

LED FACADES IN URBARCHITECTURE*

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Abstract. *Rapid development of electronic technologies at the beginning of this century resulted in intensive changes in urbarchitectonic formation of façade planes and physical structures. Advent of LED lights and LED panels made possible that the physical structures in urban agglomerations worldwide, old or new, have opened a new chapter for strategic urbarchitectonic design and different cultural illumination diversity of houses in space. The user relationship towards activities in physical environment, exterior and interior has been changed, and new visual-esthetic living style has been established, a new and more dynamic form of social communication behavior towards the identity of a place and total evaluation of environment characteristics. A new orientation in ivisual and functional creation of urbarchitectonic forms was born, in redefining of a concept of culture of walls, culture of house facades and in general of facade planes, whose life is active not only during daytime by around the clock.*

Key words: *LED panels, facade, urbarchitecture, strategic design, visual esthetics.*

1. INTRODUCTION

Application of LED panels in design of the facade planes, especially at the beginning of 21st century, resulted in the urbarchitectonic physical structures obtaining new, more esthetic volumes, and rendered the space in their immediate environment more attractive and challenging for all the users. A new formal instrument has been made, an architectural material using the light effects to accentuate forms, emphasize geometry and elevate culture of exterior and interior wall facade planes and change functional spatial concept in micro-ambiance entities. Apart from that, usage of LED panels accomplishes a better organic urbarchitectonic dialogue in space, a better vocabulary with an increased kinetics of colored visual fields.

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We are dealing with a new urbanology and a new understanding of coherent complex pictures of disintegrated cities and their parts. It becomes ever more visible through a tragic discontinuity of construction and induction of chaos into the existing urban fabric, through degradation of local and traditional culture, through disrupted esthetic, historical and cultural relations between the parts of the houses.

This situation with everyday clogging of urbarchitectonic space is dangerous and urbi-
cidal. It makes us think about their renovation, remodeling, repair and healing. It exhibits necessity to create new and reconstruct old forms of physical structures of cities. This applies both to day and night appearances, in order so that architecture would be living around the clock. The tendency of the designers, worldwide, to stimulate esthetic-conceptual-illuminative reformation of micro-ambiance, artifact entities, houses, ground and roof levels and to create a new symbolic and communicative identity and new, enhanced urbarchitectonic cultures of people is realistic. Such city-building tendencies may be recognized in realized urbarchitectonic creations from all corners of the planet. There are several pioneering examples.

2. ANALYZED LED FACADES

2.1. Led action facade in Madrid

This facade, called the LED Action Facade, by Langarita Navarro Arquitectos, is a full-motion video board attached to the Medialab-Prado Centre in Madrid - Fig. 1. Being placed in a public space like this, allows the board to be viewed by many pedestrians passing by and could be used for displaying many important public messages, but also what is to say that it's not going to become something like Like any other private screen connected to Internet, the Led Action Façade can show a great variety of contents of public interest, whether it is in the form of information, food for thought, or just for fun. Its exceptionality springs from its ability to bring together residents of the neighbourhood and visitors to the Triángulo de las Artes to share a space that fosters social participation, bidirectional interaction and a sense of belonging to a community that is much more explicit than what one tends to find with most conventional public spaces.



Fig. 1. LED Action Facade Madrid, Spain

Popularly known as the "Triángulo de las Artes" (Triangle of the Arts), the zone that lies between the historic centre of Madrid and the Retiro Park is notable for its profusion of art galleries to the extent that it has come to constitute one of the greatest concentrations of art works in all Europe. At the apices of the triangle, the most relevant exhibition facilities in the zone are the Prado Museum, the Reina Sofía National Museum and the Thyssen-Bornemisza Museum. These were joined in 2008 by the CaixaForum, a non-profit-making exhibition centre sponsored by the banking entity that gives it its name. The construction of the new centre, fruit of reforms and extension work carried out on an old textile factory, was accompanied by the opening up of two adjacent squares that function as the building's vestibular spaces. One of these is the result of the demolition of a petrol station, a fact that explains the appearance of an awkward flank wall that did nothing to favour its appearance. The problem was resolved by means of a now-famous intervention that covered this vertical face with greenery watered by a concealed irrigation system. The other space, which was opened in 2007 and named Plaza de las Letras, is of similar origin and thus faced an almost identical problem.

