

Revitalization of Public Spaces: Sustainable and Bioclimatic Strategies that Improve the Qualities of Skopje's Urban Matrix

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Abstract: *This research analyses certain sustainable urban strategies that are in correlation with the improvement of the air quality, lowering of the air temperatures in summer period and improvement of the social cohesion of its habitants. More precisely, this research discusses about the possible ways of application of the analyzed bioclimatic urban strategies for achieving sustainable solutions regarding urban planning and design of a public space in front of the railway station in the center of Skopje. The proposal for new green public space in front of Kenzo Tange's project from 1965 is designed to be context-sensitive and ecologically treated space. It is intended this project to be a new meeting point, with a strong modern attitude in its forms that respects the natural, historical, social and cultural context in which it is placed. This study was conducted in the following steps. At first, the sustainable bioclimatic discourse was analyzed in order to give explanation which of the mentioned sustainable urban principles can be applied on the analyzed case. Then, different analytical methods and information from various scientific areas were used, which helped in detecting the real problems present on the analyzed location. In order to define the adequate bioclimatic strategies that will have ecological and socio-environmental qualities, the so called "green features" were established. "Green feature" in this research represents a sustainable quality of a particular strategy or urban measure that can improve the climate of the city, improve the air quality, lower the summer temperatures, revitalize the chosen location, improve the social cohesion, create people centered urban design and redefine the city values. These "green features" can assist in determining project's sustainability value. Having in mind that this location is situated in dense and polluted urban matrix in the city of Skopje, the bioclimatic strategies recognized in this research were found as applicable solutions in the presented project. These strategies and measures can also be applied in wider urban context on cities with similar environmental problems.*

Keywords: Bioclimatic architecture, Revitalization, Sustainable urban strategies, Social cohesion, Environmental urban planning, Fibonacci's numerical order.

1. Introduction

In today's modern societies, a great need exists for careful, thoughtful evaluation and planning of man-made and natural resources, in terms of both current and future usage [1]. Cities, towns, buildings and public spaces must be carefully planned for their habitants and for the complete environment. In that manner, this research explains the analytical and design methods applied on a specific location in the center of the city of Skopje. The analyzed location currently is an unappealing, dehumanized asphalt parking in the center of the city in front of the railway station. Reviewing the scientific literature on low-carbon cities, green cities, healthy cities [2], [3], [4] as well as conducting this research, helped us to come to the conclusion that this location should be designed as: green, compact, walkable, healthy, barrier-free and socially vibrant space that will deliver a high quality life to the people gravitating in this area. This conclusion led in defining the concept of this project: transformation of the analyzed location into a green public space in a form of representative landmark of the city. The name of the project "Kenzo" is honoring the architect who was engaged in the biggest project after the terrible earthquake in Skopje in 1963.¹



Figure 1: Left: Current situation (authors)

¹Kenzo Tange was a Japanese architect, and winner of the 1987 Pritzker Prize for architecture. He was one of the most significant architects of the

20th century and designed major buildings on five continents. His university studies on urbanism put him in an ideal position to handle redevelopment projects after the Second World War. His ideas were explored in designs for Tokyo and Skopje. Tange's work influenced a generation of architects across the world.



Figure 2: Right: The project Kenzo (authors)



Figure 3: Left: The project Kenzo (authors)

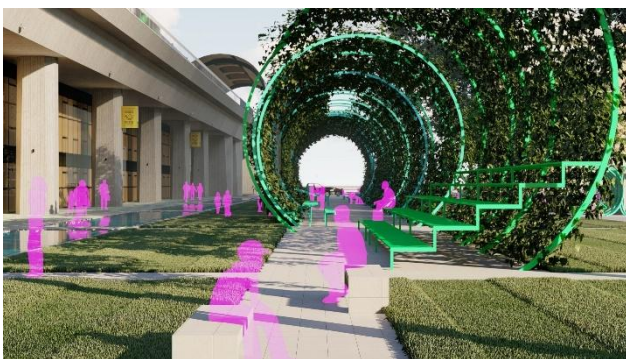


Figure 4: Right: The project Kenzo (authors)

The main element of the structure in the developed project is a modular cylinder with a diameter of 8 m. Modularity is in relation with the Fibonacci's numerical order. The steel profiles shaped in form of a ring are connected with steel wires and form a cylindrical tunnel covered with local natural vegetation. When it comes to greenery, it is necessary to place a carefully selected plant, whose characteristics help the problems with polluted air and noise and create a pleasant atmosphere. Also, the greenery should be adapted to local climatic factors. The greenery of the cylinder is ivy, which flourishes in Skopje. Ivy is an evergreen creeper that purifies the air: neutralizes toxins such as formaldehyde, xylene, tulle and carbon dioxide.

