



A Critical Analysis of Lighting and Illumination of the Central District of Tehran
Uma Análise Crítica da Luz e Iluminação do Distrito Central de Teerã

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Abstract

This article tries to survey and criticize the quality of lighting and illumination in the central district of Tehran, by comparing it to standard codes. Findings report that the traffic lighting is standard, but illumination of sidewalks and pedestrian areas and cycle paths has many problems. Most of the important buildings of the district are not illuminated properly and lighting them according to their masses and architectural features is needed. In conclusion it has been resulted that there is a distinct need to a master plan for public lighting which, apart from defining general concepts, often put forward designs for specific urban districts and unifies light design in them.

Keywords: Illumination; Lighting; Urban space; Street

Resumo

Este artigo examina e critica a qualidade da luz e iluminação no Distrito Central de Teerã, comparando-o com códigos padrão. Verifica-se que a iluminação nas vias de tráfego é normal, porém a iluminação de calçadas, passagens de pedestres e ciclovias apresentam problemas diversos. A maioria dos principais edifícios do distrito não é iluminada adequadamente, ressaltando que iluminá-los de acordo com as suas massas e características arquitetônicas é necessário. Conclui-se, portanto, que há a necessidade distinta de um plano geral para a iluminação pública que, além de definir conceitos gerais, muitas vezes apresentam projetos para distritos urbanos específicos e unificam o seu *design* de luz.

Palavras-chave: Luz; Iluminação; Espaço urbano; ruas

1 Introduction

One of the factors of attraction and vividness of a city involves in the duration of activity in that city. A longer period of activity calls for proper illumination of the urban space after sunset. A proper light makes a city safe and attractive and allows progress of the urban functions. Lighting of cities is a subject that encompasses various aspects from economic and social to environmental and physiological ones. The present research aims at analyzing the lighting and illumination of streets and major elements of district 6 of Tehran on Kargar, Keshavarz, Vali-Asr and Fatemi streets, and criticizing of possible defects in this respect.

The research methodology has been based on a library-documentary research to collect information in the area of light standards followed by compilation of theoretical foundations of the work. Upon selection of a scope with a wide range of numerous and various operators, field survey, photography and observation have then been used for a case study.

2 Background

This subject is a rather new one in urban designing. As for the subject of light in urban spaces I should refer to a few English books which have been used as references in the present research plan from which the following article has been extracted. These books include "Light for Cities", authored by Ulrike Brandt and Christoph Geissmer-Brandt (2007) and "Light Zone City", authored by Christa Van Santen (2006).

Another reference is the book "A Development in Using Light: An architectural Recount", authored by Gardner & Moluni (2008). "Time Saver Standards for Landscape", authored by Charles Harris and printed in 2003, has been used as a reference in the standards and tables of the research. This book deals with standards of illumination of streets in wake of their width and functions.

We can also mention "Lighting Design Basics", by Mark Carlen and James Benya, translated to Farsi by Mahmoud Ahmadinejad, and "Fundamentals of Lighting Design in Urban Spaces", authored by Jahanshah Pakzad and Elham Souri, which both

were published in 2013. Although they had not yet been printed at the time of working on the present research plan in 2012, but are used in writing this article as references.

3 Definitions and Concepts

Lighting has a different meaning from illumination. Lighting is "a quantitative concept which deals with applied and standard illumination of a space and can be calculated and measured" (Gardner & Moluni, 2008) whereas illumination is "a qualitative and artistic design of light of a building or a space which depends more on formal and aesthetic aspects than standards and measures (ibid). However, good illumination always takes into account the qualitative and even sentimental aspects of the light quantities and always reduces and increases the illumination standards on the basis of social, cultural, functional, historical, natural, and urban and architectural backgrounds of a space in order to achieve a desirable and expected environmental quality (Okhovat, 2009). Moreover, a change in lighting of the places and spaces that we use, would not only alleviate the agitation of views at night but also lead the values from usual interests of emphatic lighting that is seen in many urban views toward health aspects of human being and calmness in night views and leave a positive impact on the style of the modern life (Aminzadeh, 2009). Different types of illumination can change the space for users and display its new dimensions.

