeable. Considering this problem, the starting point of the author is to develop requirements for newly emerging urban tissues in Poland and in areas outside local boundaries.

![Figure 5: Santo Domingo, Medellin, Columbia. Google.com](image)

The first area of research is the area of single-family houses in Szczecin, which is located in the northern part of the city. Thanks to the recently built bypass, it is well connected with the city, however, there is no function in them, and its continuous growth causes more and more deficiencies. This area from the south is built up with multi-family housing, which in the north is thirsty for single-family housing, the same applies to complementary functions, which in the truth are insufficient for the southern part, but in the analyzed area they are not present at all.

Another area of interest is the area of favela located in Medellin. It is the second largest city of Colombia, which has a population of over three million. The problem of creating slums in this area causes distortion of the urban tissue. There is no basic function in the field, criminality is increasing, which causes the emergence of abnormal socio-cultural relations. The specificity of this area requires the adoption of other activities and interventions to improve the quality of life of the local population.

3. Urban nodes
The national rescue system operates on three levels, i.e. at the national, provincial and county level. The national and voivodships level ensure coordination and constitute supporting bodies for county activities. Since 2004, the activities of the services in Poland have been adapted to the applicable rules in the European Union and meet the requirements set by the European Commission and Parliament and apply to European standards.

In the case of actions of the fire brigade, operating on the basis of the system called the National Rescue and Firefighting System (KRSG), whose tasks are to organize the fight against fires, catastrophes
and other local threats. The event catalogues created on their basis assume time axes for individual events, indicating, among others, for maximum response times, completing the composition and travel of rescue units to the event - fire, traffic accident or other local incident. Similarly, the operation of units of the emergency medical system applies to the Act on State Emergency Medical Services, which describes the organizational rules of the units with the determination of median time of travel on a monthly basis, the third quarter of travel time in a month and the maximum time of arrival.

Tab. 1 Travel time in emergency

| Journey time on a monthly basis | An event in a city agglomeration | An event outside the urban agglomeration |
|--------------------------------|---------------------------------|-----------------------------------------|
| Median - second quart          | max 8 min                       | max 15 min                              |
| Third quartile                 | max 12 min                      | max 20 min                              |
| The maximum time               | max 20 min                      | max 30 min                              |

Figure 6: Travel time of the emergency medical unit.

Considering the case of the estate in the Warszewo district in Szczecin, as it has been presented, we have housing estates with visible borders, we can designate further ones. You can see the accompanying functions - shops or recreation. The time shown applies only to the road (in comfortable conditions, no traffic jams or other events). For one time, the time is counted from the moment of acceptance of the application - we also have the time to complete the unit, equipment and get there - this time should not
exceed 10 minutes. The graphic below shows that the time is significantly exceeded, because the road itself is over 10 minutes. Therefore, it is necessary to program a new node.

A previously described area of favela in Colombia, is an area of very intensive development, with difficulty to classify it (single-family or multi-family). Located in the central part, there is a complementary function located at short distances. The location of special services units is marked on the map. However, you should pay attention to the fact that we are dealing here with much smaller distances, but with much higher distances. This is due to the specificity of the area. With poor infrastructure and communication capacity. Therefore, for a given area, a denser distribution of nodes should be adopted despite short distances.

4. Conclusions
Mechanisms for the creation of urban nodes is based on a matrix of interrelated jigsaws with the possibility of using the entire pool or parts thereof depending on the condition of the area concerned. Depending on data output, the adapted data pool to create a city node will be different. Ordering these criteria will create an operating mechanism that will be a specific matrix for urban node programming.

For areas of spontaneous urbanization, including substandard ones, if they do not provide access to basic services and municipal facilities, the optimal way to complement their deficits is to create centralized nodes, which functional program should be developed with the community participation, while in the technical sphere it should provide mobility and low energy demand, which would allow to minimize the infrastructure interference.

Application of this research can be useful not only in Poland, but also in Europe or every country in the world. Using the matrix and substituting the output will be possible to set the functions and programming node for any area. This mechanism uprising capabilities to create temporary housing areas on areas affected by natural disasters or a leftover area being previously war zones, to the creation of new urban nodes to organize urban space and intervention in existing forming towns aimed at improving the quality of functioning.
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