

## SPECIFIC PROBLEMS OF MEDIA FACADE DESIGN

*UDC 72.012.6+692.23=111*

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**Abstract.** *During the last years we have been facing a growing need of involving architects into processes of modern city medialization. Transposing contemporary media logic into architecture must be accompanied by qualitative answers within architectural theory and practice. The field of media facade is interdisciplinary - not only does it involve research within architecture and urbanism, but also within some border areas of technology, urban design, art, culture, media and marketing. Media facade design process involves analyses of some specific design aspects.*

**Key words:** *facade, integration, interdisciplinary design, media architecture.*

### 1. INTRODUCTION

Over the last decade, and a bit longer, the city landscape in world metropolises has undergone significant changes under the influence of globalization, commercialization, media and digitalization. Contemporary authors consider such hybrid space to be "media city"<sup>1</sup> – characterized by the changes in urban area and media. Rem Koolhaas believes that the traditional spatial hierarchy of cities is replaced by a kind of "junk-space", or in other words, "accumulation, summing and adding"<sup>2</sup> in space. On the other hand, McQuire notes that along with spatial changes of cities, there are also changes occurring in the media themselves – such changes relate primarily to "decentralization and distribution mobility through digital network".

Dynamic digital information moved from virtual to physical city surroundings. Public realm of 21<sup>st</sup> century urban space is no longer limited by physical space of streets and squares, but also the virtual space of electronic media, or more precisely, public space becomes the place of interaction between material and immaterial worlds. Development of new technologies, encompassing computer, electronic and audio-visual resources as well as new building materials, is leading toward new forms of architecture – media architecture.

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Received September 01, 2011

<sup>1</sup> Term *media city* taken from McQuire, S. *The Media City*, 2008.

<sup>2</sup> Rem Koolhaas, AMOMA, Koln, Tachen, 2004, pp.163.



**Fig. 1.** SPOTS, Postdamer Platz, Berlin, 2005, *Realities:united*, Tim /Jan Edler  
([www.spots-berlin.de](http://www.spots-berlin.de), [www.realites-united.de](http://www.realites-united.de))

The main topic of media architecture is architecture seen as a medium, "*communication medium*" conveying a certain message, content, images. Media architecture changes the present concept of design and façade construction, emphasizing the aspect of communication between architectural structures and environment. In this sense, we can say that the media façade is an entirely new urban issue, and "*urban area becomes a suitable ground for the application of modern technologies principles*".<sup>3</sup> **Media facade** is a facade that is both functionally and aesthetically specific and thus represents the *integration* of architecture, technology and content to new media presentations of modern art and/or communication.<sup>4</sup>

After the period of façade facing treatment with respect to ensuring thermal, acoustic and physical protection and safety as well as aesthetic uniqueness, attention should be directed to a new façade function – medialization.

## 2. SPECIFIC PROBLEMS OF MEDIA FAÇADE DESIGN

As for the problems regarding the mentioned façade construction, media façade is a specific issue – these special features relate to size, shape, space, integration level, visual comfort, the impact of temperature changes, the effect of wind and fire, economic and energy sustainability.

### 2.1. Locating within the facade

The overall appearance of the building having media façade is significantly conditioned by position, shape and size of media content on façade itself or facades of buildings, and it is the result of designers' creativity and many other factors as well. In relation to entire structure media content is:

