

The Impact sunscreens have on a building's façade

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Abstract:

Glass facades have become a feature of modern architecture because of the natural lighting and external view of the building, which works on a visual connection between the inside and outside of the building, but some countries, especially Arab ones, are exposed to an ample amount of sunlight throughout the year, which exposes their buildings if designs are not made that suit this climate with dazzling light and high heat, which makes the general atmosphere of the users of these buildings uncomfortable for them, in addition to their impact on the economic, environmental and social aspects of so, The importance of this study stems from the realism of the suffering of some buildings in hot regions due to the design of buildings that do not take into account the needs of the climate. The research dealt with the facades of high-rise buildings and how to deal with them, and also touched on how sunscreens work and their importance for the facades of buildings and how to make designs that suit the exterior shape of buildings and maintain it from an aesthetic and functional point of view, also touched on and mentioned examples of modern buildings in the State of Kuwait in which types of sunscreens were used. The research concluded with several recommendations such as the importance of using sunscreens because of their aesthetic impact and improving the functionality of the indoor environment such as reducing the heat entering the building, which reduces waste of energy necessary for cooling.

Key words:

sunscreen; building façade; solar radiation; outdoor sunshades; sun glare.

Introduction:

A facade is usually defined as the front part or exterior of a building. It is a word driven from the French façade, which means 'frontage' or 'face'. In architecture, the facade of a building is often the most important aspect from a design point of view, as it will be the key to make for the rest of the building. From the designing point of view of a building, the exterior is additionally of extraordinary significance due to its effect on vitality proficiency. For historical facades, many local areas regulations or governing laws or other laws restrict at large or even forbid their alteration (Boswell, 2013).

Well-designed sunscreens and sun control or shadings can dramatically reduce buildings in gaining heat and cooling requirements (Figure 1) and improve the natural lighting quality of building interiors. Sun control and shadings can also improve user visual comfort by controlling glare and reducing contrast ratios. This frequently results to improved satisfaction and productivity. Sunscreens offer the opportunity of differentiating one building facade from another. This can provide relative interest levels and human interests to an otherwise different design.



Figure (1)

Shows unusual shape of Sunscreen for U of Iowa's Campus

Aim of the research:

Discussing the effect of sunscreens on the façade and therefore on interior comfort of buildings.

Research importance:

The importance of the research lies in the spread of this problem in most buildings in hot countries that enjoy an abundant amount of sunlight throughout the year, as the inappropriate design of the facade makes the problem exacerbate and increases the discomfort of the residents of these buildings, in addition to the lack of studies in this field.

Research field:

Building facades; interior design; sunscreens.

Research Methodology:

The research follows the descriptive analytical approach by highlighting the different methods and materials for the development and construction of sunscreens for buildings.

Previous Studies:

The history of urban planning in the world has been established since ages or centuries. Zoning was the main tool adopted and little consideration was given to building law and economic growth in general for the associated environmental consequences. Failure to comply with building regulations was promoted to be the punishment or penalties by the frequent Prospects of Sustainability and Planning of Cities.

A research study put focus on the literature of Vertical Greenery Systems when used as passive tool for energy savings in buildings. First, with the information obtained from the literature, some key aspects to consider when working with VGS are clarified, such as the classification systems, the climate influence, the plant species used and the different operating mechanisms. The main conclusion of this literature was to discuss sunscreens and climatic situations. it can be concluded that VGS give incredible potential in lessening vitality utilization in buildings, particularly within the cooling periods.

The results of this study have shown that the investigations of VGS are not equally distributed around the world, being basically concentrated in Europe and Asia. Furthermore, the review concludes that some aspects must be studied in depth, such as which species are the most suitable for each climate, influence on energy savings of the façade orientation, foliage thickness, presence of air layers, and finally, substrate layer composition and thickness in the case of green walls (Gabriel Pérez, 2014).

There are certain studies that have investigated the use of origami sunscreens with various architecture for the design of active solar façades of energy efficient buildings. This paper presents a mechanical study on the dynamic response of shading screens that are formed by origami panels activated through the tensioning and relaxation of selected strings. The basic functioning of these screens includes tensegrity units with displacement amplification properties that are equipped with piezoelectric cables.