The two approaches: durability + economically affordable construction, makes the structure ideal for public spaces. The inner space is shaded and green. The openings that subtract the green tunnel are in direct relation with the solar radiation and air circulation. At the same time, they enable better pedestrian circulation through location. Transformation into anthropomorphic and natural habitat is considered to be a perfect solution to enhance the social cohesion and to enrich the space with different functions that can attract more people to visit this location in different periods of the day.

2. Purpose of Study

The climate in Skopje is continental with cold winters and dry hot summers. Skopje, in the center of the Balkan Peninsula, is nestled in a valley between mountain ranges that surround the city from the north and the south. This landscape proves deadly in the winter period [5]. As warm air rises up toward the mountains, it meets the colder, heavier air travelling downwards. This temperature inversion creates a blanket of smog that settles heavily over the valley, trapping polluted air on city streets and in the lungs of residents [5], [6]. Located in a valley without big wind flows, the air circulation and ventilation of the city doesn't help on reducing the air pollution especially in the winter period [7], [8]. In the period from October till the end of April the level of air pollution is huge and way above normal [6], [8].

The summer temperatures in Skopje during the day usually reach 38 - 40 C. If the temperature is measured close to the asphalt surfaces it grows for additional 10 C [9]. These surfaces are radiating the heat for prolonged time till late in the evening. In that manner city of Skopje can be characterized as heat island [10].

Another big problem for the people that work, study, shop, dine or sight see in this area is the absence of vegetative and green surfaces, open public spaces for resting and enjoying the nature free of charge [9]. They must go and sit in some of the restaurants and café bars located on the bank of the river Vardar.

The problem with the social cohesion in this area is also evident. The conducted questionnaire showed that the residents, as well as the people working in the surrounding buildings do not have open public space where to enjoy the nature and gather. The children do not have enough green and open space for playing. The old people do not have open parks for walking and gathering. The young people living in the surrounding houses and buildings wrote in the questionnaire that they are lacking of an open space where they can perform music, theatrical performances and different kind of student's competitions, exhibitions and gatherings....

The analyzed location is in the center of the city and has a very complex socio-political and architectural position. In the immediate vicinity of the river Vardar it is embedded between two opposite architectural concepts. From one side of the location is the neighborhood Madzir Maalo (dating from the beginning of the XX century) - a symbol of the

city's spontaneity, tradition, presenting different stages of the historical development of Skopje. From the other side of the location is the Transit Center, a symbol of the Modern in Skopje.

Madzir Maalo started to settle in 1873 when the railway line Thessaloniki - Mitrovica was built. It is one of the first neighborhoods in Skopje on the right side of the river Vardar with orthogonal street pattern. In that period, Skopje can be characterized as a town with oriental features built on medieval Byzantine and ancient foundations. The neighborhoods in Skopje until the XX century were positioned on the left side of the river Vardar and characterized as organic urban matrixes: houses with courtyards - closed towards the narrow and organic streets. Only Madzir Maalo was developing as an anthropomorphic settlement on the right side of the river, spontaneously: houses had open yards, gardens and wells; neighborhood fountains; picturesque streets. After the withdrawal of the Ottomans, during the Balkan and World Wars, the neighborhood tended to Western European influences that resulted in building larger houses with neo-classical, neo-baroque features owned by the wealthier families. This neighborhood has remained the same for a long period and was not developing, nor restoration of those beautiful houses was conducted. For the last two decades, there has been a constant pressure for building hotels and tall residential buildings due to the expensive land in the downtown area [12].

After the Second World War, the new political order planned the city as a functionalist city by zoning the main urban zones: housing - work - recreation. After the catastrophic earthquake in 1963, when 80% of the total built fund of the city was demolished, Skopje grew into a modern city and a city of solidarity. On the international competition from 1965, eight plans were made for the central area and at the end, the ninth plan was made as a combination of the best ideas [11]. All plans were in the spirit of modernism - completely opposite to the previous character and look of the city. New modern and brutalist buildings create a completely different image of the city, opposite of the oriental spirit followed by the Western European tendencies. The massive concrete blocks, the clear geometric shapes composed in large functional ensembles made Skopje a city for the new modern man. The new buildings tended to be "progressive" in design style, a tone set by Tange's response to the demand of "a new architecture for a new revolutionary society" [11]

The density in the center of the city grows every day by adding new building on every location that was empty and green [12]. This trend especially escalated when the project Skopje 2014 emerged [12]. Due to the Skopje's high population density and pollution [5], the opportunity to plan prosperous, livable, low-carbon city is urgent [1] [13]. In the 21st century, the world is beginning to notice the first effects of climate change. That is why the cities of the future are planned as cities that are sustainable, smart and in harmony with nature.