- Located on one façade only,
- Located in parts of all facades,

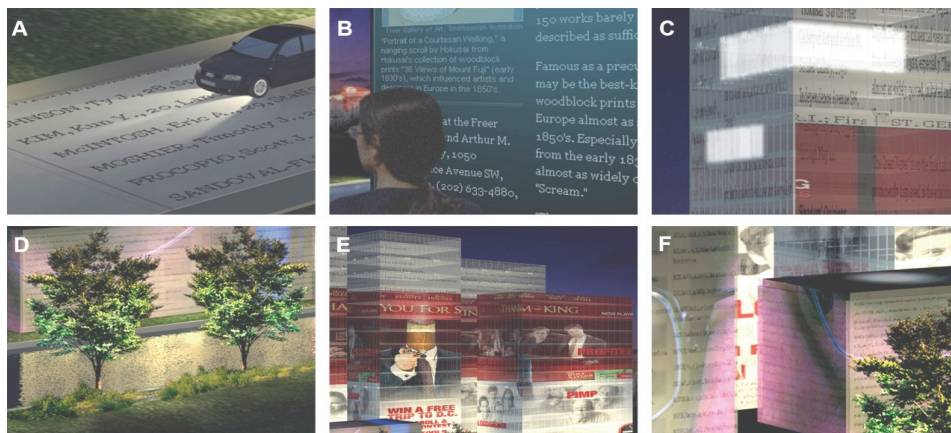
<sup>3</sup> Đokić, V, *City and city square (Grad i gradski trg)*, The Faculty of Architecture, Belgrade 2004, p.212.

<sup>4</sup> Heausler, *Media Facades*, 2009.

- Located at hierarchical level in relation to the building height,
- Located on the entire building.

When analyzing the possibilities for media façade location within the building façades, the following influential factors are to be taken into consideration (Fig. 2.)<sup>5</sup>:

- Relation to the street and all kinds of influence originated from there, and so on (a).
- The needed level of details and ideal perception distance (b),
- Backlight on the façade at night (c),
- Position of tall trees and other potential obstacles and/or water surfaces (d),
- Position of other media façade nearby – media content competitiveness (e),
- Space (linear extension), form of the structure (f).



**Fig. 2.** Factors affecting the location of media content on certain structures  
([www.e-collection.ethbib.ethz.ch](http://www.e-collection.ethbib.ethz.ch))

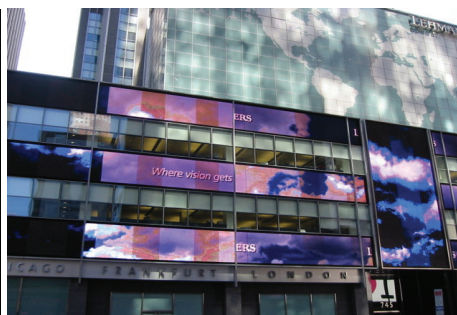
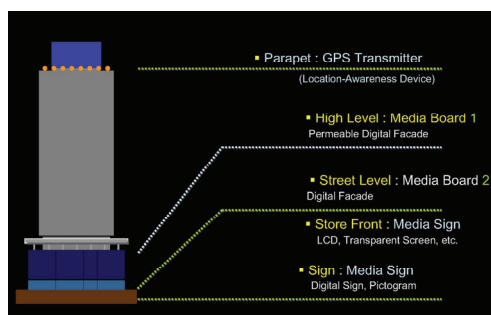
Street illumination, traffic lighting and street noise can influence media façade to some extent, primarily by its intensity. Thus, the audio-visual characteristics of media façade are disturbed. Such facts are to be taken into consideration when defining the level of audio-visual characteristics of media façade, since the level of illumination represents an important parameter affecting proper perception of the façade within its environment, that is – day and night conditions. As for the selection of media content location in relation to the entire building, minimal and maximal perception distances are to be analyzed in order to choose abstract or detailed contents. The presence or absence of back-light from the building interior at night may endanger the functioning of media façade and, therefore, the need for activating the elements of opacity should be considered, or media contents are to be located only in those parts of the façade where such problems do not exist (parapets and so on). The position of tall trees or some other physical barrier may obstruct media façade, as well as the reflection of some larger water surface; therefore, the position of media façade should be defined in accordance with the mentioned conditions.

<sup>5</sup> Schoch, O. *My Building is my Display*, Communicating spaces, 24thCAADe Conference Proceedings, Greece, 2006, pp 610-616.

The presence of another media façade nearby is not to be considered as a barrier, as far as functionality is concerned – yet, it can be seen as a competition of the offered media contents. The accumulation of media contents is not acceptable in all urban areas. It can exert positive influence on the increase of centrality in business centers, but on the other hand, it may disturb the primary function of residential areas.

Finally, the form of the structure, as well as its size, perceptiveness and space may exert certain influence on designer while selecting location for media content – designers can either emphasize façade surface, the entire building or three-dimensional building coat.

