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TOWN-PLANNING AND URBAN DESIGN

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Vertical green plates are an alternative to middle street refuges

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***Abstract*:** The modern world has transformed the human landscape from the surrounding urban space into a soulless and machine-like environment. The unrestrained expansion of the urban environment in comparison with the natural spaces of the city has led to a reduction in the size of urban landscaping, limited the area of urban land for planting plants and habitat of animals and birds. The need for integrated landscaping in the form of vertical structures together with lawns in the middle of the street can improve the characteristics of these green islands, making them more stable elements of the urban ecological framework. Green walls with form-forming panels, which have many favorable environmental, energy and economic factors, can reduce the amount of pollutants associated with the road network. The involvement of all these surfaces in the air circulation system associated with the movement of vehicles will improve the conditions for the dispersion of pollutants in the urban environment. The placement of vertical green landscaping elements between traffic lanes will reduce environmental tensions in the mainline territories and optimize their green space. One of the factors of stability of any city is its transport communications of various levels. Streets, as part of these communication levels, can include green screens in their territories, which can be installed in various parts of the city by expanding the elements of streets and roads and thereby spreading their beneficial impact on the environment.

***Keywords*:** street and road network, urban transport, ecological framework, vertical landscaping, "green" screens, sustainable development of the urban environment
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ГРАДОСТРОИТЕЛЬСТВО И УРБАНИСТИКА

Научная статья

Вертикальные зеленые экраны как альтернативный способ озеленения улиц

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Аннотация. Современный мир превратил человеческий ландшафт из окружающего его городского пространства в бездушную и машинную среду. Безудержное расширение городской среды по сравнению с естественными пространствами города привело к уменьшению размеров городского озеленения, ограничило площади городских земель для посадки растений и обитания животных и птиц. Необходимость комплексного озеленения в виде вертикальных конструкций вместе с газонами посреди улицы, может улучшить

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характеристики этих зеленых островов, сделав их более устойчивыми элементами городского экологического каркаса. Зеленые стены с формообразующими панелями, обладающие многими благоприятными экологическими, энергетическими и экономическими факторами, могут уменьшить количество загрязняющих веществ, связанных с улично-дорожной сетью. Вовлечение всех этих поверхностей в систему циркуляции воздуха, связанную с движением автотранспорта, улучшит условия рассеивания загрязняющих веществ в городской среде. Размещение вертикальных зеленых элементов озеленения между полосами движения уменьшит экологическую напряжённость на примагистральных территориях и оптимизирует их зеленое пространство. Одним из факторов стабильности любого города являются его транспортные коммуникации различного уровня. Улицы, как часть этих коммуникационных уровней, могут включать в свои территории зеленые экраны, которые можно установить в различных частях города за счет расширения элементов улиц и дорог и распространения тем самым их благоприятного воздействия на окружающую среду.
Ключевые слова: улично-дорожная сеть, городской транспорт, экологический каркас, вертикальное озеленение, «зеленые» экраны, устойчивое развитие городской среды
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Introduction

Each system in its natural state, it is under two opposite tendencies, namely positive entropy (disorder) and negative entropy (regularity). Accordingly, the first tendency always takes the system out of natural equilibrium and the second tendency, based on the existential goals of the system, tries to restore the necessary compatibility to it (environmental protection). Now, if we want to view this view based on the complex challenges of cities today. Which is the increasing population and urbanization rate followed by more intensive development of cities and changing the pattern of human habitation. Let's match there is no doubt that urban growth has deviated from its natural path and moved more towards environmental disorder and resource depletion [11]. The extent of the destruction along with its unusual pollution in the urban environment has been such that it has been raised as one of the main and most important concerns of human societies in the past few decades. On the other hand, accelerating the implementation of more and more environmental threats in cities. Not only the world today but also the human condition it has become a machine and an artifact rather it is a reminder of the bitter truth that day by day the surface of these artificial environments is expanding unbridled compared to the natural spaces of the city [14]. With the trend of reducing the size of urban green habitats and increasing concerns about the limited land area of cities for planting plants. Deployment of green cover of natural elements such as plants in the form of green plates of life instead of the current middle refuges not only can it make the poor performance of these middle islands more accountable to the urban environmental network. But by injecting dense and integrated green texture of these plates into the gray texture of city traffic. These green levels of life as one of the key proposed contemporary solutions to reduce noise and air pollution reducing the effect of the city's heat islands reduce the absorption of solar energy and reflected rays from the street, reducing dust particles in the air around the streets as well as improving the conditions of oxygen production and production of moisture and evaporative cold and by compensating for the lack of ground in the city streets to build a middle green space in them, increase urban greenery per capita and sustainable development in many dimensions. Cities also play a more active and effective role [10].