This open space appeared in 2004 as the result of a fire in the Mediodía sub-power station. The subsequent demolition of the installations uncovered another blind flank wall, this time of an old industrial plant that had housed the sawmill factory Serrerías Belgas, which is presently being refurbished as the new headquarters of Intermediae, a centre that comes under the aegis of the Arts Department of the Madrid City Council and that works in the field of digital technology applications in artistic creation. The Arts Department also refurbished a space beneath the Plaza de las Letras to house Medialab/Prado, a programme that preceded Intermediae and also working with artistic expressions related with digital culture. When the square was developed, the wall of Serrerías Belgas was covered by layer of undulating steel sheets. Although this palliated the effect of the flank wall, the solution continued to be of a merely provisional nature.

The same year in which the CaixaForum opened its doors the Arts Department of the Madrid City Council set about finding the definitive solution. The idea was to make the most of the visibility of the flank wall because of its privileged situation in the heart of a district so linked with the world of art, and also because of its intrinsic geometry consisting of a large vertical plane with a staggered profile at the top, directly facing the CaixaForum building. The Medialab/Prado programme was commissioned to produce the concept, development and contents of the project. The result of the initiative was the conversion of a blind flank wall into a large-scale digital screen that has been named Led Action Façade. The vertical face has been covered by a regular matrix of truncated aluminium cones, each of which functions as a colour pixel since it contains three diodes (LED) that give out light according to the RGB chromatic model. The section of cones has been designed in such a way that their inner faces reflect the light of the emission source and amplify the size of each pixel, which ends up with a diameter of five centimetres.

This design permits a considerable reduction in the number of LEDs necessary to cover a designated surface and, although it reduces the resolution of the images projected on to the screen, it also considerably cuts installation costs. In the end, 35,000 nodes were required to cover the surface of one hundred and forty-four square metres. Moreover, the physical independence of the cones means that, instead of adopting the usual rectangular profile, the screen has a staggered upper profile like that of the flank wall it hides. When the screen is switched off the volume of the cones gives the cover a vibrant crinkled sur-

face, thus distinguishing it from the other conventional facades. Its orientation is due north so that it is never exposed to direct sunlight, yet it has sufficient light to function during the day while, by night, it offers more contrasted, vivid images.

From the moment of its installation, Medialab/Prado has been continuously organising workshops and seminars where experts and occasional users are invited to come and explore its possibilities. The exploration is structured around two main themes. One is concerned with the production of quality content that will capture the public interest and that is also related with art, public space and the new technologies. The other facet involves individuals and groups who come together to reflect on production of this content, understanding this work as an open, continuous process of experimentation with new methods of interaction and participation. Contributions can be constant and stable as well as specific, periodical and anonymous.

2.2. The BIX façade in Graz

Its unusual form differs radically from conventional exhibition contexts, many of which maintain the traditions of the modernist "White Cube". The team of architects used an innovative stylistic idiom, known as blob architecture within the historical ambiance of the Murvorstadt. Thus, the gigantic building affectionately called the "Friendly Alien" by its creators Peter Cook and Colin Fournier, in form and material, stands out consciously against the surrounding baroque roof landscape with its red clay roofing tiles but nevertheless integrates the façade of the 1847 iron house. Architecture, design, new media, internet art, film, and photography are united under one roof. Kunsthaus Graz - Fig. 2, was developed as an institution to stage international exhibitions of multidisciplinary, modern and contemporary art from the 1960s to the present day.



Fig. 2. The BIX Façade in Graz, Austria

It doesn't collect, maintains no permanent exhibitions, has no permanent depot at its disposal and no research establishments. Its exclusive purpose is to present and procure contemporary art productions. Kunsthaus Graz implements an innovative concept, which offers various possibilities in its galleries to fulfill the high curatorial requirements of contemporary exhibitions. The BIX Façade of the museum represents a singular fusion

from architecture and New Media and is based on a concept of the Berliner architects realities:united. BIX, a name which consists of the words "Big" and "pixels" is the acrylic glass skin of the eastern side of the building toward the Mur and city center and represents an oversize urban screen, which serves as an instrument for artistic productions. BIX projects accompany different exhibitions and are not transported into the public area, also the direct environment is defined and shaped. Beyond that the "communicating outer skin" offers also a possible drilling platform for art projects, which bring up for discussion the dialogue between media and area. 930 40 Watt fluorescent rings are embedded in the 900 m² outer skin, with the illumination level of each one being steplessly variable between 0 and 100%. Each light ring functions as pixel, which can be served by a central computer. In this way they can be developed as roughly screened indications, texts and film sequences, which radiate far into the urban area and thus, the blue blister of Graz with a screen of immense size makes an art gallery.