3.1 Standards of Lighting of Various Urban Spaces

Urban lighting is a combination of lighting passages, buildings, advertisements, billboards, urban displaying monitors (urban televisions) and ceremonial lightings. It also helps to create conditions for continuing urban activities and functions at night and plays a significant role in establishing secure, calm and attractive urban environments. Adoption of a scientific and planned approach for lighting can improve quality of urban life, attractiveness, duration of activity and urban security. Nowadays, urban authorities of many important cities of the world use lighting consultants to implement numerous plans toward establishing communication between people,

light and urban environment while pursuing a social outlook toward urban lighting (Li *et al.*, 2005).

According to Paskovic (2012), there are five main objectives in the strategy for outdoor lighting:

- (i) to provide a safe and sound environment for people;
- (ii) to offer a safe path for automobiles, cyclists and pedestrians;
- (iii) to facilitate widespread use of parks, open spaces and sport facilities;
- (iv) to increase important elements and key points...to provide lighting opportunities;
- (v) to use a visual master plan to guarantee the harmony of all elements in a single unit.

In the meantime, we should notice that illumination does not imply a strong and coherent lighting. Utilization of this type of lighting would recall the very mistake committed a few decades ago for maintaining security and reducing crimes in the urban spaces. A world full of congruous and bright light and without darkness implies the death of space as definitely as absolute darkness does (Mahvash, 2004). In other words, mere illumination of urban space without correct lighting results a space without urban identity and life. A successful lighting in urban or architectural aspects would rely on an accurate understating of the subject of lighting. A correct perception of people and their needs is a requisite of any type of successful lighting. On the other hand, knowing the characteristics of materials and their levels as well as attention to the light which is reflected from them, is another principle of a successful lighting. Because what our eyes see in our surrounding and what our brain perceives, depends on the amount of light being reflected from different surfaces (Taghvaei *et al.*, 2013).

Lighting of the city pursues two major objectives: 1. Functional aspect: Provision of light to maintain security and safety and easy vision for the city dwellers; 2. Aesthetic aspect: Provision of light to create a peaceful, beautiful, happy and vivid environment to rejoice the dwellers. Lighting of various urban spaces depends on:

Lighting of urban routes: By routes we mean various accesses in the hierarchy of urban communication network. The routes include freeways, arterial streets, collectors and local accesses. Each of these routes has its own illumination design and particular lighting. The present research surveys the streets of the case study and proposes standard lighting for those streets.

Lighting of arterial streets: Among different routes of a city, the highest importance should be attached to the urban streets. Because they are “places full of various and numerous events where citizens come and go for varied reasons at different hours of the day” (Pakzad, 2006).

Night life of a city is based on the leisure time and widespread utilization of the urban space. Therefore “lighting of city streets predisposes the presence of citizens, pedestrians and strollers and helps thriving of the urban life” (Habibi *et al.*, 2009). Here pedestrians draw a particular attention. “Foot path and sidewalk are the actual places of the night life and events of a city. They are the actual places where collective memoirs and urban memory form. (ibid: 27). This is seen only in certain streets since provision of light is usually focused on driving lane while sidewalk is lit by the light of shop windows. This light is sometimes so strong that “may leave negative impact on the visual function of drivers. Dazzling resulted from excessive light sources... may be reduced by limiting the reflected light in horizontal and vertical angles...Proper lighting can bring about a suitable situation for night driving and ” (Licht, 2007).

Lighting of boulevards: In many cities certain central streets including boulevards symbolize the city attractiveness and have a strolling role in addition to other functions. Modern boulevards leading into the centers take on a representative function; they are a European invention of the 19th and 20th centuries (Brandt & Geissmer-Brandt, 2007). In nineteenth century in Paris “boulevard was a tree-planted and relatively wide route which was invented for the stroll and promenade of the well-to-do of Paris (Gideon, 1986). In fact boulevard is usually formed by a pedestrian route located in the middle of the width axis. A strip of green space and sometimes a water stream parallel and along the path support the pleasure aspect of the boulevard.

Therefore, “boulevard is actually a tree-planted route to which private cars gradually entered” (Pakzad & Souri, 2013).

Ulrich Brandi writes about the light of boulevards: “The width of boulevards facilitates separation of public light into three zones: Light for passing cars, light for passing pedestrians and light on the buildings. The separate function of each of these lights should not compete but complete each other. Light on the street too, exactly like the light on the sidewalks, only with a little more brilliance, warmth and intensity should still be homogeneous. The lamp-posts on the sidewalk of the boulevard should be 3 to 5 meters tall. The lamps that are predicted for boulevards are of special type with a fairly decorative shape” (Brandi & Geissmer-Brandi, 2007).