Figure 5: Left The project KenZO (authors)

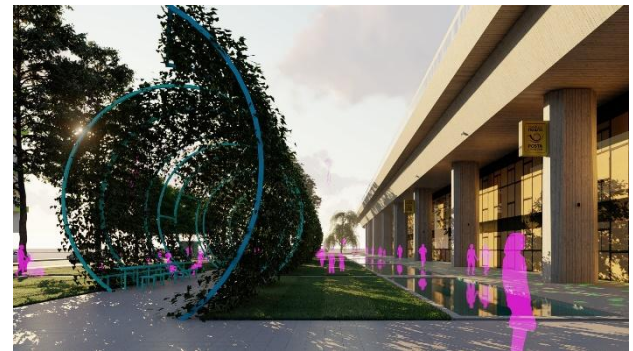


Figure 6: right: The project KenZO (authors)

The chosen location placed between the vernacular concept and the mechanical modern concept, must offer a solution that will be a harmonious fusion of all the aspects considered (historical, social, cultural, economic, ecological, ect.). The new solution must correspond with the historical and cultural heritage in this area and in the same time has to offer a solution to the existing problems this city is facing, as a post-socialist city; city in transition. This city must increase the percentage of green surfaces [2] [13]. Without developing and applying urban strategies oriented towards sustainable and bioclimatic planning, this crowded and polluted asphalt city will not reach its full potential.

The purpose of the study that further was developed as an architectural project was: designing a public space in front of a building that represents a cultural heritage of great importance for the city as green eco-friendly space celebrating the life of the past and future generation of this city. The multifunction character of the location will enable revitalization of the location by redesigning the existing parking and adding a number of new urban contents. Revitalization of locations in the center of the city that have lost their mining through time by adding new urban contents that enlighten the context of the nature and social cohesion represents very important sustainable urban principle [1], [2], [13].

The idea of this project was implementing bioclimatic principles, focused on air purification and lowering of summer temperatures with simple, cheap but thoughtful methods. Around 85 % of the location is transformed into green and water surface. The water surface positioned near the structure in the same time acts as a mirror that exemplifies the importance of this architectural monument.

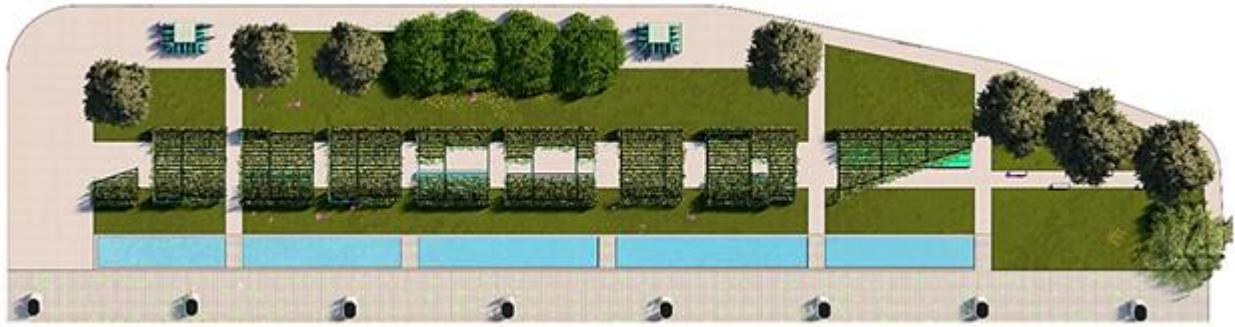


Figure 7: The floor plan of the project KenZO (authors)

3. Materials and Methods

3.1 Sustainable urban principles

The sustainable urban discourse has been analyzed and discussed by many theoreticians and many institutions mainly because of its importance on global level. Reviewing the scientific literature as well as the existing frameworks related with sustainable urban principles, *The Copenhagen Agenda for Sustainable Cities* [1] was found as very useful for this research. This framework of ten principles was created by fifty most important urban experts in the world. They shared their opinion on: what are the most important steps for creating sustainable cities. Representing all parts of the world and from a wide range of disciplines, they all agreed that for making cities sustainable we need a radical change of mindset, new strategies and new governance models to support development and foster a new generation of urban leadership [1].