A numerical procedure for the simulation of the responses of these sunscreens under arbitrary loading is formulated. The proposed model is utilized to consider the incitation movement shown by the rudimentary origami module, and its vibrations beneath the activity of wind forces. The peculiar ability of tensegrity shading systems to harvest the mechanical energy stored in the strings is investigated, by drawing comparison with the energy harvesting abilities of photovoltaic panels and micro-Eolic turbines (Raffaele Miranda, 2020)

In recent past, there has been much increase and intensity towards introducing the variety of sunscreens and glazing available for use in buildings (Figure 2). A wide extend of movable shading items is commercially accessible from canvas overhangs to sun powered screens, roll-down blinds, screens, and vertical louvers. Whereas they regularly perform well, their usefulness is restricted by the requirement for manual or mechanical control.



Figure (2)

Shows movable metal lattice sunscreen in a private residence in California that provides more privacy (joeadsett.2022)

This requires architecture professionals to fully separate and specify all glass. They should be prepared to separate and specify glass U-value, SC, and net window U-value for all types of sunscreen systems. The shading coefficient (SC) of a coating shows the sum of sun powered warm pick up that's conceded into a building relative to a single-glazed reference glass. Thus, a lower shading coefficient means less solar heat gain (Figure 3). The visible transmittance of a glazing material indicates the percentage of the light available in the visible portion of the spectrum admitted into a building.

When designing these sunscreens, carefully evaluate all maintenance operations and safety implications. In certain areas and cities or locations, there are certain harms such as nesting birds or earthquakes that might

reduce the viability of exterior sunscreens in the design. The need to maintain and clean these sunscreens, particularly operable ones, must be channelized with any life-cycle cost analysis of their use.

Figure (3)
Shows Modern shape of Mashrabiya help in decreasing solar heat gain and provide privacy for occupants (m.indiamart.2022)



1. What is High Rise Building's Facade?

In present day high-rise buildings, the outside dividers are frequently suspended from the concrete floor slabs. Examples include window ornament dividers and precast concrete walls. The facade or front side might need to have a fire-resistance rating, especially if two buildings are very close together, to lower the likelihood of fire spreading from one building to another.

Keeping a general viewpoint, the facade systems that are suspended or attached to the concrete walls will be made from aluminum or stainless steel. In recent years more lavish materials such as titanium have sometimes been used, but due to their cost and due to their edge staining issues, these have not been popular (Figure 4).



Figure (4)
Shows Modern metal façade as new material used as sunscreen (pin.it.2022)

Whether it is applied or not, fire protection is always a bigger concern while going for the design consideration. The melting point of aluminum is 660 °C which is typically reached within minutes of the start of a fire. Placing fire sprinkler systems on each floor features a significantly positive impact on the fire security of buildings with curtain walls. The increased use of unused materials like polymers, come about in a percentage of high-rise building exterior fires over the past few a long time, since they are more combustible than conventional materials.

Some building architectures might limit the percentage of window area in exterior walls. It was a common phenomenon in the Georgian period for already existing or placed houses in English towns that needs to be given a fashionable new facade.

At the time of changed medieval ages and start of modern era, sunscreens idea was created and are installed to