Lighting of foot paths and sidewalks: The illumination particularly planned for pedestrians is a rare issue and therefore foot paths and sidewalks are often lit by street lamps. The light focused on the path (5 to 7 lux) should be low and directly vertical toward the ground as much as possible so that it wouldn't bother the pedestrians (A. A. U. IES, 2011). The light which is reflected to the ground does not cause dazzling or dimming of vision. Indeed these types of lamps would require accessory equipment as compared with regular lamps with open angle installed on 3-4 meter posts (Paskovic, 2012).

Sidewalk lamps should distribute light sufficiently in order to illuminate the surrounding area. Distribution of vertical light from a proper height (Harris, 2003) and correct distance should cover the surface of the sidewalk to such an extent that there should be no dark patches so other pedestrians can be recognized easily. In place where feeling of security is an important issue for pedestrians, lower height of lamp posts and little distance between them is likely the best approach. In the meantime, pedestrians should have a proper vision of the moving traffic and the standard which is presently emphasized is that light should be sufficient enough for the people to recognize each other from a 4-meter distance. A key factor in this respect is to maintain security for pedestrians and cars (Van Santen, 2006). There are other points which can affect the proper designing of lighting in the urban routes such as:

- (i) Possibility of using a post with two lamps in different heights for routes separated for cars and pedestrians (Figure 1A);
- (ii) Shape of lamps should be in harmony with other existing urban furniture;
- (iii) When determining the intensity of light for the sidewalk of an urban street, the intensity of the light reflected from the window shops should be considered;
- (iv) The proper height for the lamp posts of arterial streets is 6 meters;
- (v) Light of the pedestrian bands and vehicle bands in boulevards should be provided separately;
- (vi) Illumination by the high lamp posts may be disturbed because of the shadow of trees particularly in boulevards therefore the height of the lamp posts in the sidewalk of boulevards should be between 3 and 5 meters (Figure 1B);
- (vii) In order to prevent light pollution and dazzling, floor lamps with upward light angle should not be installed (Figure 1C);
- (viii) The lamp posts of local streets and alleys should be more than 6 meters (Longcore & Rich, 2004).

Lighting of green spaces: Proper lighting of town parks has a great impact on vitality of urban spaces and facilitates social interactions. There must be a good view of the pathways and also of any cycle paths. The feeling of safety is also a factor. The transition from the well-lit street to the park must not be abrupt as far as light is concerned, but naturally tuned to the adaptation of the human eye.

In order to create a peaceful atmosphere, trees and bushes are often illuminated. In a park or a grassy area with trees and bushes, the choice of the right lamp is precise work. Deciduous trees need a different light source from conifers (Van Santen, 2006). When lighting green spaces, it is necessary to pay attention to the color and warmth of the light so that we would neither disturb the biological system of the trees nor hurt them (Longcore & Rich, 2004).