With the increase of technology in buildings, lightings, and computers, there have been several buildings designed which use all of these components on the facade to create a more dynamic facade which can change and show different things. What these facades show varies greatly, and I think the effect is very different depending on what they do show and how they do it. Pictured above is the Kunthaus Graz, by Peter Cook (of Archigram fame), a museum in Graz, Austria that uses a rather low-tech method to create its media facade. Beneath the glass of the facade is a series of round fluorescent tubes which are controlled by a computer and can be turned on and off to create a series of effects. This low-resolution "banner" is sometimes used to display an advertisement for an exhibit going on inside the museum, sometimes displays artwork related to work inside the museum and sometimes just other patterns. The effect here is that the building becomes a billboard for its purpose, but it does not overpower the overall design of the facade, and that is perhaps because the design is so wacky that it is hard to overpower it with anything less than Las Vegas.

The Led Action Façade is the extraordinary solution to an ordinary problem. Situations in which the continuous transformation of a city uncovers blind flank walls that mar the cityscape are frequent and abundant. In this case, however, the form in which the situation has been resolved offers so many side benefits that the original problem has been relegated to a status that is little more than anecdotal. In effect, more than in what it hides, the screen's importance lies in what it shows. Though it may be true that one finds more and more similar devices in urban space, it is also true that they are almost always geared to the unidirectional dissemination of propaganda or advertising messages. The Led Action Façade, however, is an interactive support linking virtual public space with real urban public space. This connection is quite unusual because people's access to the forms of social relations held out by the new technologies normally occurs in the private domain, which means that people's ability to join digital networks is neither equitable nor universal.

2.3. Shanghai corporate pavilion

The LED facade of the Dream Cube pulses different colors and designs based the physical actions of the visitors participating inside. They sense that they can create a better city, better life, and better world through the power of collaboration and collective action. How do you make a huge pavilion awesome? You create the building out of recycled

CD cases. So, what can you do to make that better? You attach a huge LED array onto the outside of that said pavilion, and you make it just about as bright as is probably necessary. But of course, you have to do more than that, because then that's just a building with some lights on it. That happens all the time at Christmas. Thankfully for us, the designers of the Shanghai Corporate Pavilion - Fig. 3. have, indeed, made it better.

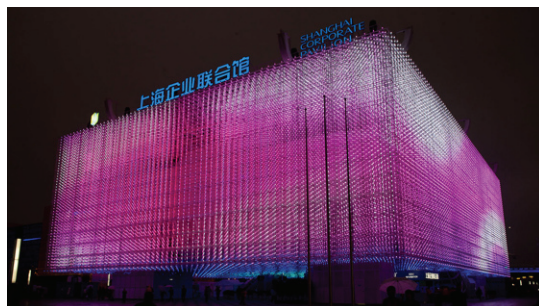


Fig. 3. New Shanghai Corporate Pavilion, by ESI Design and architect Yung Ho Chang.

When we say that the building is covered by an LED array, we mean the entire thing. The entire facade of the building is covered in these lights, making it look ridiculously impressive at night, as you can see from the images. Additionally, the lights can change, including greens, blues, pinks, and yellows, and this is where the real surprise comes in. There isn't a computer controlling when to change the colors. It's actually the people inside the building. According to the designers, people that go into the Shanghai Corporate Pavilion are lined up in a queue, and it's there that they are told that their actions have a consequence on how the colors are illuminated on the outside of the building. A collective response from the group, whether that means waving their arms, or clapping their hands, instigates a transition of colors on the outside of the building. On the inside, there's a series of interactive exhibits, before they finally reach the "Dream Cube Control Room," which apparently has another surprise in store for participants, and will also "make them think."

ESI Design, based out of the United States, worked in conjunction with architect Yung Ho Chang to create the entire interactive design, from inside and out, to create one of the most spellbinding buildings on the planet. On top of all the nice little tech treats in store for those who get to make it, the building itself is eco-friendly in many different ways, including solar panels, and a roof that actually collects rain water for future use. Unfortunately, the building is only being used for Expo 2010, and after the expo, the building will be recycled. So, if you're in the neighborhood, you definitely need to check this out.