Materials and Methods

In this part of the article to choose the appropriate method and solution, from the three main topics of our discussion, that is the green wall traffic and intermediate refuges (middle green islands) will be discussed. And in the continuation of this articles, we will explain how all three parts of the

topics are presented having a chain of reliable and interrelated potentials, they will be able to reduce the amount of environmental pollution in high-traffic urban areas and will improve the stability of urban ecosystems and consequently strengthen its ecological network as much as possible.

Introducing the green wall

Green wall is a new technology that today is slowly finding its place in the contemporary and progressive cities of the world. A green wall is a wall that is covered as a stand-alone structure or part of a building with vegetation and in another definition of the green wall refers to a wall that is partially or completely decorated with special vegetation.

The role of green walls in the sustainability of architecture and urban planning

Green walls can be used as a suitable solution to solve ecological problems in urban centers and metropolises as well as to improve human health problems and environmental issues. Of course, it is important to mention that these walls have unique features they can form small vertical green spaces compensate the land area restrictions of cities for planting plants in a desirable and effective way. Another significant advantage of green walls in the ecological sector, environmental the economy and energy will be as follows [6].

First the ecological effects

Reduce noise and air pollution in cities, reduce the absorption of solar energy and reflected rays from the streets, reduce dust particles in the street air. Decreasing the microclimate temperature and increasing the relative humidity of the air increasing green space per capita in cities, produce more oxygen save on polluting energy, including fossil fuels, creating a micro-climate in cities [13].

Environmental impacts

Decrease UHI, reduce the effect of carbon decreasing air pollution, reducing the effect of the city's heat islands ensuring environmental health and increasing environmental diversity and improving the beauty of city landscapes which can ultimately have positive psychological effects on city dwellers [14].

Impacts in the field of energy

As a shading device internal temperature regulator and natural air cooling around the streets and adjacent buildings energy conservation.

Impacts in the field of economics

Earn double points in the credit system LEED, increase the value of independent real estate adjacent to the street by up to 20% increasing urban agriculture improving the quality of life of citizens [19].

Types of green walls in public areas of the city

Green landscaping walls: these walls are considered as a strategic tool in the living architecture method the green walls of the enclosure are usually sloping at the scale of vertical surfaces and their main use is to reduce noise and stabilize sloping surfaces. These types of walls are on the walls of bridges highways and often high vertical walls are used in the city and improve the view of the city. The green walls of the compound are traditionally made of concrete blocks and today with the advancement of green wall technology from polypropylene and bags (Geotextile) Contains planting medium used.

Living wall system

Living wall systems known as green walls or vertical gardens they are made of modular panels each of which contains its own soil and other growing environments. In the simplest sense a wall system living includes modules, panels, planted blankets or bag containers carry vegetation which can be fixed on a structural wall with an independent frame. Panels in living walls can support plant species with different densities and great variety compared to green facades. Of course, It is worth mentioning that to maintain the vegetation in these walls automatic irrigation and feeding system is installed in it. Other interesting points in connection with the walls of life they perform very well in both sunny and shady conditions which will allow these walls to be installed in both tropical and temperate urban areas [18]. In general, the green walls of life can be divided into three general categories.

Modular grid panel system, Layer system, Scaffolding

a. Modular grid panel systems (Modules):

Modular grid panel system it is light and made of galvanized steel and is designed in such a way that it keeps the green facade at a distance from the wall surface. The grille panels are modularly stacked together and can cover a large area. These panels can also be shaped to form desired shapes and curves. This modular system is due to the stiffness of the panels it can be used as a bridge between different parts of the building or as green walls in public areas of the city independently (fig. 1) [2].