If we observe the structure as a whole, depending on the part of the structure where media content is located, it is important to consider the implications of designing various media contents in regard to the building height. In such case, directives are to be taken into consideration in order to define certain location hierarchy, in accordance with distance and perception angle. Therefore, depending on the number of floors, the building may consist of the following spatial units accompanied by adequate media technology (fig. 3.)<sup>6</sup>: ground floor, street level, high level, highest level. The Lehman's Brother building in New York represents the illustration for various media content positioning within a building: in parapet zone, and in the second upper-part across the entire façade. (fig. 4.).



**Fig. 3.** Media contents positioning in accordance with the building height ([www.ocw.mit.edu](http://www.ocw.mit.edu))

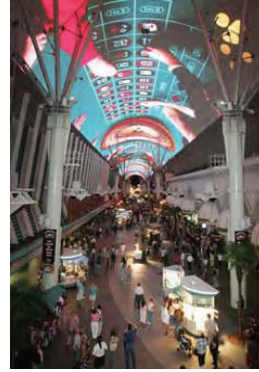
**Fig. 4.** Leman's Brother, New York ([www.webdesignerdepot.com](http://www.webdesignerdepot.com))

## 2.2. Dimensions, space, media façade shape

As for media façade dimensions, there are no specific limitations. Nowadays, the largest media façade, 100 meters high, was designed as a curved façade having 33 floors – it is the building Tamer Tower, Podium in Dubai, and as soon as the construction works have been completed, by the end of 2011, the building itself will be visible from the distance of 1.5 kilometers. So far, the largest realized media façade is the one belonging to King Road Tower, Jaddah in Saudi Arabia (10 000 m<sup>2</sup>). Also, we should mention the size

<sup>6</sup> MIT/ Dennis Frenchman and Susane Seitinger, Media Lab Joint Faculty,-Student's Seminar : *Seul Digital Media City*, Development Institute 1/04, at [www.ocw.mit.edu/courses/urban studies](http://www.ocw.mit.edu/courses/urban studies)

and arch shape of the media canopy in Las Vegas in Frimon Street, which is 427 meters long.



**Fig. 5.** Podium , Dubai, unrealized , 2004 (www.displayled.com) **Fig. 6.** Frimon Street, Las (www.vegas.com/attractions1)

Media facades are usually designed to be two-dimensional – three-dimensional effect is possible in special cases only. A more common is the so-called „2.5 D" principle where media façade is not restricted to one surface only, but has been extended to spherical surface (Grand Lisboa, Makao) or "flows" along the edges of the structure (Galeria store-Seul). The images are created through a number of RGB LED lamps arranged in a specific layout and density in 2D format (fig. 7, 8.). Three-dimensionality is achieved by activating 3D software or three-dimensional arrangement of pixels.



**Fig. 7.** KPN Tower, Rotterdam, 2000. arch. Renco Piano -2D media façade (http:// arclighting.de)

**Fig. 8.** BIX Kunsthhaus - 2.5 D media facade (http:// arclighting.de)

As for the form of media façade, it can be:

- in plane ,
- curved in one,
- curved in both directions.

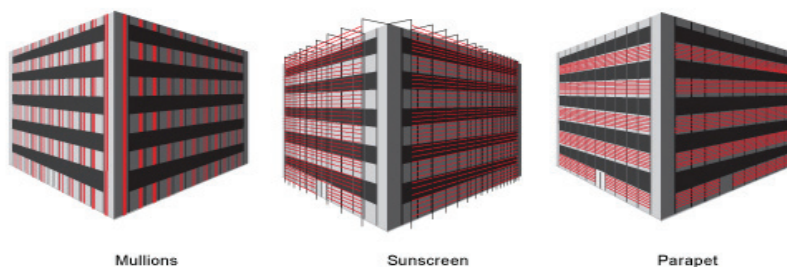
### 2.3. The level of integration media and façade elements

The level of integration is the key structural characteristic of media façade. Only in case of full integrity can we talk about media architecture in the true sense of the **word**. The display can also emphasize such correlation. When it comes to the integration level of the elements and façade media, there are two basic cases. The first one means subsequent addition of media elements to the previously designed and built structure, and the second one is parallel design and construction of media façade and structure as a unique architectural work.

