

UDC 711

**L.Sh. Rakhimzhanova**

*PhD in Architecture. Senior researcher, Research Institute "Almatygenplan",  
Kazakhstan, Almaty, Dostyk av.85, 050010  
e-mail: lr-design@yandex.ru*

## SMART GEOMETRY CREATES A SMOG FREE CITY

**Abstract:** *Smog is one of the main problems of urbanism. Smart Geometry is a very powerful tool for urban planners and architects to control air related problems. Based on the author's projects this article presents the possibilities of geometrical forms that, jointly with the laws of nature, solve urban planning problems and create a healthy ecological atmosphere in the cities. All shapes are the result of the transformation of aggressive environmental factors into favorable ones.*

**Keywords:** *urban problems, smart geometry, smog, nature laws, architecture.*

There is the Great Architect of the Universe who has created the Universe, arranged the planets in it, and built life on the Earth based on the Geometry. All of that harmoniously works up to now. The ancient architects followed his principles. Three basic ideas are contained in treatises of the Veda: a convenience for the body, stability for the mind and happiness for the soul (Tushkin,2014). But the modern world has lost this knowledge and began to construct urban buildings at random, creating chaos in the society. Spontaneous growth of cities has ceased to correspond to concepts of the comfortable environment so that the concepts of ecological architecture seem new even though the ancient Greek word "eco" meant "home", i.e. any building was meant to be healthy initially.

In the Middle Ages architects attached the significant importance to the sacred geometry of architectural forms, because they were able to clean the space both on the physical and spiritual level. Nevertheless, these principles have been forgotten today, and this is the reason for the collapse of the modern architecture. Let us consider several geometric shapes aimed at solving this collapse and creating a healthy urban environment.

### A. Dome shapes

Domes of the steppe peoples ventilated the indoor premises on hot days by virtue of the Venturi effect. The laws of aerodynamics were applied both in mobile and stationary dwellings. The wind flow was caught by the special architectural forms installed on the roof and then was sent to the internal living spaces (Fig. 1). To clean and cool the external air flows the water reservoirs or water vessels were placed in the way of their movement.



Figure 1. Methods of ventilation in the hot countries

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The same techniques may effectively work in the modern urban design. Thus, for example, it is known that smog is accumulated in cities due to the architectural and urban-planning obstacles located on the way of mountain-valley circulation, formation of an inversion layer and full absence of movement of air masses. Using the reasonable building geometry (forms) it is possible to aerate the urban territory from smog. The adjusted architectural compositions allow creating the forced aeration both in the horizontal and vertical direction; they are able to concentrate, dissipate or redirect the wind flow depending on the problems to solve.

### B. Conical shapes

The most difficult obstacle to find a solution against smog is the formation of an inversion layer over the cities, which not only prevents contamination dissipate, but reflects it back to the ground as a screen, constantly increasing its harmful effects on the environment and people's lives. Thus, we live in a closed «container» with deadly chemicals. It is necessary to punch a hole in this «container» to let the fresh air in the urban environment. To solve this problem, we have developed several models from stationary in the mountains to flying over the city at the inversion layer. They break the inversion layer and remove smog from the urban space due to Geometry of a conical shape, creating vertical thrust because of the difference in wind speed (law of Bernoulli). The most economical one is a self-opening and self-raising model with inflatable rings (Fig.2) They may be located directly over the city and can be in the form of vertical airships with remote control.