Another important framework of urban principles is given in the publication *Cities for People in Practice* (2015) by Chris Busch and CC Huang [3]. This publication represents a guide for creating sustainable urban forms and transportation solutions to some of the most pressing challenges facing modern cities, including congestion, pollution, and urban sprawl [3]. These eight principles are essential ingredients to sustainable, economically vibrant cities that deliver quality of life for their residents. They are the following ones:

- 1) Walk - Develop neighborhoods that promote walking.
- 2) Connect - Create dense networks of streets and paths for non-motorized transit.
- 3) Transit - Build extensive, high quality transit with good connections between modes.
- 4) Cycle - Prioritize bicycle networks that offer protected lanes.
- 5) Mix - Zone for mixed-use neighborhoods.
- 6) Densify - Actively encourage greater density around major transit hubs.
- 7) Compact - Set growth boundaries and plan for compact regions with short commutes.
- 8) Shift - Increase mobility by regulating parking and road use [3].

According to Jan Gehl, [14] external activities are influenced by many conditions. The physical environment is one of the factors that influence activities in many different ways. There are three types of outdoor activities that take

place in public spaces, and each of these activities requires a specific physical space:

- 1) Essential activities - Necessary activities take place in all conditions: going to school or work, shopping, waiting for public transport, etc. These activities take place throughout the year, regardless of the exterior, and the citizens have no choice regarding them.
- 2) Optional activities - Optional activities happen because the citizens have a desire for them and they happen only in the exterior that provides them and has good conditions for them. This category includes walks in the fresh air, sitting in the sun, walking around enjoying, and so on. These activities occur when the time and place are pleasant and the exterior of the city or neighborhood is encouraging them to do so and are particularly dependent on the physical conditions of the environment. When the outdoor space is of poor quality, only the necessary activities take place, the citizens rush to go home. When the outdoor space is quality, people stay on the street and in the city, sit outside, socialize and cover a wide range of different activities. The good environment expands the activities in the city.
- 3) Social activities - Social activities are all activities that involve people in public spaces. These include: children's games, meetings, conversations, various activities, and most often - passive contact, simply watching and listening to other people. These activities can be considered as a result of the two previous categories (necessary and optional activities). Social activities occur spontaneously as a result of people moving and being in the same space. This means that social activities indirectly depend on whether and how good the space is designed for the necessary and optional activities to take place. The nature of social activities depends on the context in which they occur. Passive contact often occurs in the city center and on the streets, which should not be underestimated. It is most freely said that social activity happens whenever two people are in the same space. This has a lot to do with city and space planning. Although physical morphology has no direct impact on the quality, content, and intensity of social connections, architects and planners have an impact on creating a quality public space that encourages activities [14].

Some of the principles given in these three frameworks are found suitable for conducting further analyses on the chosen location and discovering ways to apply them through suitable urban strategies on the analyzed case.

3.2 Research Methods

Environmental planning is a decision-making process that addresses environmental parameters when creating human designed environments. It is an interdisciplinary field that includes urban planning, landscape architecture, architecture, engineering, related arts, natural sciences (biology, geography, meteorology, physics...) and social sciences [9]. Different analytical methods and various scientific findings were used in order to come up with precise answers regarding the real problems at the analyzed location:

- 1) Problems that the people gravitating in this area are facing;
- 2) Problems related with the climate of the city in the summer period, and
- 3) Air pollution problems of the city of Skopje.

Methods used in this research to illustrate the present situation at the location, are the following ones:

- Analysis of the solar radiation during all year around;
- Analysis of the air circulation during all year around (rose of dominant winds);
- Analysis of the high greenery, low greenery and asphalt surfaces on the location;
- Analysis of the pedestrian walking routines;
- Measuring the air temperature on location during day and night in summer period;
- Analyzing how many days in the winter period had high air pollution index in the center of Skopje (information taken from the measuring units);
- Interviewing people that gravitate in this area;
- Analyzing the height of the built environment that surrounds the location;
- Analysis of the historical, political and sociological context of the surrounding, having in mind that the

location is situated between two fundamentally different concepts: MadzirMaalo, as a low residential settlement from the early 20th century and the Transport Center, a representative of the Brutalism in Skopje.

