

Architectural Green Spaces Design of Medical Centers with Passive Defense Approach

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Abstract

Since medical centers, from the perspective of civil defense, are considered as centers of critical urban land, therefore, it is essential the criteria and defensive mechanisms to comply in design. One of these strategies would be taking advantage of the vegetation in a hospital. From this perspective, the use of vegetation in the hospital needs to scientific and expertise comments by the expert in the green space who is familiar with knowledge of passive defense. In this study, it is tried the principles of architectural green spaces design of medical centers to discuss from an architectural defensive approach and passive defense. For this purpose, using descriptive-analytic method and library research tool, the role of security in outer space of the medical centers are investigated, and in the end, a set of strategies for architectural design of green space for a therapeutic complex in order to reduce the vulnerability of human resources and improve security will be presented, by taking advantage of the fundamental concepts of passive defense. The present research achievements in the designing of green spaces for the medical centers will be useful in line with promoting passive defense purposes.

Keywords: passive defense, green spaces, medical centers, security, design, architecture

1. Introduction

1.1 Statement of the Problem

Security is a social issue and considered to be the effects of communal living. In other words, the security is often associated with phenomena and other people to make sense. At the national level, this concept goes beyond survival and the country's self-preservation (passive defense committee, working and researching group, 2011, p. 12). Mentally, the most important thing is a need for the security that is treated as the most important purpose of life and the essence of mental health (Fromm, 1981, p. 11). According to Maslow (1968) when the physiological needs are met, immediately people regard to meet and satisfy the higher-level needs such the security. The needs are tightly associated with social and physical ability of the environment (Salehi, 2008, p. 22). The passive defense is meant the defense under minimal management or passive defense. Active defense is reactive and reflexive action, so in surprising case, the passive defense must be held accountable inherently (Asgharian jeddi, 2008, p. 52). The hospital is a medical institution using the power of diagnosis, treatment, health care, education and research severs in order to improve the treatment of inpatient and outpatient to deliver. The hospital is the most important provider unit of a network health service in the country and has at least 32 inpatient beds (Safe Hospital, 2013, p. 48). A safe hospital is that at the time of a disaster to occur, does not destroy and the patients and staff are involved in the least damage. In critical conditions, more than any time the hospital is needed, the safe hospitals could continue to operate and provide important community-based health services as established. The safe hospital design aims to raise the awareness and make effective change, to ensure that the reversible structure of health facilities, the lives of patients and health personnel in disaster become protected and risk to employees and health care institutions become minimized through crisis management and creation of passive defense plans (Safe Hospital, 2013, p. 42). While the hospitals in time of war must be immune from attack under international protocols, past experience suggests that the enemy, in many cases, is targeted the medical centers. The green space in the first place would have prevented the accurate identification of medical centers and ultimately reduce the harm and dangers of enemy attacks.

1.2 Research Methodology

In this study, it is considered to formulate recommendations and considerations for designing therapeutic area of open spaces with passive defense approach and tried to put factors influencing the design principles to be evaluation criteria and after analyzing the information obtained, we reach the recommendations for the design of green space of medical centers. According to the study, the methodology requires manner that we can cover all sides of the issues. Therefore the methodology in this research is descriptive, survey one and the method of gathering information over the description and in the survey sections would be library and field way, respectively.

1.3 Research Questions

The main question of this study: what are the solutions for appropriate green spaces design of medical centers with passive defense approach? To answer the main question, it should be known that what are the green spaces of hospital positioned for the passive defense? And how the passive defense can affect designed green spaces hospitals? And what are principle requirements and considerations for the green spaces, established by the passive defense?

1.4 Research Hypothesis

The following are factors that affect somehow to take a decision to stop threats from the perspective of passive defense: ground and geology, neighborhoods and topography.