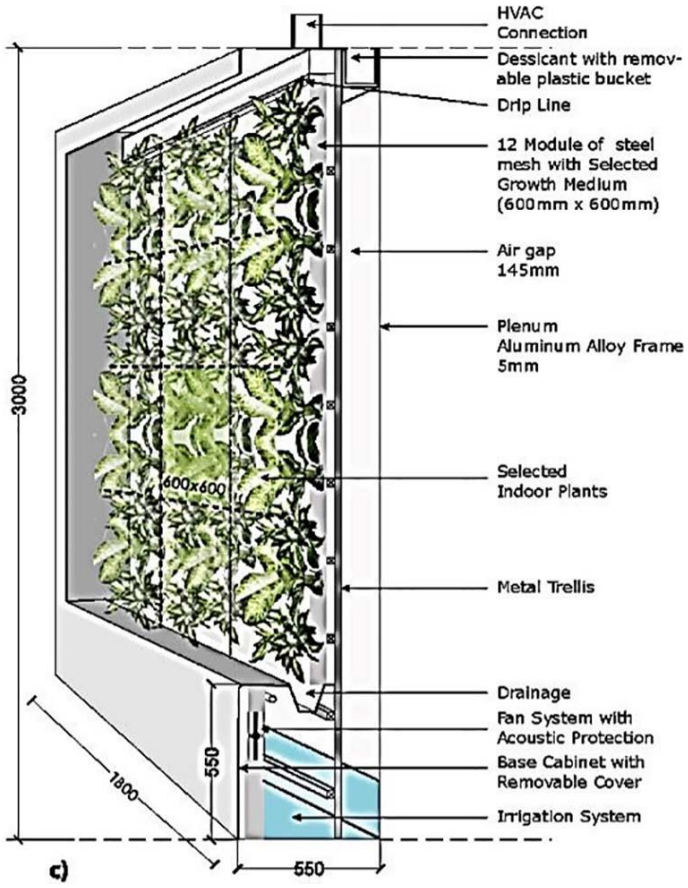

Figure 1. Details of the grid panel system of green walls[2]

[2] Be prof. Agis M. Papadopoulos, Green walls as element of bioclimatic design in Mediterranean urban buildings, Thessaloniki – Greece, November 2013, p. 49

b. Layer based systems:

Layer-based living wall system they are made of planting container holders and use metal or plastic. The bed is placed directly in an empty container or in permeable water composed of a tissue bag (fiber). In this system the planting containers are connected to each other and fastened to the wall either in the form of frames or secure independent metal shelves. Alternatively, metal, or plastic planting containers can be hung on a metal grid mounted on the wall. Single planting containers can be removed for storage or replanting. Most systems are layer based just like hydroponic green wall systems it is designed for automatic irrigation. Cultivation environments in these systems provide a protective structure for plants and equipment and access to climate and nutrients and reduce the need for continuous management with hydroponic systems [5].

c. Scaffolding:

This system can be modular planting containers or large panels. The system through hooks that protrude from the load-bearing walls it out It is installed (or independent free structures) to create air cavities between the walls, (Or other structures) and the back plate of the green wall system is created. This system is hydroponic an inert growth medium is provided for plants to become physically firm (established), Such as garden resin. Mineral pumice or felt cover; these materials act as water retaining sponges. Although most of them are saturated with water and will make the system heavier its hydroponic advantage will ensure that no structural erosion occurs in the growing environment [14].

Introducing urban traffic

All movements that take place in the city for transportation whether with motor vehicles or without using them on the communication surfaces of the city. As a result, it creates a circulating motion on the communication surfaces which is called traffic. In another definition, Traffic is an internationally known term and, in the law, refers to the collection of vehicles and people and animals on the roads. These factors include humans' way vehicle. If there are no three factors there will be no problem called traffic [6].

Types of traffic flows One of the reasons to produce pollutants in high-traffic urban environments, increase or decrease the speed of traffic flow accordingly the traffic flow of stop-motion type has a much higher concentration of pollutants compared to the smooth and uniform flow of traffic. Therefore, traffic flow can be identified by two factors: average speed and speed a change which is called traffic dynamics. In other words, traffic flows that are dense and stop-motion type have high dynamics and traffic that is smooth and floating they have low dynamics. Dynamic traffic emits more pollutants [2].

Adverse effects of urban traffic

To better investigate the destructive effects of pollutants from urban traffic it is necessary to mention a few of them:

For example, carbon monoxide in the respiratory air of cities can convert large amounts of hemoglobin in the blood into carboxyl hemoglobin a stable compound and reduce the amount of hemoglobin that carries oxygen to tissues causing disorders such as adverse effects on the system; central nerves vision problems changes in heart function, respiration, fatigue, drowsiness coma and death [4]. But nitrogen oxides can be potentially dangerous to human health because the toxicity of nitrogen dioxide is four times that of nitric oxide. Therefore, nitrogen monoxide as the largest producer of toxins could pollute the air by oxidizing and converting it to more toxic nitrogen dioxide [5]. Other high-risk elements that can be mentioned below are hydrocarbons with side effects such as increased lung cancer mucosal irritation and adverse effects on hematopoietic centers and carbon dioxide with side effects such as brain reactions mucous membrane irritation and respiratory system increasing the resistance of the lungs to air flow and chest pain as well as the element lead which due to its suspension in the air of cities enters the

body through respiration and reduces the ability to carry oxygen in the blood causes insufficient oxygen to reach the brain. Of course, the release of environmental pollution from urban traffic is not enough for these elements and with the production of noise pollution, greenhouse gases, deforestation mass production of solid waste due to the disposal of scrapped vehicles, visual pollution and finally reduced air quality has degraded urban life [7].