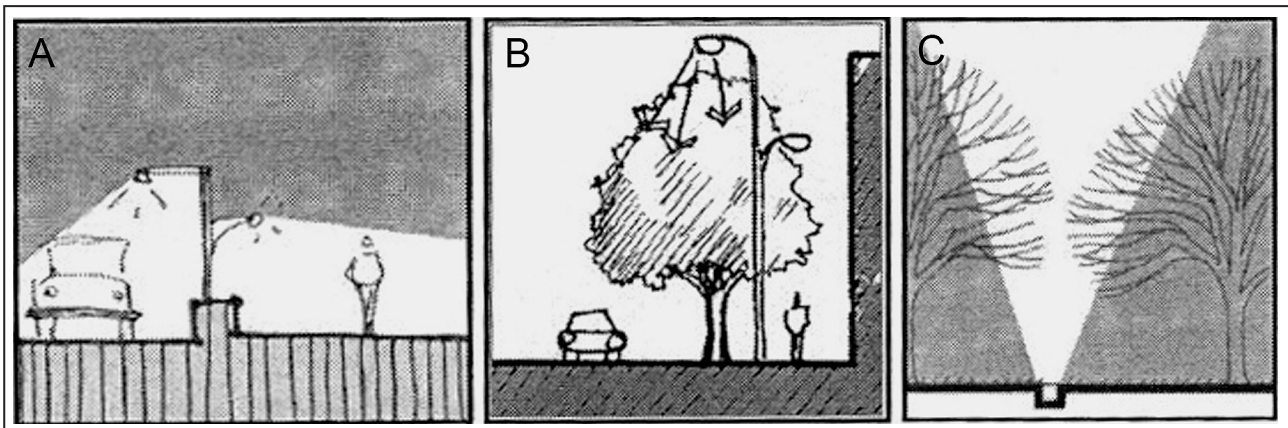


Figure 1 Time saver standards for landscape architecture. A. Possibility of using a post with two lamps in different heights for routes separated for cars and pedestrians; B. Illumination by the high lamp posts may be disturbed because of the shadow of trees particularly in boulevards therefore the height of the lamp posts in the sidewalk of boulevards should be between 3 and 5 meters; C. In order to prevent light pollution and dazzling, floor lamps with upward light angle should not be installed.

3.2 Standards of Lighting of Distinguished Buildings

In lighting distinguished buildings it should be noticed that in which angle the building is seen and that which façade of the building influences the viewer the most. A suitable combination of dark and bright parts displays the forms in the best possible shape. A detailed façade with many recessed and projecting sections sometimes result in strong shadows. To avoid this, the shadowy areas can be softened with additional direct light from another angle.

The amount of light and its distribution on a given building, is determined by the position of the lamps and the choice of the light source, and it is the most important factor in achieving the desired result. As far as the positioning is concerned, a combination can be made of the following options:

- (i) On the building;
- (ii) On the ground in front of the façade;
- (iii) On masts or poles;
- (iv) On buildings in the area (when this is unavoidable) (Van Santen, 2006).

At the same time, we can create a variation by changing the luminosity of the light (Brandt & Geissmer-Brandt, 2007). Issues which should be taken into account in lighting of distinguished buildings are highlighted as follows:

- (i) The points of a building that deserve attention, the characteristic features of the architecture, must be illuminated;
- (ii) The totality must be preserved: no distraction should be caused by the illumination of details;
- (iii) Three-dimensionality (this depends on the shadows; looking in the same direction as the beam of light results in an absence of shadows);
- (iv) Architecture is space and mass, so not only the façade should be illuminated, but the depth should also be accentuated;
- (v) If a building is sufficiently transparent during the daytime, then it should also be the same at night. A controlled amount of artificial light is necessary for this;
- (vi) In general, the lighting of buildings must be moderate, or the relationship with the environment is disturbed;
- (vii) Lighting up many details makes information unclear and impossible to “decode”.

If the use of different colored lights is overdone, the lighting effect itself becomes the aim, instead of accentuation of the architecture.

- (i) The addition of decorative patterns such as lines, spots or dashes is not appropriate in an architectural context;

(ii) If possible, light fittings need to be installed where they can't be seen; the operation of the light should never be distracting;

(iii) Construction materials are only shown to their best advantage when the light source optimizes their color (such as brick, concrete, wood, metal) through good color rendering; due to the texture and color of each material;

(iv) The illumination of white material offers a great deal of possibilities (Van Santen, 2006).

4 Case Study: Analysis of Lighting in District 6 of Tehran

Part of the district 6 of Tehran which is bounded between Kargar, Fatemi and Vali-Asr streets (between Vali-Asr square and Fatemi intersection) and Keshavarz Boulevard has been chosen as a place for the case study since it enjoys a variety of urban elements. Different aspects of urban lighting including the lighting type and pattern concerning the functional and social role of the streets, presence of cultural, religious and governmental buildings as well as Laleh Park and its impact on the urban environment are examined.

4.1 Illumination and Lighting of Kargar Street

The case study reviews Kargar Street between Keshavarz Boulevard and Fatemi Street which is categorized as an arterial street used by automobiles and pedestrians simultaneously. Because of the existence of a public park, two museums and a handicraft mall on the eastern wing of the street, its sidewalk is frequently used. But in spite of its relatively wide width, it is illuminated just by lampposts of driving band. This sidewalk which forms an excursion route from the park to the museums and the mall, needs a specific lighting.

Only the part of the sidewalk in front of the handicraft mall is lit with a few lamps with color lampshades installed over the fences every 5 meters whose light cannot illuminate the sidewalk.

According to the existing standards, the use of a single post and two lamps with different heights for simultaneous illumination of the street and

sidewalk can be a suitable option which would result in provision of proper illumination while occupying less space with more efficiency.