2. Literature

Landscape architecture with many capabilities in the fields of organizing and planning the surrounding environments can be helpful to design in targeted way to guide human demands of other sciences and brought the more development for the designers than ever. It also has the ability to take steps on how to better solve some fundamental tension between different knowledge sectors and within its framework. One of the issues which are the main component of our needs to survive today is the security, without which the activation cycles are disturbed within the society. There has been less considerable attention to defense and security issues in designing green spaces and it has been ignored to provide solutions of preventing medical centers vulnerability and preserving the hospitalized. However, there have been considerable studies and researches related to designing the buildings under passive defense approach, one of the most essential achievements is to prepare and develop Section 21 in National Building Regulations. Complying with defense and security consideration of medical open spaces designs are functions of several variables that geographic area for the intended regions type and level of military threat, source of threat and passive defense strategies and plans tailored to the type of threat would be the most important variables. The considerable volumes of annual development projects in the country are related to architecture sections and environmental design and health projects and certainly if used landscape architecture capabilities, to consider the requirements and considerations of the passive defense can, play an important role in reducing the damage caused by a war and disaster. Despite the very high costs in the construction of medical centers, less attention is paid to the issue of passive defense. However, in developed countries, the concept of passive defense is institutionalized from many years ago (Karimi, 2011, unwarranted).

2.1 Green Space Network Review

The green space has long been considered by the designers and architects both in buildings and in the city and this is because of the benefits of green space that they are pushed into this position, including visual beauty, oxygen production and air purification, spiritual and mental tranquility, and shadow utilization etc. Contemporary in architecture and urbanism, Le Corbusier was the first person in the twentieth century who was back a green roof forgotten to work (Tofan, 2009). Of course, over some reason had been from the years away, they are added by another important reason. Today, with the development of satellite technology and spying practices by some countries in the affairs of other countries, the designers have been led to take advantage of green space as a passive defense action (Rezaghali Poor, 2012, p. 86). The green space in addition to the previous functions is added by new functions, the benefits of green space are discussed briefly below.

2.2 Spaces Per Capita Health

The hospital, one of the centers with a lot of people referring, as well as increased the quality of patient recovery process, needs to anticipate the green space as necessary. Based on the standards for the hygiene uses posed in the most comprehensive urban plan, the area is devoted to green space would be a maximum of 30% of the entire area. Despite the fact that 30% is devoted to the parking lot and 40% remained is occupied by surface of ground floor in the hospital building.

2.3 Places and Situation of Hospitals in Islam Viewpoint

No doubt, Islam is a religion that matters most to individual and community health. In numerous verses and hadiths, the Muslim community in various aspects of personal was paid attention and sometimes the principles of prevention and treatment were in detail expressed in such a way that now, despite the passage of more than 14 centuries, make each reader amazed and wondered. Among these recommendations, there are the precise narrations and sayings that determine the characteristics of a hospital with detailed Islamic examples. Among these features are derived from the traditions and sayings, we can mention the following:

The place is built in beautiful and scenic situation, enjoys the clean air, with abundant and tasty water, except vegetable green is not seen, not deep in places and land posts, placed in the city, from away from general and noisy places (in a quiet and silent situation), away from the pollution and the environment is safe and clean (Kazemi, Kolivand, 2012, p. 17).

2.4 Landscaping and Green Space

Energy and health of human depends largely on the direct effects originated from the environment in which s/he lives. In a medical center, it does relay matter to consider the beauty of the area and can increase staff efficiency, reduce the stress and speed up the recovery rate of patients. The complex of green spaces, walking paths, beautifully-made streets with appropriate materials, benches, stands, information kiosks and service, canopies, waterfront, lighting, etc., would be including basic strategies to beautify the medical center. Increasing scientific evidence, including randomized controlled trials, has shown that putting patients at the natural situation mitigate their own pain significantly (Ulrich, 2008).

In this regard, the green space would be considered as one of the very important elements in medical centers landscaping. Today, the scientific data demonstrate that plants as well as beautify the environment contribute as a way to solve many environmental problems. Therefore, it is essential the types of plants and their use procedure in landscaping medical centers be identified.

2.5 Multi-Functional Design of Urban Spaces

Multi-functional space designing means using architecture and urban spaces in times of war and peace. The large spaces and buildings such as the subway, major hospitals and other large buildings that in urban townscape are often used as an urban indication must be designed in such a way that also during the war have to be able to properly meet the conditions of war and crisis. For instance, London's Underground was designed in such a way that can be used in times of crisis such as war, with more than twenty million capacity people as refuge.

Green Space: Under normal conditions: leisure, landscaping, moderate climate and the environment

During the crisis: the refuge place

After the crisis: the establishment of relief camps, temporary housing camps, mobile hospitals, food and pharmaceutical depot (Farahmandian, 2015, p. 5).

