NEW CITY STRUCTURE: DOES IT COME FROM THE PAST?

WAWRZYNIEC ZIPSER POLAND

The spatial structure of cities, especially large ones, has been a challenge for generations of planners and architects. Its complexity causes many difficulties for the very task of its identification, let alone planning and solving spatial problems. The drive to improve, better yet adapt the spatial structure of a city to the needs of its inhabitants has marked the history of cities as long as they have existed. Regardless of the need for security, prestige, beauty or accessibility, the principle goal has always been functional solutions.

INTRODUCTION

> The spatial structure of cities is determined by many natural and topographical factors, such as rivers, landscapes and natural resources. Other important factors include their position in the settlement hierarchy or the role a specific unit plays or played in the settlement structure (Zipf's Law). In addition to historic factors, current tendencies, such as the global economic situation and changes in the spatial behaviour of citizens linked to their level of socio-economic development are influencing the spatial structure of cities. Together all these factors require a city-specific approach. A feasible framework which can be fitted in a flexible way to individual cases will make it possible to prevent undesirable or dangerous processes to the natural and social environment.

> It appears that the main factor placing high requirements on the spatial structure of the city is the system of relations which enables communication among inhabitants and satisfies their needs of mobility. If accessibility or mobility are not guaranteed at an acceptable level, the spatial structure of a city could handicap urban society (or at least parts of it) by limiting freedom of choice and restricting accessibility.

> The biggest challenge faced by planning is to match the urban structure of cities to their increasing degree of urbanisation, which can produce pathological structures such as slums especially in developing countries. Another decisive factor is changing demographic structure, equally in countries with high birth rates as those with negative birth rates. Another key factor is how to adjust existing city structures to potential, future communication systems. They may take advantage of new technologies linked to communication which affect physical movements believed to continue to dominate interpersonal contacts. This trend is supported by the experience of previous decades and the effect of virtual relationships over the World Wide Web. The future mode of transportation could take the direction of more individualised mass transport, meaning a network of main transfers enriched by a network of local options. As it is difficult to anticipate the exact form of such future transport systems, the new city structure should anticipate development possibilities of mass transit in a flexible way.

< Looking at developmental determinants from a historical perspective, it seems that their importance and influence over spatial decisions have become much more significant than at the time when modern city structures emerged. This process is linked to the emergence of ecological awareness or related awareness of cultural legacy within democratic societies. In the past, decisions to build a moat or city walls or to demolish buildings due to railroad construction caused no challenges other than financial or technological. Paradoxically, modern technology with much greater potential is hampered by feelings of responsibility for the environment and the way humans have affected it many times over. Nevertheless, the responsibility to influence the living environment in a balanced manner persists.

< Important factors in the decision making process are money, system deficiencies linked to local authorities, and legal structure (i.e. the absence of a cadastral tax in Poland). They caused indirect transformation of agricultural land into building lots, thus increasing demand for these areas and facilitating urban sprawl. The authorities of the

largest metropolitan areas in the country and in the world may share the blame of not addressing this issue, as they do not always approach problems linked to the functional structure of a city in a systemic way, even though the cities as concentrations of capital and innovation should be models of such an activity. Planning does not seem capable of delivering city structure which provides adequately for the needs of mobility and level of knowledge of their citizens.

> Reacting to current challenges each era has better, often idealised, naive, or worse solutions, be it 'ideal' baroque cities, utopia cities, 'garden' cities or neighbourhoods, building higher buildings or creating artificial islands in the sea.

> The end of the 20th and the beginning of the 21st centuries were not able either to bring about timeless concepts despite the level of technological development and higher demand producing new towns and megalopolies. Albeit interesting solutions seem conservative, minimal and fragmented in the context of challenges facing the settlers and the global urbanisation process. It seems timely, therefore, to recall an idea evoked by Zipser some 40 years ago (Zipser, 1965), which attempts to solve structural problems of city settlements in a holistic way, reaching beyond the purely spatial framework of planning.