- Analysis of the necessary and possible programs and functions and their impact on the citizens.

4. Results and Discussion

The conducted methods helped in detecting the real problems present on the analysed case. Based on all mentioned analyses, the precise sustainable bioclimatic principles and strategies were found as most adequate for implementing on the chosen location and climate. In order to define adequate sustainable bioclimatic strategies that will have ecological and socio-environmental qualities, the so called “green features” were defined. “Green feature” in this research represents a sustainable quality of a particular strategy or urban measure that can improve the climate of the city, improve the air quality, lower the summer temperatures, revitalize the chosen location, improve the social cohesion, create people centred urban design and redefine the city values [9]. These “green features” can assist in determining project’s sustainability values. They can be used in any similar project

Table 1: “Green features” applicable on the analysed location

N	Green Features:	Referring to
1.	Planting and sustaining large green surfaces with low greenery.	VEGETATION
2.	Planting and sustaining locally adjusted greenery that helps in reduction of the polluted air (ivy, pine, chestnut, etc.)	
3.	Using the local winds and the passive cooling strategies for increasing the air circulation.	AIR
4.	Positioning air purifiers into the open public space.	
5.	Designing water surfaces that lower the air temperature in summer period and bring humidity, calmness and relaxation.	WATER
4.	Revitalization of existing “brownfield” locations by making a mix-used development plan that includes a variety of uses within a project and creates opportunities for pedestrian-oriented design.	MOBILITY
5.	Developing bigger areas in the centre of the city that promote walking and gathering.	
6.	Prioritize bicycle networks - Increase mobility by regulating road use: combining bicycle streets + pedestrian paths. Incorporating bicycle parking.	
7.	Barrier-free access - Walkways and ramps designed as friendly surfaces for people with disabilities.	
8.	Adding playgrounds for children made of natural materials (wood, rubber, ropes).	SOCIAL COHESION
9.	Adding energy-efficient artificial lighting in the public space - brings life on the location during the night and makes them interesting and safe for the visitors.	
10.	Adding amphitheatres and squares - spaces that fulfil the interests of different groups of people related with: musical and theatrical performances, open-air exhibitions, public gatherings...	
11.	Designing urban furniture that will offer the visitors a pleasant accommodation, socialization and in the same time will provide space for throwing and selecting the garbage – recycle bins (for glass, plastic, cardboard/paper)	
12.	Designing the public space as new landmark of the city that will represent a new tourist attraction.	

5. Results and discussion

Cities should function in harmony with nature rather than in opposition to it. Cities are potentially environmentally friendly, as they have the capacity to become self-sustaining and energy producing instead of energy consuming. City planning should be people centered, rather than design centered. A city is a constantly evolving organism, and city planning must take a broader perspective than the design of individual buildings. To realize this potential, we must develop the concept of bringing the nature back to the city. We need to create awareness among the young architects, urbanists and city users to think about resource reduction and motivate them to change their behavior and consumption patterns. Reuse of “brownfield” locations instead of new ones is very important sustainable principle for improving the qualities of a city. Revitalization of locations in the center of the city that have lost their mining through time by adding new urban contents that enlighten the context of the nature and social cohesion - making it a greener and socially vibrant place represents an imperative in the conducted research.

The goal of this research was to show that bioclimatic sustainable urban revitalization should be understood as multidisciplinary approach: analyzing all the possible aspects important for certain location in order to achieve quality solutions that will serve well for present and future generations enabling them to live in healthy, ecological, sustainable and socially vibrant environments. The presence of the elaborated “green features” in any urban project done for this or similar location assists in determining project’s sustainability value.

Benefits of incorporating projects of this kind that support the sustainable bioclimatic urban planning in the city of Skopje as well as in other cities facing similar problems should be:

- Improving the air quality,
- Lowering the high summer temperatures resulting from the large asphalt and concrete surfaces – in all the cities that are characterized as heat islands,
- Improving mobility and walkability,
- Reducing carbon emissions,
- People centered city planning, rather than design centered urban solutions,
- Redefine city values: a sustainable city depends on the attitude and behavior of each urban individual and user. The sense of citizenship and individual responsibility towards sustainable values should be encouraged rather than plain consumerism.
- Incorporating more and different out-door activities (such as walking, bicycling, exercising, gathering, playing, performing...)
- Improving social cohesion,
- Supporting a harmonious and prosperous society.

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