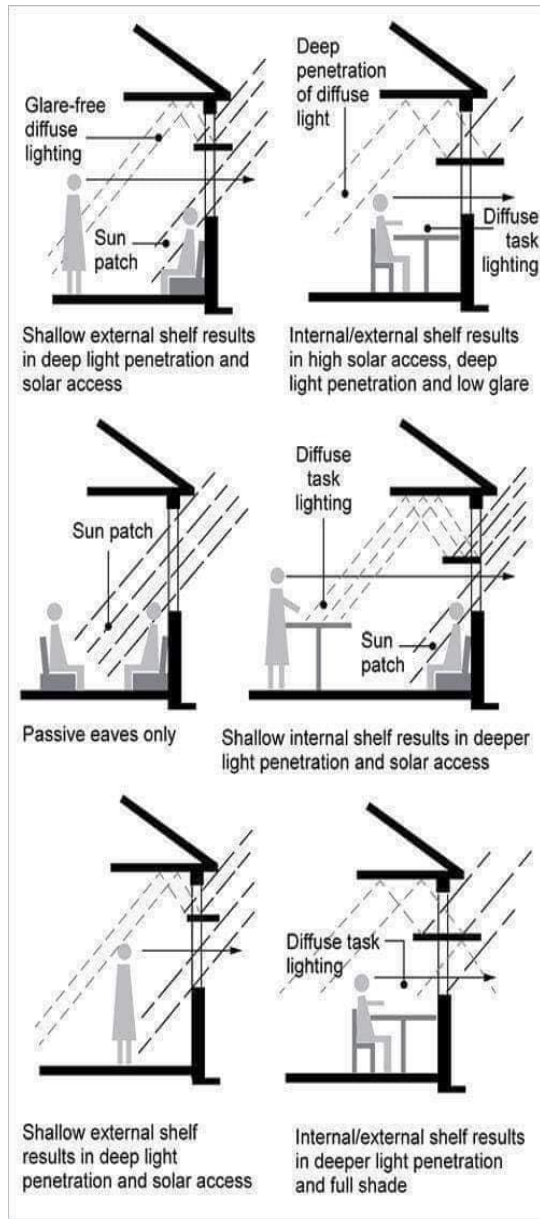


Figure (5) shows the influence of sunscreen on interiors comfort (pin.it.2022)

provide an added beauty and dimensional enhancement to the flat surface of a building, enhancing its overall aesthetic in any case. Over time, more important benefits for sunshades have been discovered. Particularly, sunshades are an important element in upgrading not only the look of a building but also its sustainability.

4.1 Sunscreens and how they work

The sunscreen is a panel that is applied alternately on the external or internal part of a building and serves as a shield from the rays of sunshine (Figure 5). The sun screening systems guarantee that light passes through the slits, while protecting the structure from UV rays and ensuring cooling during the hottest months. The panel also prevents high temperature caused by UV, which prevents buildings from becoming unbearably hot. The sunscreen panels also have an aesthetic and architectural role, because of their variety of shapes, colors, and materials, and this will allow them to adapt harmoniously to the facade of the building.

4.2 Benefits of Sunscreens in Building Façade

There are certain benefits of sunscreens that evolve the sunlight induction to the buildings. One of the most beneficial features of it is their ability to contribute to improved energy efficiency for businesses. Their presence blocks direct sunlight from entering through windows or doors, and this will help better regulate the temperature of the building. Not only does this keep the inner environment cold inside the building, but it can also lower regular air conditioning costs.

Due to its flexibility when created or formulated, metal would be the ideal material for perforated sunscreens and sunshades, and it offers greater durability than many other building materials. Metal is also easy to preserve and accessible in an assortment of colors to help the esthetic factor of a building. Customized perforated sunscreens and sunshades create a one-of-a-kind look for the building, providing vertical setups to attain the structural unique features to every project. The perforation pattern, sizes of the holes and shapes allow control over privacy and the amount of light coming into the interior of the building. This can lower energy costs, reduce glare and heat from the sun, allow natural light to

illuminate the interior of the building, improve the aesthetic appearance of the buildings and help make a building look amazing (Figure 6 A&B).



Figure (6.A)

Shows a latticework of coated aluminum giving a solution to possible glare, and provide elegant touch to the façade (mgerwingarch.2010)