THE CONCEPT

> This is an old theoretical concept of general improvements of city structures, developed in Wrocław in the late 1960s and 70s. It may look like an 'utopia', but is still very interesting. The idea considers some spatial postulates, such as avoidance of 'extra-urban transit' and network-conditioned collisions, and facilitating access of inhabitants to activity zones and recreation areas. Urban agglomeration improvement has economic, social and technological aspects. As contact is essential in urban society the main task is to find the best pattern to optimise contact efficiency. This concept is based on a specific definition of urbanisation as a spatial effect of:

- achieving a sufficiently high level of likelihood of contacts which are necessary to satisfy the leading need pattern of a given society,
- gaining an equilibrium between optimal (or possible) and realised numbers of contacts for a given urban element,
- elements of origins or destinations of contacts being endowed with that amount of freedom regarding their spatial location to make their position dependent on the two above conditions.

From this definition a genealogy of the formation of concentration can be construed as a result of following three types of processes based on the equilibrium of the set of contacts: <

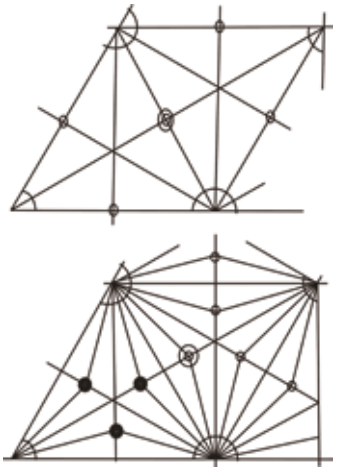
- coincidence type – when only a territorial coexistence occurs caused by the attractiveness of an area through possible competition of clustered elements,
- consequence type – when the existence of some elements provokes better allocation conditions for other elements without direct links among them,
- cooperation type – when direct active interactions are the most important factors.

THE MAIN REQUIREMENTS OF THE STRUCTURAL PATTERN

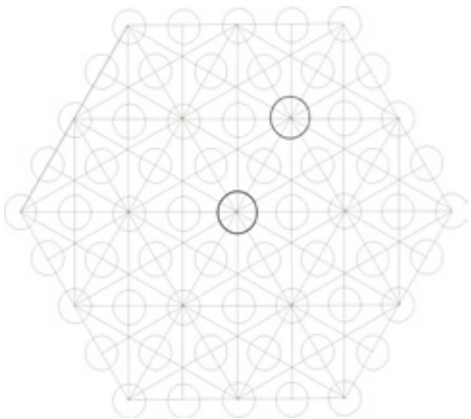
The spatial effect of urbanisation must be placed within the framework of such a network, the best way to get regular systems which will satisfy the following assumptions. The pattern must be: <

- **adequate** to the definition of the actual urban system to enable the structuralised subject to perform its functions as well as possible,
- **flexible** because of diversity of concrete conditions of topography, social and economic structure, historic heritage, technology, climate etc.
- **realistic** in the sense that it may be introduced in reality without extraordinary means and in a stepwise process of structure rebuilding,
- **diagnostically clear** – it has to be quickly examined and evaluated.

- The search for a regular pattern has several advantages: the system makes it possible to divide the area in a relatively similar and usually economic way, supporting social behaviour important for human integration. The pattern is dividing the area into settlement units but it also represents communication arteries which support the traditional city expansion along the main roads. Such a system would provide the localisation of settlement elements in advance, e.g. residential areas, community facilities and services areas, protecting the city structure against the chaotic development. Evidence that contacts between citizens and other city activities and functions are most significantly linked to city structure demonstrates the decisive role of communication systems in creating new structures and improving existing ones. The necessity of contact between urban elements provides the possibility to differentiate between their good or bad positioning.
- In his research Zipser (1965) examined the number of regular shapes of roads which could constitute the basis of a regular urban structure (e.g. checkerwise-diagonal, hexagonal-triangular, triangular-bisectrix and radial circumferential).
- After experimenting with many sets of possible solutions (different selectivity parameter, different origins and destination distribution) all networks whose shapes imposed various space distributions of origins and destinations of contacts were investigated. It was deduced that the best, most polycentric patterns of concentration (Fig. 1), the patterns which avoid a very big and rigid monocentric agglomeration (in its 'radiality'), are networks built on triangle-diagonal connections called 'F network'. All experiments confirmed also a very high adaptability, resistance and stability of the chosen network.
- A triangular-bisectrix network makes a communications warp for a regular urban system called the triangular-catenary structure (Fig. 2). Acting as theoretical schedule, it was modified to eliminate external transit from residential districts and to link the districts between them to link them with many service centres. Splitting those sections of the triangular-bisectrix network which link 'twelve-armed' interchanges into a tree-route-beam, fulfils both requirements. One route, the central one, is situated along the old one and becomes a direct link between the centres of the first range of the urban structure, while side-routes which create a spindle-shape or a narrow deltoid, serve as communication systems for residential belts. A further step was to divide the side-routes into highways (two in each belt) and serving arteries. The 'four-armed' interchanges hitherto existing within the triangular-bisectrix system, were thus replaced by three points. Two of them shifted to the inside of triangles. They may be called the 'residential points', according to their localisation within the settlement belts. Now a 'residential point' finds itself at the same distance of three other 'residential points', off two centres of the 1st range, and not much further from the third one (Fig. 2). Thus each centre has 12 or even 18 'residential points' within its nearest range, which results in similar consequences as those already described.



