

# Sustainable Design Proposals in Shopping Center Public Interiors

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*Abstract* — This study aims to develop some design proposals to provide the aspect of sustainability in the public interiors of shopping centers which are one of the most common structures of the era. Aspects that constitute the design criteria for the public spaces shopping centers from a sustainability point of view have been discussed. Effects of natural daylight and the interior finishing materials on the concept of sustainability in the public areas of shopping centers have been drawn.

*Keywords*— Design proposal, sustainability, interior design, materials, lighting, shopping centers.

## I. INTRODUCTION

THE importance of the concept of sustainability is increasing everyday; while the world population is increasing and the overall quantity of natural resources is decreasing. The conflict of this century is an increase in peoples' life quality while a decrease in the overall consumption of natural resources. It is estimated that the world's population will almost double from the present 6.2 billion to around 8 to 10 billion by 2025 and as a consequence, will increase both the demand on resources as well as the environmental impact resulting from human activities. Since the earth is a closed ecosystem, it will not be possible to support such an exponentially increasing population within the traditional growth-oriented economic models [4].

Therefore, a shift in the current economic and socio-cultural framework is required: a transition from a traditional material and product paradigm to an emerging knowledge and service paradigm; a transition in which the research into sustainability shifts from a technological and product-related innovation process to a broader techno-socio-cultural process [3].

Built environments and the building sector is the area which uses an important amount of energy and materials that are produced by world resources. Working Group of Sustainable Construction (WGSC) (2004), determined that 50% of the energy and the materials that are produced with world resources are used by the building sector in the world. If we consider the case in Turkey, Energy Consumption Report of European Union implies that 31% of the produced energy is used by the building sector [11]

Shopping centers are one of the most common structures in Turkey, which are developing continuously in the last two decades. The number of shopping centers are increasing every

day. So the concept of sustainability in shopping center design has become a major problem.

On the other hand, shopping centers have turned into social gathering spaces for lots of people. People spend their leisure time and socialize in shopping center public spaces so the public spaces in shopping centers have turned into leisure areas. This transformation makes shopping centers social and the existence of recreational spaces increase the time spent. Public spaces in shopping centers as recreational areas should be reconsidered in the means of an increase in their space quality and the sustainable concerns in interior design [1]. This study aims to make design proposals in shopping center public interiors to achieve more sustainable shopping centers.

## II. THE CONCEPT OF SUSTAINABILITY IN PUBLIC SPACES

The concept of "Sustainability" started to be discussed in 1987 in United Nations with the report by the World Commission on Environment and Development, which defined sustainable development as "meeting the needs of the present without compromising the ability of future generation to meet their own". Since then the term 'sustainability' and such expression as 'green', 'eco' and 'environmentally friendly' have been used to describe multitude of products and actions that show concern for the earth's resources. The overuse of these terms has threatened to reduce the potency of their meaning. Principles that can summarize sustainable design are; to build small, make spaces efficient, use recycled or recyclable materials, recycle and compost all waste, build recycling centers in facilities, use renewable resources, create safe healthy living environments, easy operated, durable and easily maintained [6].

On the other hand "Sustainability" in any area requires a harmonious relation of social, environmental and economic factors. Considering the results of researches, regarding the vast amount of energy consumed by buildings only 5% is spent by the construction processes while more than 45% is spent by management, repair and maintenance activities [15]. These output data suggest that building industry is going to play a major role in the continuing efforts to decrease the total energy consumption or at least shift some of this consumption from non-renewable resources to renewable ones. In this point of view, the concept of Sustainable Design and Sustainable Architecture should be clearly defined [10].

Sustainable design stands for a holistic creative process, which “seeks to translate and embody global and regional socio-environmental concerns into products and services at a local level. This necessarily demands a system view of design” [6].

Sustainable architecture is an approach to architectural design that emphasizes the place of buildings within both local ecosystems and the global environment. Sustainable architecture seeks to minimize the negative environmental impact of buildings by enhancing efficiency and moderation in the use of materials, energy and development space [6].