2.6 Green Space Planning Methods in Medical Applications

2.6.1 Outdoor Green Space

Creating green space in the area around the hospital building has been the most common solution to benefit from the green space that all groups present in the hospital can use it. If open space of hospital is impressive, the yard can be also be planned on a wider level and extensive green spaces in the garden, spatial diversity for use by individuals or specific activities to be created. Among these gardens can be ornamental plants garden, herbs plants garden etc. could be mentioned.

2.6.2 Green Space in the Central Courtyard

Green space surrounded by the building of the central medical center is becoming as a courtyard. The central courtyard increased the hospital environment places exposure at the sunlight and can bring proper perspective to them.

2.6.3 Green Space in the Covered Courtyard

Some medical centers because of limited cost and area established a small green space within or adjacent to the building. In these spaces, unlike previous methods, there is no possibility of walking or sitting in and only visible from inside the building or adjacent spaces that can lead to vitality, freshness of spirit of the patients and other people in the hospital.

2.6.4 Green Space in the Roof (Green Roof)

If the limited surface area to create green space and landscaping, the option of creating green space on the roof with wide viewing capability is appropriate. In this case, appropriate access and clarifying part of it, such space shall be provided on the roof to notify users.

2.6.5 Green Space on the Terrace (Green Terrace)

Unlike green roof that is built on the highest level or most of all directions are open, a green terrace space is outer accessible limited from several directions by the building. The terraces are for a private and secure space, usually in the form of a long narrow balcony.

2.6.6 Green Space on the Walls of Buildings (Green Wall)

One of the new ways also highly regarded in sustainable architecture is green walls, which is also known as vertical gardens. This approach is divided into the green surface and oxygen walls and each has certain characteristics which can be used in the design of health care facilities based on their design goals and desires. The green walls compared with other methods have greater influence on their surroundings, especially hospital building. Among these can be used to purify the air, become as thermal insulation materials, temperature control, increase moisture, reduce the absorption of solar energy and reflected radiation, reduce pollution and so on (safe hospital, pp. 117 and 118). The vertical green approach to building height would be a creative way to bring nature into the interior sets (architecture, 2012, p. 142).

2.7 Green-Space Defense Purposes

The most important element playing the camouflaging scheme role of green space is apparent form and shape of the tree and its leaves so that using the visual beauty, first the role of distortion in vision, creates field of view and after illusions, creates the outline for the individual viewer (Department of passive defense Khatam Anbiya Air Defense Base, 2006). The most important green space defense purposes are as follows:

2.7.1 Deceiving the Enemy and Disrupting Shadow, Objects' Shape or Form

Today the sky and space is not a country's territory alone and other developed countries are able, utilizing electromagnetic spectrum science to discover and identify the objectives in the shortest time possible depending on the type of vegetation and changes in ground phenomena's reflectance spectra. We have benefited from the strength of the enemy such that, due to their past experiences and future developments, exploit taking full advantage of the lure of the green space satellites. In this regard, disrupting the shape and form by disrupting regular straight lines of the objects and changing it to irregular form by using vegetation and green space would be one of the most important materials used in the relevant items and a skillful and artistic practice. Disrupting and breaking lines and the shadows of the buildings using shadows of trees could be helpful lack of accurate identification of the center. As well, the use of vegetation could prevent all hospital buildings being seen and deceive the enemy the building scale and volume of services provided to detect and downplay the center. This can cause confusion of the main hospital building, at the time of the bombing. Finally, with the spread increase of vegetation in the hospital, taking advantage of the tourism spectrum inhibitor of heat, coloring homogeneous, using the same elements with the texture of the ground and vegetation etc. were effective in reducing the effects of directly enemy's shooting and surveillance (safe hospital, p. 122).

2.7.2 Camouflage

The overall concept of camouflage is about make both color and shape of the installations and equipment the same as surrounding (Eskandari, 2012, p. 169) and it is camouflaged with vegetation. One of the most important green space applications is its application in place concealments and camouflaged critical environments versus the eyes of civilians and the enemy. Texture and adaptable trees, shrubs and herbaceous elements or building of hospitals for having various dimensions, having different vegetation cover types and different shapes of leaves, branches' and stems' diversity and so on will be very useful to exploit the defensive schemes. According calculated that every plant has its own growing season, soil, climate and special ecological adaptation of environment, it should be determined based on how to use and establish appropriate plants for centers camouflage and concealment (Safe Hospital, p. 122). Not to be easily recognizable places to aerial photography, it is better to use the colored roofs with environmental vegetation (Jahansary, Pourzangbar, 2015, p. 3).