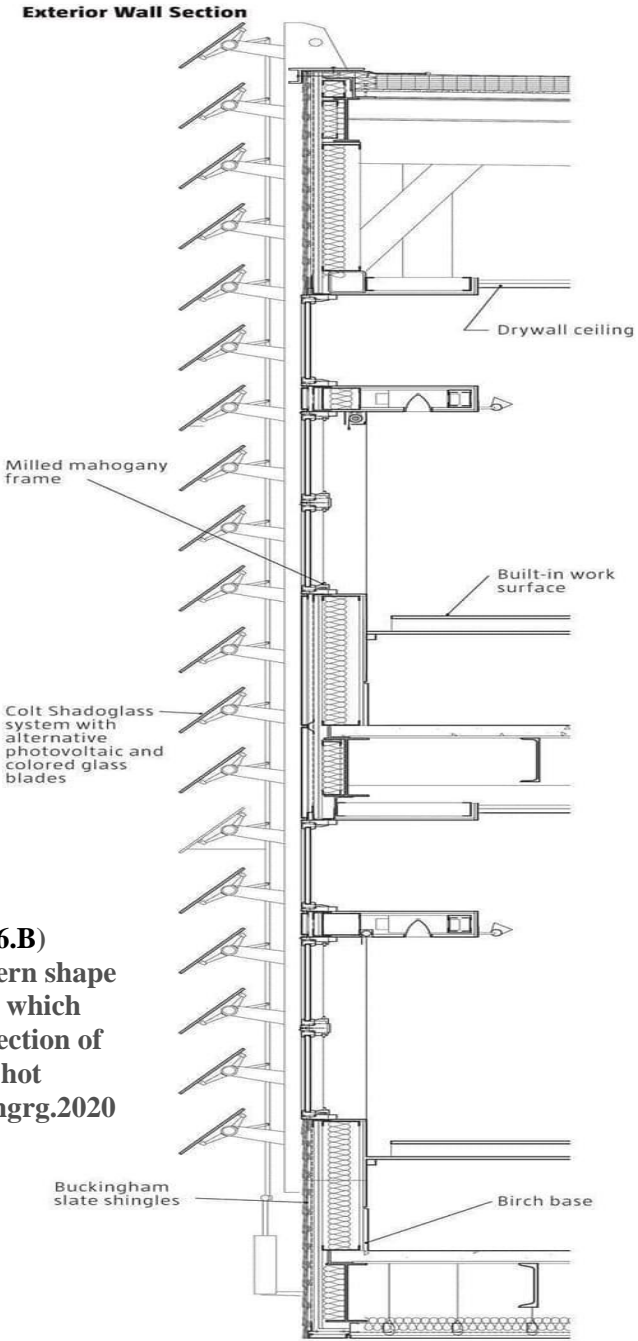


Figure (6.B)
Shows A modern shape
of cladding which
provide protection of
glare in hot
countries(r3engrg.2020

Punctured sunscreens and sunshades can moreover be manufactured with reused fabric, helping in generally supportability efforts. Sunscreens are easy to assemble and install, and hold nothing back in terms of strength, durability, and function. They can be incorporated in the façade

of the building structure, or as infill in a steel frame. They add beauty and functionality to any type of building designs and will make it well-fitted.

4.3 Design of Sunscreens for in building's windows

Given the wide variety of buildings and the range of climates in which they can be found, it is difficult to make sweeping generalizations about the design of sunscreens. However, there are certain design recommendations that needs to be followed to make viable sunscreens and ensure entrance of enough sunlight.

These points include:

- Up to the greatest extent which is possible, limit the amount of east and west glass as it could be the reason to block the sunlight. Consider the use of landscaping to shade east and west exposures (Figure 7).
- No need to fix or shading the north side glass in the continental. Like in the United States latitudes there is a high possibility to receive very little direct solar rays. In the tropics, disregard this rule-of-thumb since the north side of a building will receive more direct sunlight. Also, in the tropics consider shading the roof even if there are no skylights since the roof is a major source of transmitted sunrays or sun's heat into the building.

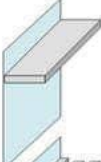

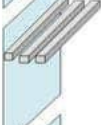

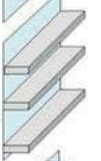

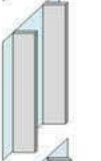

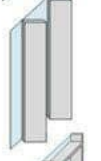

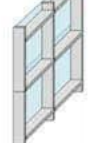

	3-D View	Section Plan	Ideal orientation	View restriction
Horizontal single blade			South	★★★★
Outrigger system			South	★★★★
Horizontal multiple blades			South	★★★★☆
Vertical fin			East West	★★★☆☆
Slanted Vertical fin			East West	★★★☆☆
Eggcrate			East West	★★★☆☆

Figure (7)
Shows The orientation of the façade obliges choosing special sunshade according to type of window / façade orientation (bembook.2012)

- Shading effects daylighting as well so there is a need to consider both these things simultaneously.
- There is no point in thinking that interior shadings such as Venetian blinds or vertical curtains to reduce cooling loads will work in both ways as if there is enough sunscreen and sunlight emitting from the building. However, these interior covers do offer glare control and can contribute to visual comfort inside buildings.
- If there is planning to install sunscreens, it needs to first study sun angles. An understanding of sun angles is critical to various aspects of design including determining how the basic building orientations should be, how much must consider while selecting sunscreens, and placing Building Integrated Photovoltaic panels or sunlight collectors.
- It is needed to carefully consider the durability of these sunscreens. It happens over time that operable shading material will require a proper maintenance and repair.
- When relying on landscape elements for shading, be sure to consider the cost of landscape maintenance and upkeep on life-cycle cost.
- Shading strategies that work well at one latitude, may be completely inappropriate for other sites at different latitudes. Applying shading ideas from one project to another might change according to location, the height of the place, orientation of the site, the building materials, and design.