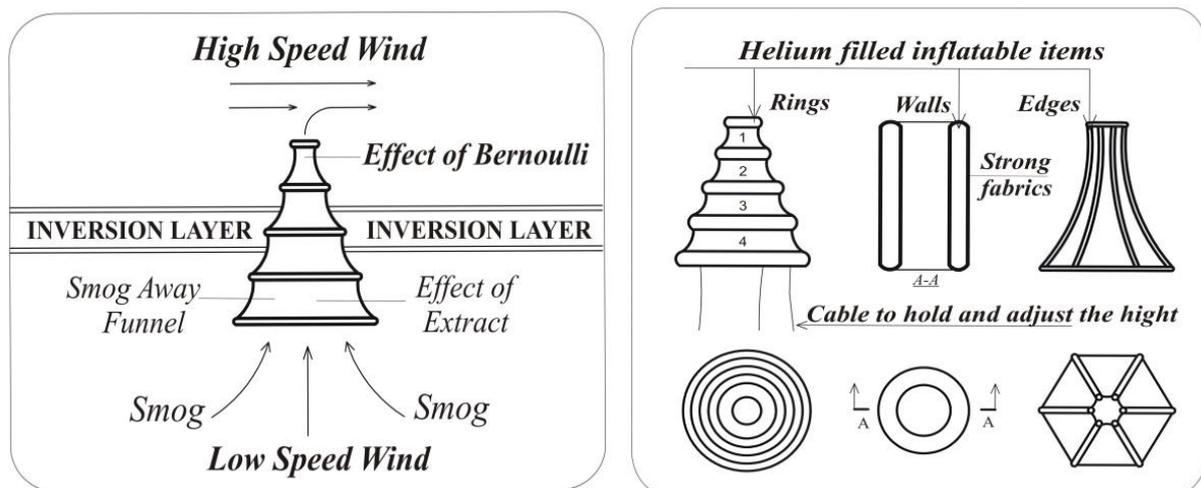


Figure 2. A self-opening and self-raising model of the anti-smog device of a conical shape

A similar smaller model is proposed to be used at the ground level in urban areas, as they are able also to transform the air, purify it, to convert carbon dioxide into oxygen through a chemical reaction of Titanium Dioxide with UV lamps inside a cone (there is a patent). This technology has been successfully tested in medical organizations and now we bring it to the urban environment. Models can be a part of the architecture or free-standing forms, performing a variety of functions such as bus shelters, lighting and others.

Smart Geometry is sometimes able to solve several tasks simultaneously. In our case this special conical shape with a certain curvature, narrowed and widened in some places, allowing to absorb polluted air without coercion and clean it, to increase wind speed in the narrowed areas in accordance with Bernoulli's law, which we also use as a source of energy. Therefore, our model can serve as a stand-alone power station in remote or inaccessible areas. The advantage of this Geometry form is that it produces free energy even in calm weather, operates independently from the wind direction, and does not have long blades, which sometimes break. Therefore, it is Smart.

Wind control is not a new solution; the humankind has known how to use it for millennia. The first sailing ships appeared several thousand years ago in the era of the earliest civilizations. Manipulating various sailings, a sailing vessel has been able to move in any direction. All that is left for us (for architects) to do is to apply this knowledge in architecture, where we also deal with the planes of buildings which are required to create compositions in accordance with the laws of physics of the atmosphere, and to direct the wind in the right direction.

**C. Triangular and round shapes**

The wind direction may be also changed by the geometric shape of water area. For example, it is known that the wind rotates to the right passing over the water surface. So, the larger water surface it passes, the more rotation it makes and vice versa: the less surface it passes, the smaller it is twisted. Therefore the various forms of water areas affect this rotation differently: some can dissipate it, while the others can gather it (Fig. 3, 4). It is possible to install the wind energy generation plants in the point of wind flow gathering.