The structure and display integration can be realized during the process of design and construction (Lisboa casino), but can also be achieved after the construction of the facility (Unique, Vienna).<sup>7</sup> Subsequently added displays, mostly rectangular forms, usually degrade and harm the quality of daily lighting in the facility (Time Square in New York).

Designers are focused on the level of media elements integration in façade composition in the process of designing. There are several characteristic levels:

- a complete lack of interest in integration of architectural structure and media elements. Display is completely independent, non-transparent layer positioned in front of the structure itself. It spoils other aspects of functioning – primarily visual comfort (Time Square in New York) and is not this researcher's subject of interest;
- setting the media elements in front of the façade in the form of steel mesh having the integrated LED lighting<sup>8</sup>, allowing the penetration of daylight as well as the view from inside out.
- a complete integration of media elements and façade. It is possible to integrate these elements in some of the existing structural elements (Fig. 9)



**Fig. 9.** Integrating media elements in façade elements: vertical bars, sun protection systems, parapets (www.mediafacade.net)

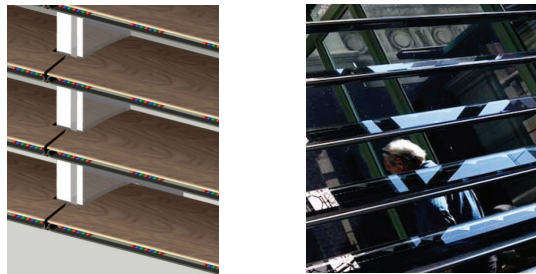
Many of the mentioned available media technologies include a total integration of media elements in the facade. As for a number of cases, it is a single facade, where the lighting elements are incorporated in materials for facade cladding (e.g. aluminium composite panels or honeycomb LED panels). In other cases, it is about the integration of

<sup>7</sup> according to Gernot Tscherteu, MEDIA FACADES FESTIVAL, at [http://www.mediaarchitecture.org/wp-content/uploads/2008/11/media\\_facades\\_exhibition\\_companion.pdf](http://www.mediaarchitecture.org/wp-content/uploads/2008/11/media_facades_exhibition_companion.pdf)

<sup>8</sup> see *Ilumesh*® i *Mediamesh*® and building T—Mobile

structural elements within facade: vertical or horizontal curtain-wall girders, sun protection systems (external and internal), parapet panels, EFTE polymers for facade construction and similar).<sup>9</sup> Finally, it should be pointed out that media facades are often designed and realized as double facades, where the media elements are incorporated in double facade space. In most cases, in order to operate, such facades use the technologies of illumination by the elements of lighting, which are placed in the space between two facades.

A special form of integration, according to this researcher, is the co-called **virtual integration**. This group includes media facades with projectors. Physical projectors are not included in the facade – it is either in front or behind, but the content is totally integrated with the facade itself. Namely, under certain conditions, it is possible for each structure to function as media facade, limited when the projector is turned on, with full form of the bond between physical and virtual domain, without specific dependencies.



**Fig. 10-11.** LED integrated in the sun protection system, made of wood and Solpix® elements meant for sun protection including integrated LED lighting and photovoltaic elements (www.solpix.com)

#### 2.4. Media facade durability

A rather delicate issue regarding media facade functioning is durability, including two aspects at least – the first one is durability of the offered contents on facade itself as well as the resulted values, which is not comprised by architecture, and the second one is related to the mode of operation. Media facades can be activated:

1. during nights and days – permanent character,
2. at night only – permanent character,
3. during special events only – temporary character.

What is also specific and interesting for architects is the façade of permanent character, which is activated at night only. Basic questions is whether or not the installation of media façade affects the operating quality and appearance of architectural structure when the system is turned off, whether or not it impairs its integral part. Taking the mentioned facts into consideration, we should strive for finding proper solutions that would not distort the looks of the building and its functioning.

<sup>9</sup> See <http://www.mediafacade.net/extern/loesungen/tragkonstruktion/> and the building Unique Tower in Vienna

Basic problems of media facade durability are related to the LED lightening lasting and potential risk of intrusion into control systems by hackers; yet, architects are not interested in analyzing such issues.