1.4 Sunscreens are useful for

Protecting buildings from direct sunlight to avoid overheating is important, especially in those structures with large windows and glazing. To create a fresh environment without sacrificing the brightness of large windows, the most suitable solutions are outdoor sunshades. These

screens will manage to combine an intensity of light and provide shelter as well from the hottest rays. External sunscreens are shielding systems from the sun that are widely used in architecture for their elegance. They are used to cool and protect structures from solar radiation without causing an unpleasant greenhouse effect. For this purpose, outdoor sunshades were created, shading systems designed specifically to shield the rays of sunshine without taking away the air from the building.

Among its several advantages of using sunscreen panel, some are:

- protection from sunlight
- natural buildings cooling
- energy savings as it reduces the use of air conditioners or fans (Figure 8)
- Possibility of mounting photovoltaic panels on it

In addition, in the winter period, outdoor aluminum sunscreens represent a barrier against wind and rain, thus performing an important function of protection and insulation from atmospheric perks and dust particles.

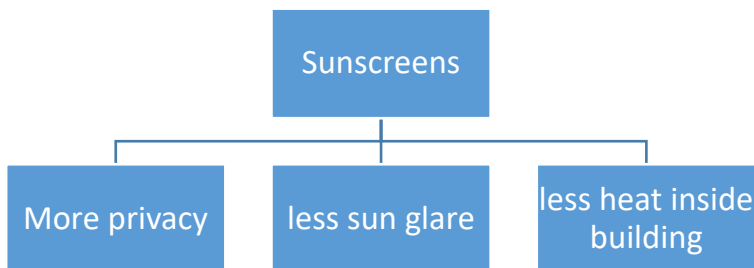
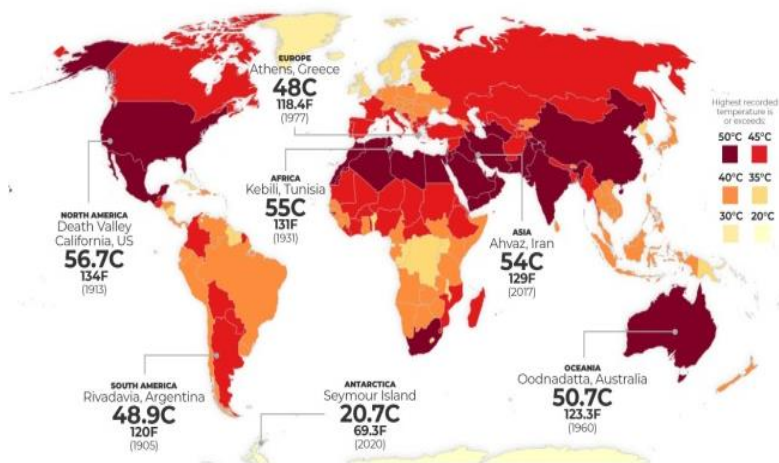
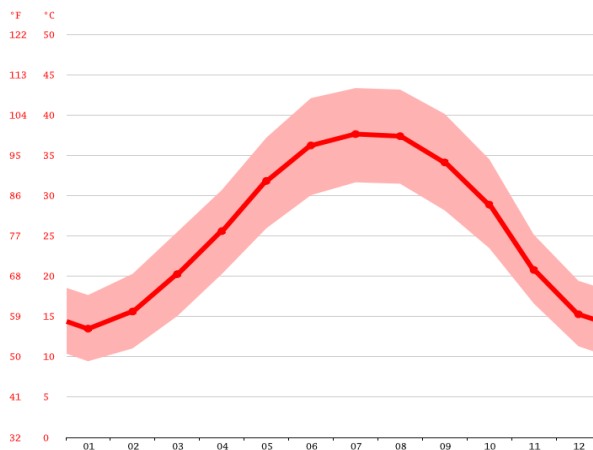


Figure (8)
Chart shows the benefit of sunscreens

5.sunscreens in State of Kuwait

Summers in Kuwait are some of the hottest on earth (Figure 9A&B). The highest recorded temperature was 54 °C (129 °F) at Mitribah on 21 July 2016, which is the highest temperature recorded in Asia.