2. Transformation of a triangular-bisectrix network into a triangular-catenary structure



1. F network – the most flexible and polycentric pattern

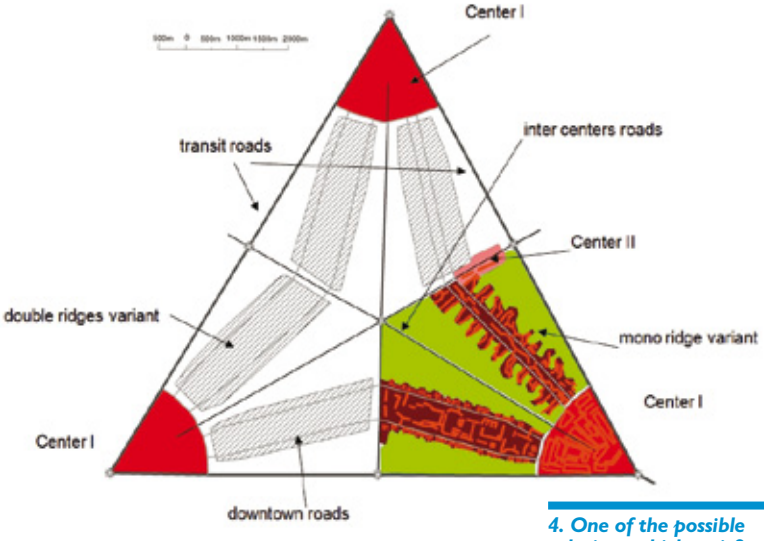
> The pattern of the triangular-catenary structure implies about a 10 km distance between the central points of the 1st range centres. This corresponds to a 10 km long side of the principal triangle of the structure. Although value is fixed and rather large dimensions of elements are involved, this makes it easier to realise the principle of strongest clustering of areas performing homogenous functions. From there rather dense residential strip districts arise with 'catenary' building systems, large communication 'traffic channels' about 150 ha in size, and green areas of 600 to 800 which constitute a linked system inside the town.

> Such an integration of homogenous districts allows to apply a controlled and constant protection of three principal man-made sub-environments in town: residential districts, social and manufacturing activities, and recreation and relaxing. The clustering makes not only air pollution protection easier (ventilation, influence of vast green areas), but also protection against noise (elimination of transit, removing arterials further from the settlement), and protection against under-exposure. These effects do not only result from functional integration but also from system regularity.

> As this structure based on the clustering principle is resulting in economies of serviced areas, as well as transmission and communication networks, it may arise some fear that its price will be enormous density of residential districts. This is not the case (see Table 3).

> When the network preserves its communication function the configuration becomes an area predestined to include various alternatively designed belts containing housing, services and productive activities. In this polycentric structure the main city centres are located at the vertices of a triangle where the biggest number of city roads converge, while local service centres are positioned in the remaining most accessible places.

> Reaching such a pattern depends on the density of the existing settlement, the road network and the shape and location of the ridges. The length of the triangular arms is expected to be between 5 and 20 kilometres and the population encompassed by the belt some 20.000 to 100.000. The biggest achievement of such a structure is a very flexible way of developing the ridges with different functions and different types of built up structure (Fig. 4).



4. One of the possible solutions which satisfies some additional demands concerning housing conditions, as well as some social, psychological and aesthetic assumptions.