Introducing the middle street refuge

Middle refuge or the same street divider bar divides the width of the street into two parts to separate the direction of movement. This lane is necessary for streets where the speed limit of vehicles is high (speed 60 km/h and more) [12]. The width of the middle divider strip is usually at least 4 meters for expressways such as freeways and highways and is reduced to up to 2 meters for first and second grade city streets. These intermediate dividing strips should be made by planting plants in the middle and along the road to prevent light damage to the cars in front and beautify the roads. The use of tall stems in the refuges is for quick access and the use of shrubs and shrubs with low height in these separating strips is necessary for very fast access (fig. 2) [7].

Figure 2. Refuge in the middle of the street[3]

Disadvantages of intermediate refuges

The middle refuges are part of the urban green spaces due to their cover of tall stems and shrubs and low ornamental shrubs. But it is worth noting that these green strips in the middle of the streets for some reason have significant shortcomings in the public environment of the city. The first problem is the numerous breakdowns of intermediate refuge tables that are now part of the communication network of cities. This problem has caused the removal of irrigation water from the tables of green space, the possibility of adequate irrigation and better penetration of water into the root basin of trees is not completely done [14].

The second problem is the loss of continuity of the middle refuges during their restoration, which will play an effective role in preventing the proper refilling of the refuges by applying different and uncoordinated tastes while displaying an uneven view of these green strips.

The third problem is the placement of various physical barriers inside the space of the refuges, such as the installation of light bases and CCTV cameras for lighting and traffic control in the city which by installing this equipment, the roots of trees shrubs and other plants in this space. They will be cut and will dry out due to removing the soil around them. Also, during the installation of

[3] By Mayor Philip Leving, Miami Beach Street design guidelines, April 2016, p.135.

this equipment, a significant number of harmful substances such as concrete leach ate enter the root basin of trees and plants. This while causing the decay of trees will ultimately impede the physical growth of roots and in some cases even prevent the growth of aerial parts of plants and trees [17].

The fourth problem is the lack of a proper irrigation system in the middle refuges which has mainly caused the irrigation of these spaces to be done traditionally in two ways. In the first method of irrigation gardeners irrigate the green space in the middle of the street experimentally and according to the appearance of soil and plants in this space. In the second method, which does not have a fixed irrigation system irrigation is done by trucks carrying water tankers which in this type of irrigation due to its nature will not only stop cars on the side of the road but also the possibility of irrigation. Adequate and principled trees will be difficult with a water tanker [10].

The fifth problem is car accidents in which the green space in the middle of the streets is another type of urban green spaces which due to the heavy traffic load around them and the possibility of cars colliding with these spaces can be considered as a factor to damage the green cover of refuges [7].

The sixth problem is the flow of salt water into the green space in the middle of the streets. Salt spraying in winter is a very important factor in damaging the green space in the middle of the streets. The flow of salt water into the green space and its leakage through the street tables into the soil of the refuges and the accumulation of salt over time not only raises the soil salinity and ion poisoning and upsets the balance of soil nutrients but ultimately results in drying of trees and shrubs will result [16].

The seventh problem is pruning plants in refuges where the green space in the middle of the street due to the cover of shrubs and ornamental shrubs and tall trees must always be pruned and tidied over time. This issue, apart from the cost and time it will be spent in many cases creates problems such as the interference of tall tree branches with power transmission wires the inclination and tilting of the wider branches towards the street and naturally the reduction of drivers' vision and breaking the branches due to factors such as wind, heavy snowfall and falling on moving vehicles mid-street pruning has faced serious problems [8].

Results and Discussion

In the previous part of these article three green wall topics the traffic and the refuges in the middle of the street were discussed in detail and there, we noted that all three sections of the work had a chain of reliable and related elements to reduce the amount of environmental pollution in the traffic areas of the city. One of these elements that can be used as a platform for linking all three axes of discussion. There are city streets as you know one of the important urban factors its communication levels. And because all the movements that take place in the city for transportation whether with motor vehicles or without using them take place on the same communication levels, involvement of all these surfaces with circulating movements resulting from these movements can cause traffic and polluted areas in cities.