Figure (9.A)
Shows a Diagram of high temperatures during the year in the state of Kuwait,(en.climate-data.org.2019)



The hottest temperatures around the world

Figure (9.B)
shows the world hot areas map. (Aljazeera.2021)

Because of the hot weather most of the year in Kuwait, most of homeowners suffering from high temperature especially if their houses contain facades of large windows, so architects and interior designers tried to come with some designs that fulfill the desire of large windows but with sunscreens to avoid high temperature, strong light glare, and to have privacy. There are unique designs that used sunscreen in different buildings in Kuwait some are residential, and some are government buildings.



5.1 Wafra Livings

It was designed by AGi architects proposes an innovative housing organization in Kuwait. It's a new type of multi-family living as a social response to housing needs in the country (Figure 10 A). The design is guided by the requirements contemporary life while balancing traditional norms and reintroduces urban life to the building level (Figure 10 B). Wafra Living is outlined as a high-rise building set back from the

Figure (10 A) Above & Below Shows using sunscreen provide privacy & glare control. Wafra Living, Jabriya, Kuwait(design-middleeast.2021)



road, with an L-shaped building characterizing the road edge. It is conceived to maximize security inside the community, while giving sufficient characteristic light and usable indoor and open-air common spaces. Cuts have been made on the ground floors of the front building to supply superior views for the tower apartments.

The design characterizes the edge of the piece and open spaces inside the plot for the community, with different uses. The building cantilevers off the ground to draw street life into the building. The ground floor level opens to the neighborhood with accessible retail facilities on the street level, integrating into the urban fabric, and links up to a high square through an inclined, stepped garden. The development is composed of 16 varieties of living typologies -extending from two room to four-room duplex- conveyed over five centers to cater to an assortment of tenants. The development incorporates different gardens, exercise centers, pools, kids playing ranges, squash court, open patios and community multi-purpose space.

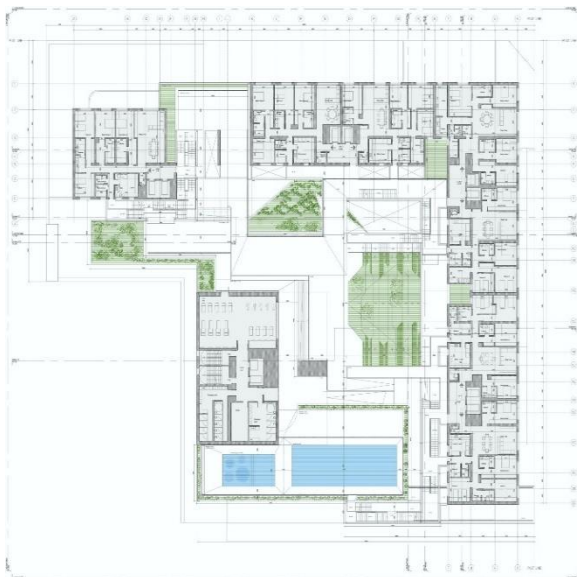


Figure (10.B)
The Horizontal plan of Wafra Living, Jabriya, Kuwait shows concentrating on privacy in design(archdaily.2021)

5.2 Sabah Al Salim Al Sabah University City, Shadadiya, Kuwait

Gulf Consult in association with Cambridge Seven Associates, Inc. of Boston have been commissioned by the Kuwait University Construction Program to carry out the Study, Design and Supervision of the College of Life Sciences at the new Sabah Al-Salem University City Campus. The Architectural Concept Design for the College is based on the creation of a central atrium under a large overhanging roof as the heart of the college (Figure 11A, B, &C). The façade design of the university contains different shapes of sunscreens to avoid strong glare into classes & offices beside of giving more comfort zones to users inside the complex.