### 2.5. Media façade – lighting and visual comfort

There are a lot of significant points where media façade can interfere with other functions of the structure. As for the mentioned functions, it is necessary to meet specific parameters meant for allowing daylight into the building. Primarily, it is related to the quality of daylight into the building. Also, there are other problems in connection with increased electric energy costs for artificial lightning. Thus, one of the most demanding challenges for architects, while looking for optimal solutions without disturbing visual comfort in interior space, is media elements integration without daylight blocking.

Depending on the object function and mode of functioning (only during a day, or during night and day), characteristics of certain media façade system are to be considered. When it comes to daylight quality of media façade there are three basic cases:

- daylight quality is satisfactory, media façade is transparent,
- daylight quality is significantly reduced, media façade is semi-transparent,
- daylight in interior space does not exist at all, media façade is totally non-transparent

Apart from visual comfort and all the aspects related to structures, it is very important to enable users to have visual contact with outer space - an unobstructed inside-out view, i.e. **visual comfort**. The need to perceive interior space cannot affect visual comfort; still, from the psychological point of view, it is very important for proper users' dwelling and functioning. Thus, when it comes to certain media facades, the use of glass having controlled variable transparency is overlooked (e.g. glass with liquid crystals<sup>10</sup>). Such glass is opaque when media façade is turned on, for example at night.

When it comes to providing visual comfort of surrounding structures, another important issue is the way media façade affects its surroundings. The presence of light in media façades, primarily dynamism of functioning, is the factor that can exert psychological negative impact on surrounding structures' users. Since the brightness of daylight in the space depends on reflected components of the opposing structures, the level of brightness and usage of changing spectrum of colors, especially at night, is visible and conspicuous and thus disturb objective factors of visual comfort. Based on the analysis of significant number of parameters, it is obvious that media façade can be applied to certain urban spaces only. It is possible to create media façade in the central city areas, where business and trade represent dominant activities.

When it comes to the process of media facilities construction within already existing urban areas, in relation to providing neighboring facilities with visual comfort, it is necessary to have a designer paying special attention to placing media elements on new structures' facades. Namely, in case there is a structure whose comfort would be impaired by media façade functioning, the whole process of media façade design should be directed toward selecting some of the existing facades only – for example, the façade overlooking

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<sup>10</sup> See Privalite -glass®



the street or higher parts of the structure itself, so that it could be perceived properly regardless of great distance.



**Fig. 12.** Media façade during the day – transparent  
(www.ledmagazine.com)



**Fig. 13.** Media facade during the night – non-transparent  
(www.ledmagazine.com)

## 2.7. Media facades and regulations – the effect of temperature changes, wind power and fires

As for domestic practice, the architecture is facing with problems of standard. The field of media façade in architecture is dealing with German **DIN**, European **EN**, international **ISO** standards and other directives to some extent. Currently, in the EU there are no specific standards regulating the use of media façade and specific sphere of protection against fires and winds, but there are various regulations and standards that are applied within media façade sector, both EN and ISO, as well as local ones.

In accordance with Directive 2002/91/EC of the European Parliament (on December 16<sup>th</sup>, 2002, with obligatory coming into force on January 4<sup>th</sup> 2006) and Directive 2010/31/EU (May 19<sup>th</sup> 2010), basic energy performances of the building were defined. Apart from the general ones, specific requirements are to be taken into consideration as well, especially the ones in relation to curtain wall (in accordance with EN 13830).

The systems of media facades in Europe are tested in order to guarantee a certain level of resistance to weather conditions: temperature changes, freezing, IP protection<sup>11</sup> (IP 65, IP 65 and IP 67) as well as wind force strikes.

Each of the manufacturers is obliged to provide certificates of resistance of a particular system to external temperatures. As for the metal meshes that are commonly used with media facades, it is -20-50 (70)°C.