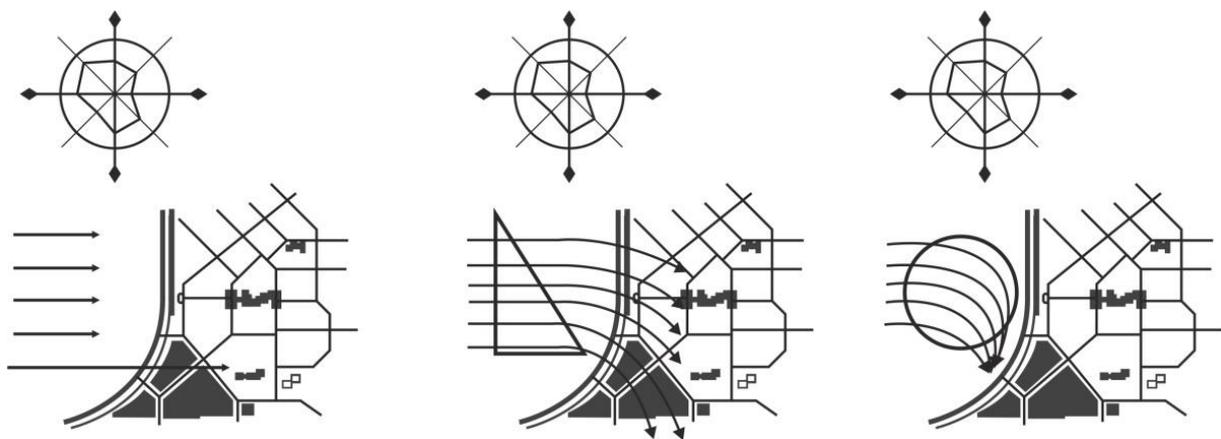


Figure 3. Application of wind rotation over the water area in urban planning

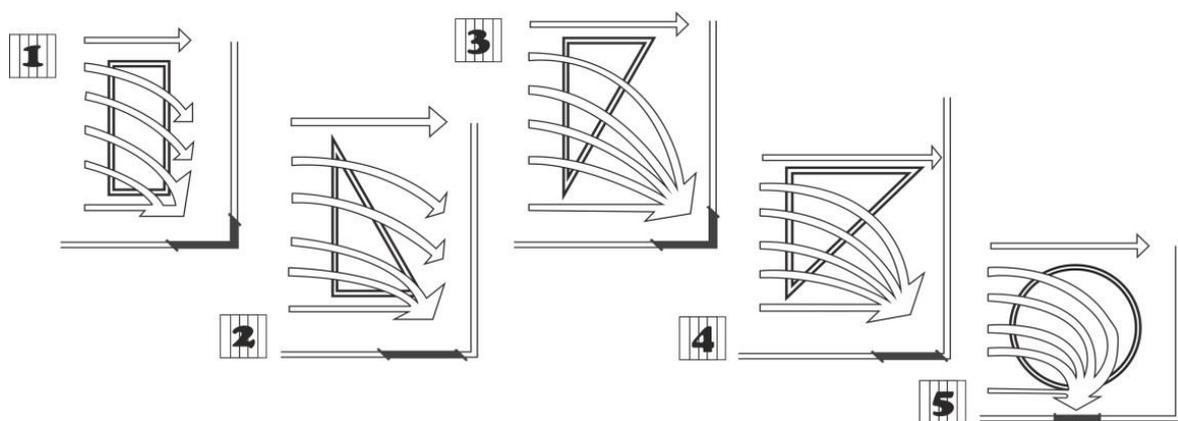


Figure 4. Example of the formation of water areas using the natural laws of wind rotation when it passes over the water surface. Geometry of water areas defines the intensity and direction of wind flow

### D. Parabolic shapes

An architect using the geometry of urban-planning forms is able to create a system of transport highways non-intersecting with the residential areas, ensuring safety and being free from the deleterious gases and noises emitted to the atmosphere. Axiomatic expression of the British: "sheep have eaten people" is read today as "transport eats people". Transport has become our main competitor for vital space: cars captured the residential areas, recreational facilities and centers of cultural and social services. In the author's opinion, one of the solutions to transport problems is the parabolic shapes of residential structures, constructed along the transport highways. Screened (shielded) buildings with garages, warehouses, parking areas located near highways reflect harmful effects of transport and protect the inhabited space located on a reverse side of parabolic buildings opened to the nature. The residential courtyards, kindergartens and schools are located there. This functional separation allows creating the residential areas non-intersecting with the transport highways and ensuring people's safety and fresh unpolluted air (Fig.5).