Therefore, it is possible to understand why by insisting on the increasing development of the road network and the dynamic nature of the city's traffic the speed of emission and transfer of environmental pollutants in different areas of the city is increasing and expanding [1]. Accordingly, due to a growing trend of environmental threats in cities another main purpose of creating streets, it will not be just to connect different points and connect them to each other. Rather, the role of the streets being in crowded and traffic environments of the city will have various functions and tasks other than their communication function. One of these important functions in polluted urban environments the task is the responsibility of the green surfaces of the trees, ornamental plants, and shrubs on the middle islands of the streets to reduce the number of pollutants from vehicle traffic. Unfortunately, this favorable environmental performance of the refuges is also due to the uncontrolled expansion and widening of roads in the city is in danger and hesitation.

To this end, I also plan to propose the use of green life plates as an idea to replace these vertical green surfaces with the current middle strips on the street I will discuss an approach in three parts and comprehensively to overcome the environmental crisis in the traffic areas of the city and the results [20].

Part One

Very noticeable reduction of defects and shortcomings in how to create reconstruction and exploitation of the usual green middle islands by replacing them with green plates living in the middle of the street.

How to create and reconstruct both models in the middle of the street:

First, the structure of the middle green islands. The usual structure of these refuges is such that they traditionally use concrete and stone tables to demarcate their green space with the side surfaces of the street. Of course, this is often due to the application of different and heterogeneous tastes in the way of their creation and restoration, it has destroyed the connection between the green islands in the middle of the streets. But that will not be the whole story but with the disintegration of the middle refuges it will not only create an uneven landscape in the city, but with the withdrawal of irrigation water from the tables of these middle islands it is not possible to adequately dehydrate the refuges and as a result with the lack of complete penetration of water into the roots of trees and plants in this space, serious damage to the green cover of these middle islands. But the structure of the green plates of life is different from the usual middle green islands [17].

These plates do not use materials such as concrete, sand, table. In creating and renovating the middle space of the street, they can use the system of lightweight modular panels made of galvanized steel mesh put your grille panels together modularly. And by forming large surfaces establish a cover of diverse and dense green plants on these surfaces. It is also worth mentioning that these panels to be formable to the desired shapes and curves will not only cause the appearance of the city to achieve a harmonious and visually orderly form in the face of various and uncoordinated tastes rather. Due to the lack of inefficient materials in the structure of these vertical green plates easily and using a regular drip irrigation system, avoid getting out and wasting on your drinking water in an acceptable and desirable way [19].

How to use both models in the middle of the street

In this section to have a proper understanding of how to use both models in the middle of the street it is necessary to consider both in terms of factors discuss irrigation and pruning of vegetation [3].

Irrigation system in common intermediate refuges

In the green space of these islands in the middle of the street two methods are usually used to irrigate them. The first method, which has a fixed irrigation system is maintained by gardeners' irrigation is done experimentally and according to the appearance of soil and plants. This of course in this way a precise law has been introduced to calculate the water requirement of ornamental trees and shrubs. In the second method, Due to the lack of a fixed irrigation system in some of these refuges water tanks carried by special vehicles are used to irrigate the green space in the middle of the street. In this method, as in the first method according to the required volume of water and the nature of this type of irrigation, adequate and effective water supply to trees and plants in this space will not be possible. In addition, the traffic of these heavy and polluting vehicles has caused more vehicles to stop, because of which it will create heavy and polluting traffic on the streets [18].

Irrigation system in the green plates of life

These vertical and green islands in the middle of the street benefit from a drip irrigation system with automatic feeding. In this system the maximum proper distribution of water in the active root space of plants is used. Also, this type of irrigation system will not only save water consumption and increase irrigation efficiency. Instead by physically removing some of the green space maintenance personnel and heavy vehicles carrying water tankers to irrigate the green space in the middle of the street it will significantly reduce many of the environmental pollutants caused by these traditional and inefficient methods [9].