Figure 1. Example of roof with vegetation for camouflage (ibid., P. 4)

2.7.3 Reduced the Harmful Effects of Bombardment

At the time of the bombing, except direct hit bombs, in cases of indirect hit, two factors can lead to damage and destruction caused by the bombs, which include blast wave and fragmentation. The vegetation as a buffer to reduce the risks of these cases is effective. The following points should be considered in the design of vegetation:

1. Recognizing the diversity of plant species in the area is useful for use in the design.
2. Observing the vegetable distance planting from each other to achieve the least destructive effects of bombing
3. Using a trunks and branches of trees to take advantage of the diameter of the stout buildings and streets.
4. Creating area of green space next to the sidewalk and on the street
5. The proper use of ornamental shrubs with appropriate diameter to cover up between trees at most
6. Using green space in idle area along the streets, passages and various buildings (ibid., P. 123)

2.7.4 Centers Concealment

Of vegetation or green space can be used for hiding in form of that use or infrastructure gets hidden under the green covers to escape against the enemy's shooting and surveillance (Rezaghali Poor, 2012, p. 87). Here, in order to make full green walls and fences so that if a supervisor changes the viewing place, not able to see objects behind the green barrier (Pishbin, 2005, p. 7).

2.7.5 Absorption of Wave

The vegetation can absorb different types of electrical and telecommunications waves, thermal, laser and this is mostly because there presents moisture between them.

2.7.6 Protecting the Roof Membrane

Building roofs or roofs exposed at intense sunlight or ultraviolet radiation that causes roof timeworn and every 15 to 20 years ought to repair, in case the roof is covered with the vegetation, the life will be much more longed like a building in Germany that is 40 years old.

2.7.7 Soundproof

Trees are good insulation against sound waves and where there is a need for silence and controlled noise from outdoor or for interior noise set not spread out; for this purpose, we can use the vegetation and trees.

2.7.8 Visual Beauty

It is obvious that the green space will be eye-catching by the human and the visual beauty of the building will help achieve the beauty and mental relaxation and will generate attractive recreation spaces (ibid., P. 88).

2.7.9 Storage and Energy Management

Heating and cooling installations in buildings are really costly to buildings and designers are always looking for ways to reduce these costs and energy waste and for this purpose, providing the thermal insulation market is diverse; but in an interesting statistic in the UK, studies on a conventional house during one year showed that 25% of home energy costs can be reduced by the vegetation (W. peck, 1999: 20).

2.7.10 Controlled Blast Wave

Controlled and prevented the fragmentation of objects and ancillary equipment of the facilities (canals, windows, glass, and so on) at the time of the events to occur are the benefits of green space and the vegetation. In order to minimize the damage and explosion effects, it is recommended in the area design between the building and the original path, retaining spaces should be created (the twenty-first discussion draft of the National Building Regulations, Building and Housing Research Center, Tehran, 2009).



Figure 2. Create a buffer space using the vegetation

2.7.11 Producing Oxygen and Air Purification Against Contaminations

One of the topics discussed in the environment is about to reduce air pollution. There is considerable information and data which specifies that the plants play an important role in making air clean and removing some of the toxic and certain material within polluted air. This and other experiences highlight that the plants play an important role as a source of natural absorbers for the removal of atmospheric pollutants.

2.7.12 Creating the Movement Hinder

A path can be blocked by the vegetation and it also causes the movement restrictions and induces clear path to the user. In all these cases, the vegetation and trees can have a significant role.

2.8 Defensive strategies to design the therapeutic areas:

2.8.1 Confined Space

This closeness can be guaranteed by the wall, ground potential and planting of trees in rows. It should be noted that the proportions of these spaces should never be such a place evokes an adverse, uniformity, cold and lifeless and imprisonment environment for users.