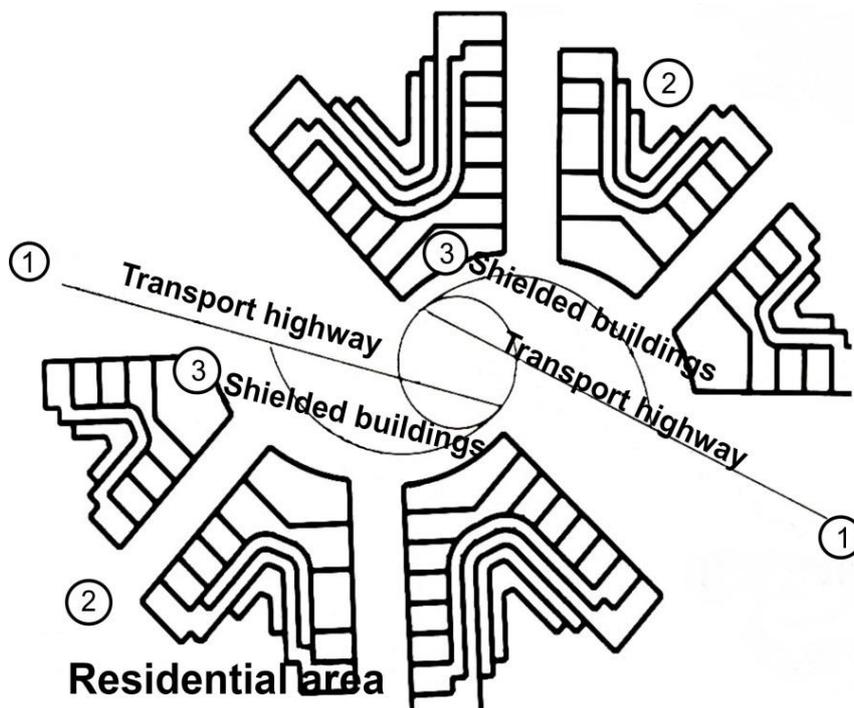


Figure 5. The concepts of residential areas non-intersecting with the transport highway:  
1 - transport highway, 2 - residential areas, 3 - shielded buildings

### E. Hyperbolic paraboloid shapes

This curved shape turned to the sun allows obtaining a sun-exposed surface where additional spherical paraboloids are located. This surface concentrates the solar energy, on the one hand, and, on the other hand, ensures a comfortable environment for the public and residential complex where a series of buffer spaces consisting of the open, closed and winding streets modify the negative environmental factors into the favorable ones (Fig. 6).

### Conclusion

Thus, we have observed the dependence of space properties on architectural and geometrical shapes that do not conflict with the Nature, but rather interact with it efficiently and solve many problems. Based on the knowledge of the Nature laws and application of smart geometry it may be possible to create project proposals for various climatic zones that solve a number of urban-planning issues simultaneously: environmental, social, aesthetic and other issues.

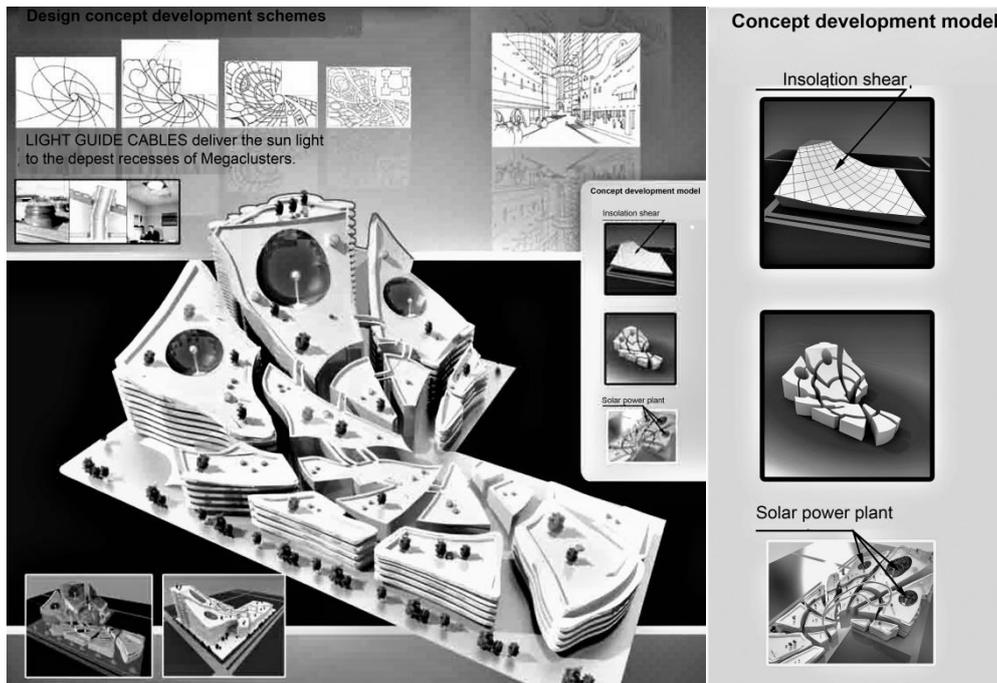


Figure 6. Reconstruction Project for "Otrar of the XXI Century" Public and Residential Complex in Astana. A hyperbolic-paraboloidal shape of the complex is caused by transformation of the aggressive environmental factors into the favorable ones

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