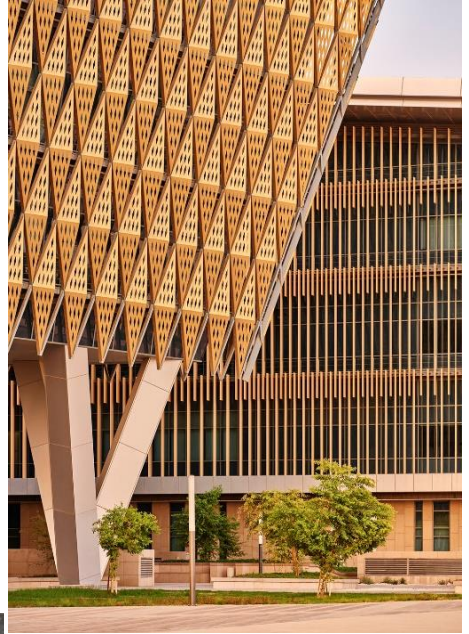


Figure (11 A)

Shows multi design in sunscreens to provide suitable amount of light in each part of buildings. Sabah Al Salim Al Sabah University City, Shadadiya, Kuwait(ckkuwait.2019)



Figure (11 B)

Multi levels design provide more shading & comfort zones, Sabah Al Salim Al Sabah University City, Shadadiya, Kuwait(sqcint.2021)



Figure (11 C)

The design as it shows in the plan of Sabah Al Salim Al Sabah University City, Shadadiya, Kuwait reflects an organized planning according sun orientation(sqcint.2021)

5.3 Kuwait Children's Hospital

The hospital is the largest of its type in the world and comprises (Figure 12 A&B): It consist of a five-storey podium consisting of Accident and Emergency, Diagnostic and Treatment spaces, as well as a unique and stress-reducing five-storey entrance and atria space with sea creatures, a twelve-storey tower and a helipad at roof level, and a three-storey basement for support services, and car parking. The venture is being overseen locally by SSH, giving support to the ministries. This empowers the partners and project team to collaborate on key plan choices, making a difference to quickly get and refine the plan to meet the necessities of both MPW and the Ministry of Health. The project use sunscreen façade to decrease the glare and discomfort of strong light, beside its stops increasing heat inside as well as giving its unique modern shape.



Figure (12 A)

Shows Kuwait Children's Hospital front (north) façade with modern design multi shape sunshade façade that provide slight sunlight for the whole building daytime(sshic.2022)



Figure (12 B)

Shows Kuwait Children's Hospital rear (south) façade with frequent shape of sunshade providing surrounded view and sunlight (sshic.2022)

6. Results

- The buildings were discussed above provided outside view beside heat control by using sunscreens in facades.
- the size of latticed sunscreen is suitable for Kuwait climate which prevent large amount of glare and heat to penetrate inside buildings as Kuwait university & children hospital.
- Designing building facades as aesthetic and functional element to achieve inner comfort as Wafra living.
- Such designs help using daylight and decrease the use of artificial ones.

Discussion

The use of sun control and sunscreen devices is an important aspect of many energy-efficient building design strategies. Buildings that employ passive solar heating or daylighting often depend on well-designed sun control and sunscreens (Figure 13).

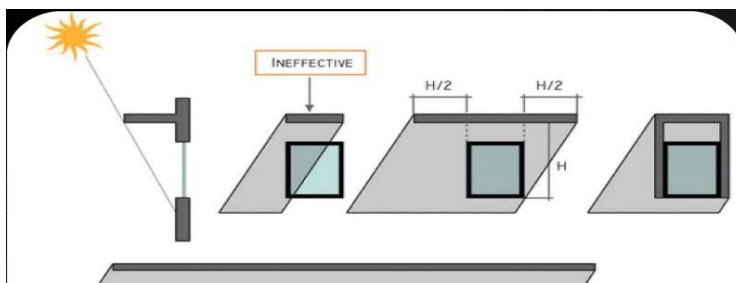


Figure (13)

choosing suitable shading & sunscreens according to the building orientation (pin.it.2015)

Amid cooling seasons, outside window shading is a great way to anticipate undesirable heat from entering a conditioned space. Shading can be given by common arranging or by building components such as overhangs, overhangs, and trellises. Some sunscreens can also function as reflectors, called light shelves, which bounce natural light for daylighting deep into building interiors.