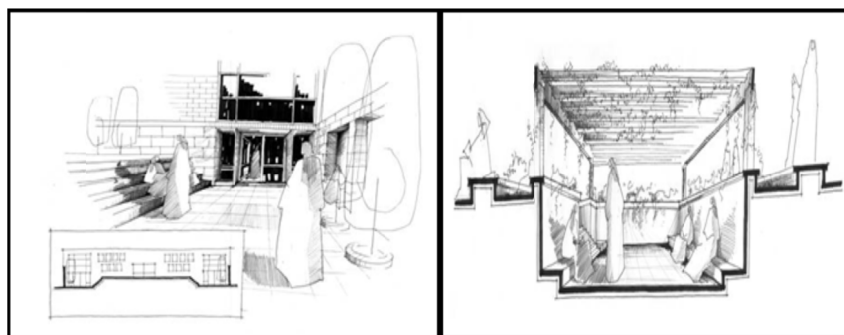


Figure 3. Confined space (source: F. Shad, 2012, p. 15)

2.8.2 Creating Safe Corners

Earth's tilt puts a possible environment to create safe corner available for us. The spaces on the lower level can remain safe with preparations such as building the walls and planting trees and they create corners that bring a sense of peace and security for the people. There is also a pilot under the building, to create a decent roof to protect against the sun in summer and rainfall in other seasons, in addition to creating a safe environment and preventing the debris from falling on pedestrians.

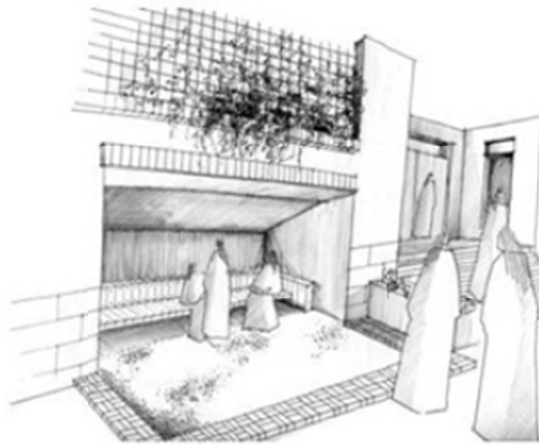


Figure 4. Creating a safe corner (Source: F. Shad, 2012, p. 15)

2.8.3 Turrets and Walls Decorated

In open spaces, paved and large surfaces did not fit. Therefore, using a simple surface features help create multiple edges to form the immediate parapet, in addition to enriching the space for supplying the activities expected under normal circumstances. Best levels which can provide individuals with lying outdoor, decorative walls, vases, benches and water atmosphere (F. Shad, 2012, p. 17). Use of decorative unnecessary elements in area of medical spaces should be minimized. Because in case of danger and an explosion to occur, each of these components cause the crisis and broken parts will behave like the fragmentation.



Figure 5. parapets and decorative walls (Source: FEMA-430, P 232)

2.8.4 Using the Appropriate Type of Green Space in the Area

Green elements protruding from the ground, in addition to make moving vehicles with scheduling at the site impossible, can be very good separation barrier in case of explosion.

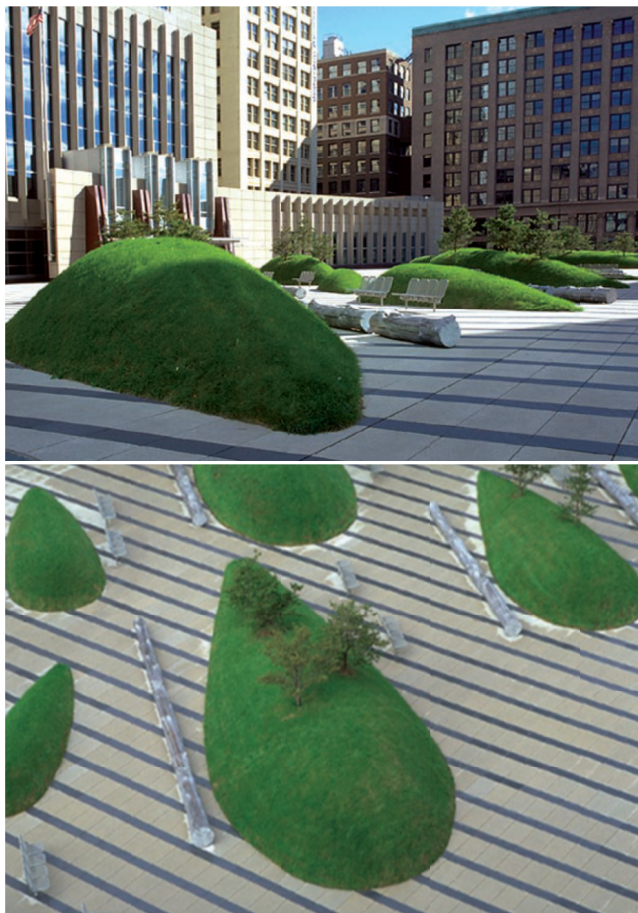


Figure 6. Use of appropriate green space in the area (Source: FEMA-430, p. 236)