Design can play a key role in the creation of a sustainable future. Design can integrate ecological requirements in the business creation process and go far beyond it. Acting as a bridge between people, technology and business, design can facilitate the systematic integration of economical, social and environmental parameters in the framework of new and more sustainable patterns of production, marketing, distribution and use. Design can become a powerful engine for suitable innovation. It can help businesses in generating solutions able to stimulate new social behaviors (e.g. accessibility versus ownership, sharing versus individual use, upgrade ability versus substitution) whilst still supporting economic societal needs. In this way, it complies with the change in the complex world that is required from design culture; from eco-design to sustainable design [7].

Moving from the important role of design in the concept of sustainability, we can clearly identify that, interior design requirements play an important role for sustainable shopping centers as well.

### III. SUSTAINABLE APPROACHES IN CONTEMPORARY SHOPPING CENTERS

Shopping centers are one of the most dominating structures in the cities of Turkey. Considering the number, the body structure and the area of shopping centers, the importance of sustainable approaches in shopping centers have become more important in Turkey. Although it is a known fact that science and technology have a crucial role in shaping sustainable human settlements and sustaining the ecosystems they depend upon. Architects, planners and interior architects have a great responsibility to help creating the receptiveness for the emergence of a new kind of architecture, a new language of construction technology, which is called sustainable architecture. Shopping centers and shopping center interior designs, material selections, organization of interior design elements should also be designed considering this sensitivity [9].

As Norman Foster mentioned, sustainability is the achievement of the “maximum” by using the minimum rate of resources. But sustainability should first of all comprise the

equality, sharing and it should also construct the balance between the natural environment and the artificial configurations [2]. Regarding this, sustainable architecture should consider the construction as a piece of world ecology and should combine climatic responsiveness with functional efficiency and a pleasing appearance. A sustainable buildings’ design should include considerations regarding orientation, natural ventilation, daylight, solar control and thermal capacity, which could result in potent form-finding building elements. Taken together, they can trigger a new architecture language, which is the discourse of the energy conservation requirements by composing the equilibrium between the world economy and its ecological systems. In this context, architecture and the environment are inextricably linked and their relationship becomes complex and multi-faceted by considering the principles of sustainable development [3].

Contemporary shopping centers should also follow those design criteria as well:

1. Avoid restricting natural conditions reaching their internal spaces that would be of positive benefit to their occupants. For example, buildings should be designed to maximize the use of daylight over artificial light; likewise buildings should aim to be naturally ventilated with fresh air rather than be controlled through energy consuming heating and ventilation systems.
2. Assist in the collection and storage of received energy sources, particularly solar energy, and then utilize this when and where required. Buildings should also be designed so that they consume far less energy.
3. Should respect their local surroundings environmentally. Not only should they minimize internal energy consumption; they should also aim not to create external demands or induce negative environmental effects. Local energy cycles can be utilized, but should not be altered or used in an unsustainable way [4].

Interior design of a shopping center is a very determining concept that has great contributions to the concept of sustainability. The public areas, which social and recreational activities are conducted and circulation areas in shopping centers may make a great contribution to shopping center sustainability. Lighting and the interior finishing materials of those areas should be discussed and carefully selected.

### IV. DAY LIGHT IN SHOPPING CENTERS

Researches identify that, 35% of the energy used in buildings are utilized for lighting. Energy consumption in Shopping center buildings, which have huge volumes and great number of users can be decreased by using day lighting. Considering the volume, function and user amount of the public spaces of shopping centers are the most suitable areas for the use of daylight [7].

Daylight is generally associated with high window-head heights, high reflective ceiling and wall finishes, narrow floor plans, large facade and skylight openings with high transmittance glazing. A daylight factor optimized building emits as much daylight as possible into the building, following a “the more the better” approach [7]. There are some examples of open shopping center structures built in Turkey. These are some positive points in those shopping centers in order to benefit from the natural day light. As it is considered that Turkey is a hot climate country and it spends 70% of the year sunny. Fig. 1, 2



Fig. 1: A view from an open structure shopping center in Turkey (Kanyon Shopping Center)



Fig. 2: A view from an open structure shopping center in Turkey (Meydan Shopping Center)

Taking this to the extreme, the daylight factor optimized building has a fully glazed building envelope. Design recommendations based on the daylight factor are the same for all facade orientations and building locations as the daylight factor does not consider season, time of day, direct solar

ingress, variable sky conditions, building orientation, or building location. This bears a number of important consequences [6].