Wind power and load capacity of media façade is the issue analyzed by specific engineering and construction solutions to the substructure where a media façade system is to be attached. Manufacturers do not deal with this problem; structural engineers are those

<sup>11</sup> IP protection (*International Protection*) represents a prescribed standard defined in accordance with EN 60529 (approved by CEI organization) regarding protection degree against the entry of solid and liquid elements into the case of electrical and electronic devices. The first number defines the specific protection level against mechanical particles, and the second one against liquids.

who are supposed to check the load capacity of primary construction by applying specific calculation. As for the weight, it varies widely in media facades (7-12 kg/m<sup>2</sup> for media facades with steel meshes, 25 kg/m<sup>2</sup> for the facades with LED modules).

When it comes to fire protection, the international standard ISO 834-10 provides a precise diagram of temperature growth curve versus time for standard fire situations. Although the fire resistance classes are defined, the field of media facades, unfortunately, is not provided with specific regulations.

As for the media facades and fires, the national standards include rather large deficiencies, since they have not been worked on so far. The problem is particularly visible in case of glass facades on which common standards for façade walls are applied as well as provisions on mandatory suspension holes vertically, between two floors in the parapet zone, one meter high (Article 17. *Regulation on technical regulations on tall buildings protection against fire*). Nowadays, the problem is even more serious, considering the need to perform full glass facades and media facades that are designed in relation to the primary construction of the building.

When it comes to the usage of non-transparent media facades (e.g. with luminous elements), it is of significant importance to calculate the usage of non-combustible panels, used for separating the area of luminous elements from the interior of the building, as well as to install the equipment for timely detection of fire in the gaps of multi-layer media facade.

As for the transparent glass media facades, the ones with 60-minute fire-resistance have already been used in the EU (fireproof glass and aluminium profile façade construction with integrated fireproof materials), which can be considered as a solution for some of our future standards.

## 2.7. Energy and economic sustainability

Taking into consideration the media façade and ecology context issues as well as energy sustainability, two main categories meant for analyzing the possibilities of energy sustainability should be pointed out:

1. energy consumption during production of material and elements and environmental impact

2. energy consumption during facility operation

The main features of *green* sustainable media architecture are:

1. ecologically "awakened" development

- reduced use of materials, usage of renewable resources, "clean" technologies during production, installation and exploitation, the possibility of recycling

- safety and speed in production, transport and installation.

2. reduced energy consumption:

- during production, transport and installation

- during the exploitation of structures:

- actively, through photovoltaic cells in mediaarchitecture;

- passively, through avoiding daylight reduction, which requires additional artificial lightning;

- through proper integration of the system for façade illumination; it is possible to use it for the purpose of illuminating interior of the building

### 3. CONCLUSION

During the last two years we have been facing the process of creation a completely new architectural issue, caused by the influence of new technologies into all social spheres and architecture. The architects have shown great interest in media facades, since they represent the effects of changes going on in modern cities. Theorists' opinions regarding the position and necessity of mediaarchitecture today are totally conflicting. Some of them believe that it is all about fashion and trend, and thus, it is a very unnecessary and harmful phenomenon, while others think that media facades will eventually become a kind of new infrastructure system in cities. There are also some opinions supporting the intensive presence of mediaarchitecture in the cities of future, but, with the limited use in certain types of structures only. However, media facade design is accompanied by a number of specific issues that have been mentioned in the above presented work. Creating a proper framework for the process of media facade design represents a good platform aimed at qualitative connection, media and architecture integration, and other fields as well.

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## POSEBNI PROBLEMI PROJEKTOVANJA MEDIJA FASADA

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*Tokom poslednjih godina svedoci smo sve veće potrebe uključivanja arhitekata u procese medijalizacije savremenog grada. Transponovanje logike savremenih medija u arhitekturu mora imati kvalitetne odgovore u arhitektonskoj teoriji i praksi. Oblast medija fasada je interdisciplinarna i podrazumeva istraživanja ne samo u okviru arhitekture i urbanizma, već i granična polja ka nekim oblastima tehnologija, urbanog dizajna, umetnosti, kulture, medija i marketinga. Proces projektovanja medija fasada podrazumeva analizu nekoliko specifičnih projektanskih aspekata.*

Key words: *fasade, integrisanost, interdisciplinarno projektovanje medijaarhitektura.*