4.2 Illumination of Vali-Asr Street

This longest street of Tehran begins from Rah Ahan (railway) square and ends in Tajrish in Shemiranat covering a distance of 18.6 kilometers. The street has sidewalks, along with each a brook and some eleven thousand plane trees on both sides. Vali-Asr Street (the length surveyed in this research) is a traditional shopping quarter in Tehran and serves as a place for gathering, shopping and strolling of citizens with a strong social role. Therefore, sidewalk is no less important than the driving band and lighting should be designed for each of them. The driving band is lit by yellow lamps mounted on 8-meter posts with a distance of 40 meters from each other which is standard. Vali-Asr also has lamp posts for pedestrians in every 20 meters but the lamps are off at night. It is because the sidewalk is lit by the reflected light from the shop windows of the commercial retailers of the street.

In fact the design of the type and shape of the sidewalk lamps or their colors are completely suitable. However, the main problem is the strong and improper lighting of the shops and there is no regulation to limit these lights. The strong lights reflecting from the shops dazzle drivers so they have to be organized.

4.3 Illumination and Lighting of Hejab Street

Standard street lamps with a height of 6 meters and warm white color illuminate the Hejab Street, one of the streets surveyed in this study. The main point concerning Hejab Street is that lighting has been provided only for the driving band without any lamps for the sidewalks. The street lacks any commercial retailers, so there is practically no strong window shop light to provide light for the sidewalks like other streets.

Whereas the horizontal sections of the lamp posts proceed up to one third of the width of the driving band, little light is reflected to the sidewalks. The result is dark sidewalks which creates a feeling of insecurity for the passer-by in addition to the

empty street. Single lamp posts with two lamps in different heights are suggested to be used on either side for simultaneous lighting of the driving and pedestrians routes.

4.4 Illumination and Lighting of Fatemi Street

Commercial function is the dominant function of Fatemi Street between Vali-Asr Street to Fatemi square which is followed by administrative function on the rest of the street. As economic institutions, banks have also a significant presence. Lack of lamps for pedestrians from Fatemi square onward where commercial function replaces administrative one, is very tangible and its necessity is further felt particularly in front of the Water Organization site which is the site of the reservoirs buried in soil and lacks any evident administrative building that can be opened to the sidewalk. The scanty light of the sidewalk in front of the Water Organization comes from light projectors installed toward the Water Organization premises. Therefore, provision of lamps for pedestrians on this street is a need for achieving a minimum of standards. The lamps on the driving band of Fatemi Street are standard and installed in correct distances. Lighting of Fatemi square like other squares is provided by very tall projectors which have been installed around the middle isle of the square. However, due to the shape of the projectors the light pollution resulting from reflection of the light of projectors to the sky can be criticized. Standard lamps having suitable covers prevent the reflection of light to the sky and therefore prevent energy waste and light pollution simultaneously.

4.5 Lighting of Keshavarz Boulevard

A wide range of functions including recreational, administrative, residential and medical ones and also common commercial functions particularly near Vali-Asr square exist in this boulevard. There is a brook in the middle of Keshavarz Boulevard with the name of “Karaj Stream” that previously played an important role in supplying water to Tehran. On either side of the stream there is a strip of green space along with side walk and cycling route that give a recreational function to this boulevard.

Not only the light for the driving and pedestrian bands of Keshavarz Boulevard is supplied, attention has been paid to the illumination of the recreational strip of the middle of the boulevard. Last year this strip was lit by using lamps with color lampshades in two different heights (approximately 3 and 5 meters) as well as strip-lighting inside the tree branches and leaves. The upper lampshade was often hidden inside the tree branches and leaves, leaving dark spots on the route. Most of the light defects of the boulevard have been removed in the current year. The color lampshade which created shadow at the height of 5 meters has been eliminated and replaced by small twin projectors with white light.

The projectors have provided a consistent and safe light throughout the sidewalk and cycling route and the lower color lampshades have turned into decorative although unbeautiful forms. It is interesting that the lamps change their forms into two-pronged lamps with a classical forged design. As the “Beautifying Organization of Tehran Municipality” has removed illumination defects of this boulevard to some extent, it would be better to harmonize the form of the lamps, flooring and urban furniture of this route, too.