Daylight factor investigations cannot help to develop glare prevention strategies for different facade orientations, even though problems of glare associated with low solar altitudes are known to be most prominent for east and west facing facades and which can be significant. Daylight factor analysis cannot even provide a warning flag as to whether there will be a glare problem in certain parts of a building [6] Fig. 3, 4.



Fig. 3: A view from a shopping center interior, in circulation areas.



Fig. 4: A view from a shopping center interior, in circulation areas.

The provision of a view to the outside is promoted in buildings through the LEED rating system. The system stipulates that 90% of regularly occupied spaces should have a direct line of sight to the outside through a vertical window that is located between 76cm. and 228cm. above the floor. This credit aims to acknowledge findings that a view to the outside is a highly praised benefit of a window. As it stands, the design criteria has several shortcomings, the most important one being that research has shown that to qualify as a “view”, a visual connection to the outside from a point in a building has to extend above a minimum solid angle width and height, the size of which depends on the type of view [6]. Fig. 5, 6.



Fig. 5: A view from a shopping center interior in food court area



Fig. 6: A view from a shopping center interior in meeting point, circulation area

Fortunately, many design teams are aware of the above cited limitations of the daylight factor and consider the avoidance of direct sunlight in parallel with daylight factor predictions. Direct sunlight studies can be performed using simulations or scale model measurements. The objective is to design facades that avoid direct sunlight in the building during the cooling season [10].

A consequent combination of daylight factor predictions and direct shading studies leads to a building in which facade openings are reduced to the minimum possible size and a required minimum daylight factor can be maintained within a desired area adjacent to the facade and ceiling openings. Buildings that are the result of this “combined approach” (weighing daylight factor against unwanted solar gains) should exhibit a considerably better energy balance than those designed following a daylight-factor-only approach [14]. Passive solar systems can be used to control natural sunlight and air circulation means can be used whereas to create a comfortable, energy effective interior environment [6]. Daylight is an essential factor in shopping center public interiors, by the control of air circulation and humidity aspects.

Three paned window systems which are made of argon and krypton can be used to have low emission coatings. These systems allow natural light to come-in (low wave radiation) to the building and prevent heat (long wave infra red radiation) increase. It is also essential to have insulation in order to minimize heat loss. Double glazed and triple glazed glasses can also be used considering the natural factor of the shopping center area [5]. While using daylight it is important to control the direct glare, reflected glare, greenhouse effect and the increase of heat in the interiors.

## V. INTERIOR FINISHING MATERIALS

Ruff (2009), indicates that, “Good design and sustainable design are one and the same, synonymous with each other. Integrating sustainable design principle and practices is creative and rewarding thus opening doors to lots of possibilities for personal expression and personal growth for the designer, the client, and the project team” [9].

Considering the building volume and the amount of users interior finish materials have a great importance in shopping center public areas. Material selection and the design is very important to have a sustainable contribution to the shopping center design. The selection of materials for certain products is of vital importance, while the material selection determines the use of our natural resources as well as the amount of energy used for the production and the application of the product. Sustainable interior materials can be analyzed into three groups: Interior floor finishes, wall finishes, ceiling finishes.

### A. Interior Floor Finishes

Floors are important design surfaces of the buildings. With the texture, pattern, color and the design; floors give messages to the occupants of the shopping centers. The designers would consider not only aesthetic considerations but also functional, financial and environmental-friendly considerations as well, while deciding the floor covering. The finishes should be available in order to ensure that appropriate activities can be carried out and cleaning can be made progressively [11]. Stone floors, including slate, lime stone, flagstone, granite and marble are durable and full of character. But these materials are non renewable, extremely heavy and stone quarrying can degrade the landscape extensively [6], Fig. 7.