2.4. The National library of Belarus

The National Library of Belarus - Fig. 4, founded on 15 September 1922, is a copyright library of the Republic of Belarus. It houses the largest collection of Belarusian printed materials and the third largest collection of books in Russian behind the Russian State Library (Moscow) and the Russian National Library (St Petersburg). It is now located in a new 72-metre (236 feet) high building in Minsk, Belarus. The building has 22

floors and was completed in January 2006. The building can seat about 2,000 readers and features a 500-seat conference hall. Its main architectural component has the shape of a rhombicuboctahedron. The library's new building was designed by architects Mihail Vinogradov and Viktor Kramarenko and opened on 16 June 2006. The National Library of Belarus is the main information and cultural centre of the country.

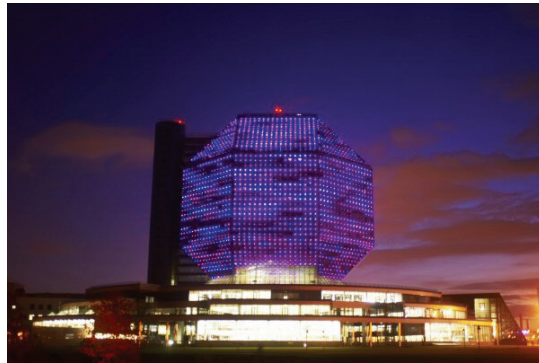


Fig. 4. The National Library in Minsk, Belarus.

Its depository collections include 8 million items of various media. In 1993 the National Library of Belarus started to create its own electronic information resources. It has generated a collection of bibliographic, factual graphic, full-text, graphic, sound and language databases that comprise more than 2 million records. The scope of databases is quite wide: humanities, social sciences, history, art and culture of Belarus. Library users also have access to databases of other libraries and academic institutions, including foreign ones.

The library service is in great demand. More than 90 thousand citizens of Belarus are library users, who annually request 3.5 million documents. Every day the library is visited by more than 2,200 people. The library delivers about 12,000 documents daily. In addition to serving as a functional library, the National Library is a city attraction. It is situated in a park on a river bank and has an observation deck looking over Minsk. As of 2009 it is the only structure in Minsk with a public observation deck. The area in front of the library is used for many public concerts and shows. The building is also the subject of an art video by French artist Raphael Zarka, "Rhombus Sectus", shown at the Bischoff / Weiss gallery, London, in 2011.

2.5. The Yas Hotel Abu Dhabi

The Yas Hotel - Fig. 5, is located within the Yas Marina Circuit, Abu Dhabi. It is the first new hotel in the world to be built over an F1 race circuit. The Hotel, designed by Hani Rashid and Lise Anne Couture, principals of New York based Asymptote Architecture, consists of two twelve story hotel towers, one set within the race circuit and another placed in the Marina itself, linked together by a monocoque steel and glass bridge and Grid Shell structure that both cross above and over the Yas Marina Circuit F1 race track.

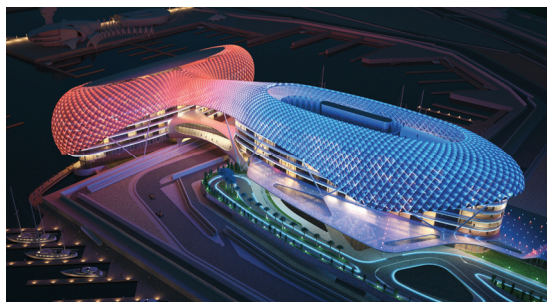


Fig. 5. The Yas Hotel, Abu Dhabi.

Asymptote created and conceived of the building as an architectural landmark embodying key influences and local and global inspirations ranging from the aesthetics and forms associated with speed and spectacle to the artistry and geometries that form the basis of ancient Islamic art and craft traditions. Of architectural and engineering significance is the main feature of the hotel's design: a 217-meter expanse of sweeping, curvilinear glass and steel covering known as the Grid Shell: it features an LED lighting system incorporating video feeds that are transmitted over the 5,389 pivoting diamond-shaped colour changing LED panes. This Grid-Shell component is a key aspect of the overall architectural design and significance of the project by producing an atmospheric-like veil visible from miles away. The Yas Hotel was designed by Asymptote to become a significant and important landmark for Abu Dhabi. The pixelated lighting design by Asymptote in collaboration with Arup Lighting creates a dynamic appearance at night, with colours flowing smoothly across the double curved surface.