< The possibility of adjusting such a structural pattern to real geographic and topographic conditions, was explored in many places in Poland (Fig. 5/p. 63), the Tunis agglomeration and the Trent Valley area in England (Nottingham, Derby, Leicester, Burton).

< If the length of triangular arms is 10 kilometres, the length of each settlement ridge is about 3 kilometres long, which corresponds to the length of the Avenue des Champs-Élysées from the Arc de Triomphe to the Louvre. From an aesthetic point of view it seems to be an adequate length.

< Large recreational spaces (even 130 ha) are located between the settlement areas. The local centre it is a place containing services, offices, administration, parking lots and some public spaces, such as squares, shopping streets etc. Parks are connected with the local centres and create big complex of recreational areas and an alternative system of pedestrian communication. Such a structure

	Wrocław (**640.000** inhabitants in 2008)	**1.000.000** inhabitants triangular–catenary city
water distribution network	**1236,4 km**	**372 km** (4 networks for each ridge) **504 km** (6 networks)
public transportation network	almost **770 km**	**181,5 km**

3. Comparison of the length of the water supply distribution network and the common transportation network (the total of street segments along which one or more lines are running)

permits to create housing areas as completely private spaces, depending on the needs of the inhabitants or cultural conditions.

CONCLUSIONS

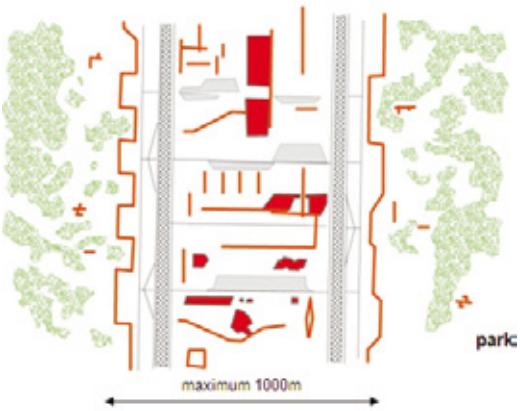
> The paper is looking for the best spatial design solution which could be applied to future city structures and does not aim to defend an idea *per se*. The author realises that such an extensive transportation system may raise some difficulties and aesthetic problems, especially in the vertices of the triangles, where the traffic flow of transitional movements is intertwined with local ones. The main problem of this approach is that such a structure does not solve the problems of depopulation of the cities due to decreasing birth rates. Yet, it may help to create developments which are an intermediate solution between suburbia and 'satellite towns'.

> It is undeniable though that the triangular-catenary structure provides a functionally justified frame for an enormous number of thorough solutions. Due to the high elasticity of this settlement system, the shape of the areas within the linear 'forum', and the spatial disposition of the areas included within the 1st grade centres, it is possible to avoid monotony, despite the regularity of the frame.

> The advantages of the triangular-catenary structure may be stated as follows:

- 'diagnostic clarity' of a system, which provides a fast and accurate diagnosis of urban processes and controls, an essential condition of a genuine 'organic' system;
- simplicity of a controlled 'modular' development of settlement areas, which eliminates the danger of serious functional interferences from the town development (a wide variety of options to shape housing areas, industrial zones and to allocate service centres may soften the rigidity of the pattern);
- economy in the overall settlement region;
- possibility of applying the structure in practice, in structural accordance with the 'primary communication system', as well as 'relative' simplicity of connecting the structure with existing elements;
- guarantee of direct contact between essential human activities: housing, social and professional activities and recreation:
- intensification and uniformity of the climatic influence of green belts;
- high and uniform saturation of designated areas for inhabitants and offices;
- avoidance of 'unnecessary' collisions;
- economy of network systems;
- creation of favourable conditions for effective common transportation means;
- elimination of traffic transit between city centres and of movements into the centre from the outside from the surrounding settlements areas.

The existence of a large-scale regular coordinating network seems to be justified, in accordance not only with ancient and medieval urbanisation doctrines but also with every system building policy in nature and human civilisation. The proposed pattern is of course only one possibility of facing the aforementioned urban development problems. <



6. Possible development of the ridge structure

5. Two different proposals of extending Wroclaw city structure from 1980s by a triangular pattern