2.8.5 Using the Right Tree

Trees are other elements that can play an important role to create safe spaces. They could be a significant factor in attracting fragmentation and mitigation and the deviation of blast waves, in addition of creating a pleasant and refreshing atmosphere (ibid., P. 16). The trees act as the first layer of defense to terrorist threats, because a large crowd is gathering place for parks and green spaces; these trees must be planted such that it does not provide the possibility for the terrorists. For this purpose, the use of evergreens such as pine and shrubs such as boxwood are recommended (Rezaghali Poor, Hashem Pour Choubi, 2015, p. 3).

2.9 Ever Green Conifers

Chlorophyll view of this plant can be used in four seasons. Dark green color of softwoods produces weighty, attractive, integrity and thinking mode of the viewers, emotionally and mentally. If they are planted as the wall or beside the wall and on the north side, they reduce wind speed up to 60% and fuel consumption by approximately 3%, because of preventing the cold penetration. When planting trees of the deciduous and needles, it is better to combine both projects in designs so that each lifters other defects and serves else. The deciduous trees with all intrigued and beautiful features of leaves, flowers and branches lost their leaves en masse in the winter and green spaces are appeared barely. Conversely, if the plan all includes the softwoods, due to changes in the crown of the garden, the garden takes heavy mood and sadness sleepy and bored over the autumn (Pishbin, 2009, p. 21). Now, if mixed, but are calculated, and static and splendor and grandeur and elegance of the evergreen green over the years, the dynamics and seasonal changes and broad-leaved of a deciduous and needle leaf conifers, all together, will be serving and will be served (Pishbin, 2009, p. 21).

2.10 Design Considerations

Generally, the designers of urban elements in green spaces for medical centers, the following table can be used.

Table 1. Design considerations of green spaces with passive defense approach (Source: Rezagholi Pour, Hashem Pour Choubi, 2015, p. 14)

Consideration	Explanation
The location of green space	Health centers' green spaces
Border trees (around)	The first layer of defense
Chair of the border (surrounding)	The auxiliary layer of the first layer of defense
The middle seat	With no sharp corners
Lighting systems	Photovoltaic systems to provide lighting during crisis
Fountain	Relaxation
Suitable coatings	Damage to people while running away
Turret possibility	Sheltering possible for people
Avoiding stairs	Help quick escape
Locating bathroom.	Not forwarding contaminated water into the underground space
Dual-purpose buildings	In order to use dual use in times of peace and war, change in use
Navigating to the underground space	illustrative elements of way
Input underground spaces	Contrary to the prevailing wind direction
Emergency exits	Used, if destroyed the main entrance

3. Conclusion

Green space in medical centers serves as a very influential part. In over than 14 centuries ago, Islam stressed the hospital building in a beautiful, green and pleasant weather place. The presence of trees and plants in outdoor hospital as a multi-functional space at peacetime could provide for the patients. Also, if designed principally and consistently under the patterns of passive defense, in times of crisis they can also be a place to shelter and at the time after the crisis help to save the lives of patients and staff in hospitals and the relief process. There is a variety of methods for the green space to enter in the use treatment, such as open green space in the yard, in the central courtyard, indoor courtyard, on the roof (green roof), on the terraces and green walls.

Green space defense purposes are: 1- Deception, 2- Camouflage, 3- Reduce the devastating effects of bombing, 4- hide, 5- Absorb, 6- Protect the roof membrane, 7- Make soundproof, 8- visual beauty, 9- How to storage and energy control, 10- Control blast wave, 11- produce oxygen and 12- Make movement barrier. The defensive strategies to design the therapeutic areas include: 1- Confined space, 2- Created a safe corner, and 3- Parapet and walls decorated, 4- Using the appropriate type of green space in the area and 5- Using suitable trees. Generally, enjoying the chlorophyll four-season view of conifer and deciduous trees along with beautiful and elegant flourish would be recommended at the same time to use; the shrubs such as boxwood with a bed of grass recommended, too.

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