"The hotel embodies various key influences and inspirations ranging from the aesthetics and forms associated with speed, movement and spectacle to the artistry and geometries forming the basis of ancient Islamic art and craft traditions, a perfect union and harmonious interplay between elegance and spectacle. The search here was inspired by what one could call the 'art' and poetics of motor racing, specifically Formula 1, coupled with the making of a place that celebrates Abu Dhabi as a cultural and technological tour de force." The 499-room, 85,000-square-meter structure was built by Al Futtaim Carillion for Aldar Properties with construction starting in 2007. It opened on 1 November 2009 to coincide with the Formula 1 Etihad Airways Abu Dhabi Grand Prix.

If you think your neighbor's holiday lighting spectacle is an exercise in excess, wait till you see the world's largest LED project, recently completed in Abu Dhabi. Created by Asymptote Architecture with lighting design by Arup, The Yas Hotel is a wrapped with a sparkling shell composed of more than 5,300 diamond-shaped panels bristling with over 5,000 LED fixtures. The curvilinear field of lights is capable of running color-changing light sequences and can even display low-res three-dimensional videos.

2.6. The Torre Agbar in Barcelona

The Torre Agbar - Fig. 6, a 38-storey tower located between Avinguda Diagonal and Carrer Badajoz, near Plaça de les Glòries Catalanes, which marks the gateway to the new

technological district of Barcelona, Spain. It was designed by French architect Jean Nouvel in association with the Spanish firm B720 Arquitectos and built by Grupo ACS.



Fig. 6. The Torre Agbar in Barcelona, Spain.

The Torre Agbar is located in the Poblenou neighborhood of Barcelona and is named after its owners, the Agbar Group, a holding company whose interests include the Barcelona water company Aigües de Barcelona. The tower measures a total of 50,693 square metres, of which 30,000 are offices, 3,210 technical facilities, 8,132 services, including an auditorium, and 9,132 square metres for parking. It opened in June 2005 and was officially opened by the King of Spain on 16 September 2005 and at a cost of 130 million euro.

The building is owned by the multinational group Agbar which has its corporate headquarters in the building and that takes up most of the floors, renting the remainder. The Agbar Tower was acquired in March 2010 for 165 million euro, after reaching an agreement with its former owner, the investment group Azurelau. Azurelau previously had bought the property in mid-2007. The purchase price was not disclosed.

3. CONCLUSION

The presented examples from Madrid, Graz, Shanghai, Minsk, Abu Dhabi and Barcelona are indicative for thinking about establishing a new philosophy of formation of façade planes of structures in the urbarchitectonic agglomerations, be them vertical, horizontal or inclined. We are convinced that by applying the LED panels on façade plans one can essentially change the world of urbarchitecture. The changes indicate innovative tendencies accomplishing multiple goals.

- Suggests new strategic urbarchitectonic design and different cultural lighting diversity of houses in space
- Decreases disintegration of urban tradition and collapse of decades long creation of coherent and complex images of cities and their parts.
- Alleviates a discontinued cultural, historical and artistic relations between the parts of physical structures.
- Makes possible an attempt to renovate, remodel, repair and heal the structures in space
- Affects the total urban culture of users through technotronic, superdigitalized volumes.
- Accentuates the importance of coloration and artistic remodeling of existing physical structures.
- Creates a visual-illuminative-digital-electronic kinetics in urbarchitectonic and facade framework.

- Improves esthetic and functional image of cities around the clock with the modified sensibility of individuals
- Coherence of content of spiritual and material coordinates in space
- Enhances the impression of value of altered visual communication and design in urban, public space.

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LED FASADE U URBARHITEKTURI

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Nagli razvoj elektronskih tehnologija početkom ovog veka uticao je na snažne promene u urbarhitektonskom oblikovanju fasadnih ravni fizičkih struktura. Prodor LED svetiljki i LED panela učinili su da fizičke strukture u urbanim aglomeracijama širom sveta, bile one stare ili nove, otvore poglavlje za strateški urbarhitektonski dizajn i drugačiju kulturnu svetlosnu raznolikost kuća u prostoru. Promenjen je odnos korisnika prema aktivnostima u fizičkoj sredini, eksterijernoj i enterijernoj, uspostavljen je novi vizuelno-estetski stil života, novi dinamičniji socijalno-komunikacijski oblik ponašanja prema identitetu mesta i ukupnom vrednovanju karakteristika prostornog okruženja.

Nastala je nova orijentacija u likovnom i funkcionalnom stvaranju urbarhitektonskih formi, u redefinisanoj pojma kulture zida, kulture fasada kuća, i uopšte fasadnih ravni, čiji je život aktivan ne samo u toku dana, već 24 časa.

Ključne reči: *LED paneli, fasada, urbarhitektura, strateški dizajn, vizuelna estetika.*