Fig. 7: A view from a shopping center interior, in circulation areas.

Carpet floor coverings can be nailed or glued to an underlay made from hessian, jute or natural latex. Low Volatile Organic Compound (VOC), water based and formaldehyde free glues are also available. Natural fiber carpet made with natural latex rather than styrene butadiene rubber (SBR) latex backing can also be used. Natural or recycled-content carpet pads made from textile, carpet, carpet cushion, or tire waste (including rebound) are another alternative [7]. Fig. 8.



Fig. 8: View from a shopping center interior, in public gathering areas with carpet floor coverings.

When polished, concrete becomes highly reflective. This system works with floor heating underneath. High thermal mass absorbs and releases heat energy gradually, helping to regulate internal temperatures naturally [6]. In some examples of open shopping centers natural materials like stone, brick and marble are used. Also some natural planting and water can be used on floors Fig. 9, 10, 11, 12.



Fig. 9: View from an open shopping center circulation areas.



Fig. 10: View from an open shopping center circulation areas.



Fig. 11: View from an open shopping center circulation and gathering areas.



Fig. 12: View from an open shopping center circulation and gathering areas.

PVC floor finishes could be preferred in the required areas due to their characteristics such as: being flexible, having good impact of sound reduction, good slip resistance especially when dry, and having good resistance to chemicals, and being suitable for food and light-wheel traffic [7].

### B. Interior Wall Finishes

The walls occupy the major portion of the visual field in interior spaces. As the walls cover the largest proportion of the eye level, it attracts more attention and has the greatest significance. Modulation, texture, pattern, color and their ability to display messages play an important role for the atmosphere of the interiors [2].

Most natural paints can be applied in exactly the same way as synthetic paints. Paint; oil based emulsion, wood and vegetable based resin paints and casein paints are made from renewable energy. Casein paints; clay paints and lime wash are non-toxic when compared to synthetic products [2]. Natural paints have a low embodied energy. Synthetic paint ingredients are electrically charged and use plastic so they attract dust and bacteria, producing less healthy environments. [8].

Wallpaper hides imperfection in walls better than paint, so is ideal for ecological restoration projects. But an environmentally friendly wallpaper is hard to find and more expensive than standard designs. Water-based alkyd paints contain fewer adhesives than water-based acrylic paints. The composition of the high solid paints is comparable to those of common alkyd-resin paints. It is better to use water based acrylic paint or natural paint for interior woodwork and high solid paint for exterior works [4]. Using some natural planting and water on wall surfaces can be used also Fig 13.



Fig. 13: View from a shopping center interior space.

### C. Interior Ceiling Finishes

The ceiling of a space should integrate well with the activities hosted in that space and also with the wall covering, floor covering and fittings in the environment. Today designers can achieve a number of different possibilities when designing a ceiling. The openings in the ceiling panels allow designers to continue a chosen edge detail around high-hat light fixtures, and sprinkler heads, speaker grills, air diffusers and other HVAC openings [5].

The ceiling type could be selected according to the activity that will take place in the public space of a shopping center. The use of acoustical ceilings can be an alternative if they are required [13]. Metal ceilings, gypsum board, plaster ceilings and mineral fiber and fiberglass acoustical ceilings can be selected according to the design and the function of the space. The choice of lighting fixtures also can be the determining factor in selecting the type of suspended ceiling. The amount of natural light in the space and the need of artificial lighting elements could also be considered in deciding the type of ceiling for sustainable solutions [12].

## VI. DESIGN PROPOSALS FOR PUBLIC INTERIORS OF CONTEMPORARY SHOPPING CENTERS

The concept of sustainability in shopping center interiors is an essential concern. Considering the building size, occupancy amount and the density of the shopping center structures in Turkey, sustainable approach became more important. There are some sustainable attitudes during the construction, design of the energy supplies or construction waste exterminations of a building. But it is also essential to consider the interior design requirements of the contemporary shopping centers. Interior design directly meets the occupants; it determines the main cost for the management of the structures.