Vegetation pruning

Common intermediate refuges these middle green islands are covered with tall trees. Decorative shrubs and some seasonal flowers and plants as part of the urban green space should be pruned over time to help maintain the rhythmic appearance of the city and by removing the branches be modified and shaped. Because in most cases, the trees in the middle of the street due to having long branches will not only be able to interfere with power transmission wires. But by tilting part of the taller branches of these trees towards the street, it will reduce the visibility of drivers and naturally cause accidents on the street. In addition, some of these trees have broken due to old age or weak branches when the wind blows or heavy snowfall and will cause a lot of damage to vehicles and their occupants by falling on moving vehicles appearance.

Green pages of life

The cover structure of the green plates of life unlike the green cover of the usual middle refuges is such that due to the lack of use of tall trees and ornamental shrubs within its plant texture pruning has eliminated the branches of such trees. So, it will not be possible for accidents such as broken branches to fall on vehicles in motion. On the other hand, by placing a cover of dense and miniature plants in the form of a skeleton of galvanized steel mesh it will be possible to form plants in a framework of desired geometric shapes and visual cohesion. This issue will not only create a harmonious appearance and coordination in the traffic areas of the city, but also due to the robust structure of its modular panels it will have the ability to protect its beautiful vegetation against these weather factors during strong winds and heavy snowfall [12].

Part Two

Applying maximum pressure to reduce the size of the middle green strips due to the widening of the street bandwidth

Today number of vehicles increases in the need for their traffic in the city. On the one hand, we are witnessing the unbridled development of the road network in the city and on the other hand, with the imposition of more restrictions by the buildings built on both sides of the streets that are in the old and compact areas of the city possibility of a more favorable widening of the bandwidth of these streets has also suffered from serious problems. Therefore, in most cases the need is to meet such a need plan to reduce or eliminate the physical green islands in the middle of the streets. It has become the most basic solution or in other words the easiest possible way to eliminate this shortage in the city streets [15]. Therefore, this weak green space in the middle of the street does not suffer from such aggression. The need to replace these strips with green plates of life due to the structure that these vertical surfaces occupy less space in the middle of the street compared to their larger model, the middle green islands. It can plan to use this idea to solve the current problem of street widening in such a way that both factors are not harmed by each other [4].

Helping to better distribute the levels of green spaces in the city by establishing integrated green living pages in the middle of the streets

The two factors of traffic and the green screen of life have a common element of the components of the communication network of the city namely the street this element as a link between both

factors will have the ability to play two distinct and contrasting roles together for the city's environmental network. In a simpler interpretation the extent of the streets as part of the communication arteries of the city due to the circulating movements that result from the movement of vehicles on all their surfaces can play a threatening role. Cause the emission of more pollutants produced by motor vehicles and its transfer to all parts of the city (fig.3) [15].

Figure 3. Vertical green panels in the middle of the street. The sketch of the vertical green refuge of the street by the author of the article (created by author)

And while on the other hand, this threatening role of the environmental network by playing another role as a protective element by integrating the green pages of life in its middle space not only from the involvement of all street surfaces with the circular movements of this movement. Somewhere it will resist and hinder rather by accompanying a strip of green screens of life along our middle axis we will have a proper distribution of green filter in all parts including compact and polluted areas of the city, this will significantly reduce the number of pollutants from its primary role. Therefore, it can be well understood that by placing a green strip of diverse and dense vegetation next to the gray strip of city traffic, it will put both green and gray textures in proper condition and coordinate distribution in the city's communication network [6].

Conclusion

Today one of the most important factors of sustainability in any city its communication levels. Therefore, streets are an important part of these levels of communication due to having a combination of different and specific areas such as privacy of public and private vehicles. Pedestrian area for stopping or moving pedestrians on it the privacy of the parking bar and the end with the privacy of the green space bar in the middle and margin. They can extend the effects of these areas to their surroundings in all parts of the city. Existence of a high capacity of various functions of these territories on these communication levels of the city. The idea of replacing the green and integrated covering of the living walls with weak coverings and sometimes removed from the middle shelves of the street has made me bolder and more sensitive. It is believed that that with the establishment of dense green strip along the middle axis of the street and its transfer through the city's extensive communication network to different parts of the city not only will its positive environmental effects have a more effective mitigating effect on the city's traffic pollution. But by softening the rough and uneven appearance of these communication arteries provide acceptable visual order to these busy urban environments.

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Источники иллюстраций

Figure 1: Prof. Agis M. Papadopoulos, Green walls as element of bioclimatic design in Mediterranean urban buildings, Thessaloniki- Greece, November 2013, p.49.
Figure 2. Mayor Philip Leving, Miami Beach Street design guidelines, April 2016, p.135.
Figure 3. The sketch of the vertical green refuge of the street created by the author of the article.

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