The good design of effective sunscreens will depend on the solar orientation of a particular building facade. For illustration, basic settled overhangs are exceptionally successful at shading south-facing windows within the summer when sun points are high. However, the same horizontal device is not as successful at preventing the sun from entering west-facing windows during peak heat gain periods in the summer.

Exterior sunscreens are particularly effective in conjunction with clear glass facades. However, high-performance glazing is now available that possess very low shading coefficients. When specified, these new glass products reduce the need for exterior sunscreens.

Many positives of sunscreens at the social, economic, and environmental levels could be easily observed through this study and studies of the past. At the social level, it makes a difference by diminishing social screening and demonstrates the stabilization of populace in these neighborhoods. At the economic level, it contributes to raising the real estate value, attracting investments, and contributing to the revitalization of different sectors. At the environmental level, it contributes to the sustainability of the land, reduces the consumption of new lands, and corrects existing visual pollution.

On the other hand, we find that sunscreen help create a suitable environment for interior design, as they help to achieve a successful design even if the building is made up of vast glass facades, as they reduce the amount of light entering the building and so that the residents of these buildings can control the amount of light entering (When using some types of mobile sunscreen), and therefore it is a comfortable environment for the user even if he is next to these interfaces in the middle of the day, and it also works to provide privacy for the most demanding places for privacy such as bedrooms or bathrooms. It is exposed to passers-by or neighbors. Also, most residents of buildings with glass facades were afraid to use bright-colored furniture for fear of exposure to strong sunlight, which would be affected and fade, but with the presence of light breakers, it works to filter and reduce this amount entering the buildings.

Conclusion

The researcher suggests that the students of architecture and interior design in the last year of study be involved in the development projects of the country under the supervision of architects and designers with experience in this field, to take advantage of the ideas of young people may change the course of design, especially if under the supervision of experts. It is also allowed to make suggestions for the development of existing buildings through the discovery of the defect and address it with a different design, which leads to give them experience and realistic solutions to architectural problems that may face them in the future in this area, as this competition among students will be the result of enriching the designs and be Also, this competition among students will be the result of enriching the designs and be the beneficiary is the country.

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تأثير واقيات الشمس على واجهة المبنى

د. نوال السنافي

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كلية التربية الأساسية- الهيئة العامة

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المستخلص:

أصبحت الواجهات الزجاجية من سمات العمارة الحديثة لما توفره من إضاءة طبيعية ورؤية خارجية للمبنى مما يعمل على اتصال بصري بين داخل المبنى وخارجه، إلا أن بعض الدول وخاصة العربية منها تتعرض إلى كمية وافرة من أشعة الشمس طوال العام، مما يعرض مبانيها إذا لم يتم عمل تصاميم تناسب هذا المناخ بضوء مبهز وحرارة عالية مما يجعل الجو العام لمستخدمي هذه المباني غير مريح بالنسبة لهم، بالإضافة على تأثيرها على الجوانب الاقتصادية والبيئية والاجتماعية لذا، تنبع أهمية هذه الدراسة من واقعية معاناة بعض المباني في المناطق الحارة بسبب تصميم مباني لا تراعي احتياجات المناخ. تناول البحث واجهات المباني الشاهقة وكيفية التعامل معها، كما تم التطرق إلى كيفية عمل الواقيات الشمسية وأهميتها بالنسبة لواجهات المباني وكيفية عمل تصاميم تناسب الشكل الخارجي للمباني وتحافظ عليه من الناحية الجمالية والوظيفية، أيضا تم التطرق وذكر أمثلة لمباني حديثة بدولة الكويت تم استخدام أنواع من الواقيات الشمسية فيها. وخلص البحث إلى عدة توصيات كأهمية استخدام الواقيات الشمسية لما لها من تأثير جمالي وتحسين الأداء الوظيفي للبيئة الداخلية كتقليل الحرارة الداخلة إلى المبنى مما يقلل من الهدر بالطاقة اللازمة للتبريد.

الكلمات المفتاحية:

واقيات شمسية؛ واجهات المباني؛ إشعاع شمسي؛ تظليل الأماكن الخارجية؛ وهج

الشمس.