Physically and psychologically interior architecture and interior design communicates the users of the space, the employees working in the shopping center and the management of the buildings site. So it is essential to consider the interior design elements from a sustainable point of view for the benefits of the all occupant that are mentioned above. These design proposals can provide a guide for the interior architects and the designers of the shopping centers; while they are focusing on the public, gathering and socializing interiors.

1. Daylight is an essential factor in shopping center public interiors. It is important to get a day light in the shopping center's public, gathering and socializing spaces. But control of air circulation, humidity, green house effect, direct and indirect glare is also essential.
2. Three paned window systems which are made of argon and krypton can be used to have low emission coatings. These systems allow natural light to come-in (low wave radiation) to the building and prevent heat (long wave infra red radiation) increase. It is also essential to have insulation.
3. Floors are important design surfaces of the buildings. The finishes should be available in order to ensure that appropriate activities can be carried out and cleaning can be made progressively.
4. Natural stone floors, including slate, lime stone, flagstone, granite and marble are durable and full of

character. But these materials are non renewable, extremely heavy and stone quarrying can degrade the landscape extensively but they can be used in some gathering spaces.

5. Carpet floor coverings should be selected from hessian, jute or natural latex. Low Volatile Organic Compound (VOC), water based and formaldehyde free glues should be preferred. Natural fiber carpet made with natural latex rather than styrene butadiene rubber (SBR) latex backing can also be used in the public spaces of shopping centers.
6. Concrete can be used with the system of floor heating underneath. High thermal mass absorbs and releases heat energy gradually, helping to regulate internal temperatures naturally.
7. PVC floor finishes could be preferred in the required areas due to their characteristics such as: being flexible, having good impact of sound reduction, good slip resistance. They also have a good resistance to chemicals. They can be used in the light-wheel traffic areas and food court areas of the shopping centers.
8. In the wall surfaces of the shopping centers, paints can be used, from oil based emulsion, wood and vegetable based resin. Also casein paints which are made from renewable energy can be used. Casein paints and lime wash paints are non-toxic when compared to synthetic products.
9. Natural paints have a low embodied energy but synthetic paint ingredients are electrically charged and use plastic so they attract dust and bacteria, producing less healthy environments so it is not suggested to use those kind of paintings in the public interiors of shopping centers.
10. Wallpapers are less sensitive to the environment comparing with the water-based alkyd paints or natural paint. So it is better to use those materials in the design of shopping center public space.
11. Using some natural planting and water can be an alternative for the design of wall or floor surfaces if it required in the design.
12. The use of acoustical ceilings can be an alternative if they are required. Metal ceilings, gypsum board, plaster ceilings and mineral fiber and fiberglass acoustical ceilings can be selected according to the design and the function of the space.
13. The choice of lighting fixtures also can be the determining factor in selecting the type of suspended ceiling. The amount of natural light in the space and the need of artificial lighting elements could also be

considered in deciding the type of ceiling for sustainable solutions.

## VII. CONCLUSION

Built environments and the building sector is the area which uses an important amount of energy and construction materials that are produced by world resources. Shopping centers have a great role considering their number and area in the cities of Turkey in the last 20 years. The concept of sustainability in shopping center design should be carefully indicated.

Interior design of a shopping center is a very determining concept that has great contributions to the concept of sustainability. The public areas in shopping centers, which social and recreational activities are conducted and circulation areas in shopping centers may make a great contribution to shopping center sustainability. Lighting and the interior finishing materials of those areas should be discussed and carefully selected in order to make a great contribution to the concept of sustainability in shopping center design.

On the other hand, the social and economical changes turned shopping centers into social gathering spaces, and recreational spaces for lots of people. This transformation makes shopping centers social and the existence of recreational spaces increase the time spent. Public spaces in shopping centers as recreational areas should be reconsidered in the means of an increase in their space quality and the sustainable concerns in interior design.

With this study the lighting and the interior finish materials in shopping center public interiors discussed. The design proposals for those areas are argued in order to make a great contribution to the concept of sustainability in contemporary shopping centers.

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