The sidewalks on the either side of the boulevard, excluding the edge of Laleh Park, lack lamps and the light of certain parts of the sidewalk (near Vali-Asr Square) comes from the shops. Replacement of the lamp posts with two-pronged ones (see text on Kargar Street) would provide light for the sidewalks particularly in the administrative, medical and residential parts. Another problem is the color lampshades of the middle foot path of the boulevard which lacks efficiency and beauty. If replacement of the lampshades is not possible, the red, green and blue colors of the shades should at least be changed into natural yellow.

4.6 Illumination of distinguished buildings

As it was mentioned earlier, the lighting of the distinguished buildings would need a qualitative and artistic design which depends on formal and aesthetic aspects. Here the manner of lighting of certain distinguished buildings of the district under the study is criticized.

4.6.1 Illumination of the Building of the Interior Ministry

The building of the Interior Ministry on Fatemi Street consists of geometrical figures which together display an interesting combination of protruding and recessed elements at different levels. However its illuminations neglected. The illumination which is used only on ceremonial occasions consists of green, white and red fluorescent lamps symbolizing the Iranian flag which has been installed along the window lintels in alternate forms. This method of illumination does not show the protruding and recessed elements of the building. It only shows those interesting geometrical forms flatly. Neither the generality of the building nor its depth, mass, and space resulting from architecture, has been taken into account in this type of illumination.

4.6.2 Illumination of the Noor Mosque

Noor Mosque which is located on the southwestern wing of Fatemi square with a brickwork façade and gem-like tiles somehow recalls the Razi-style in Iranian architecture. The illumination of the mosque emphasizes on major elements, namely minarets, the dome and portal. Walls are only lit by strong yellow and green downward light beams without any lighting design. The light sources are so strong that fine details of the brickwork and tiles and delicacy of vaults are not practically seen. The yellow lamps at the base of the minarets strongly flash upward which only create light pollution while eliminating fine shadows that display the elegance of vaults. The strong green light is also seen at the crown of the minarets and its reflection illuminates the dome, too. From top of the wall a projector, located at a distance from the wall whose choice is unclear, reflects a strong yellow light to part of the wall while shadow completely looms over the other part of the wall. The objective of lighting seems to be solely the random illumination of certain points without a thoughtful designing. None of the principles mentioned in the section of lighting of distinguished buildings, such as preserving totality of the building, geometrical figures of the building, architectural characteristics, three-dimensionality of the building and its decorative delicacies have been observed in this primitive lighting. The light beams of the illumination of this mosque can be seen in Figure 2.

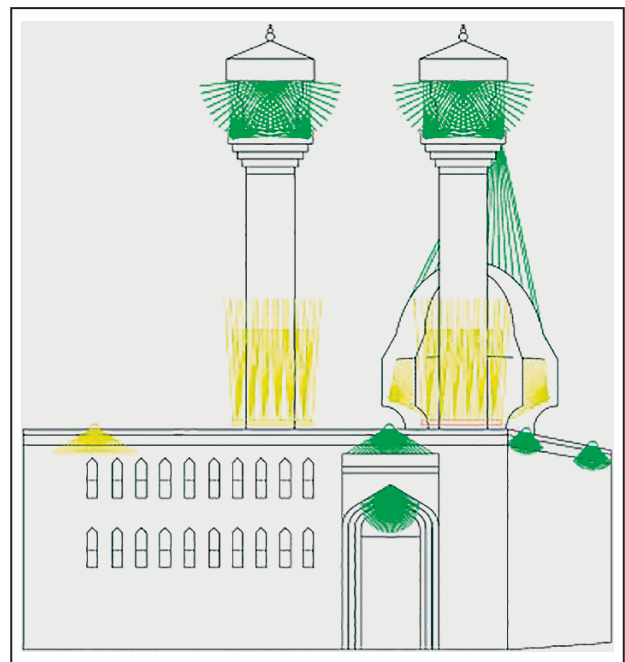


Figure 2 Illumination of Noor Mosque (tracing by Shokoufeh Sabbaghi).

4.6.3 Illumination of Laleh International Hotel

The modernist building of the Laleh Hotel on Fatemi Street has lintels along horizontal windows of the building. The façade of the building has a type of illumination in which these horizontal lines have been lit in three sections with green, violet and blue lights. The eastern façade is a plane wall without any window which is lit with a single purple light. In spite of application of colorful lights, the general identity of the building has been preserved and there is no light dazzling and intrusion. Figure 3 shows the illumination of the building. Despite its simplicity this method of illumination appears to be acceptable as compared with other buildings of the district. However, a principled illumination could give a better manifestation of the projected upper part of

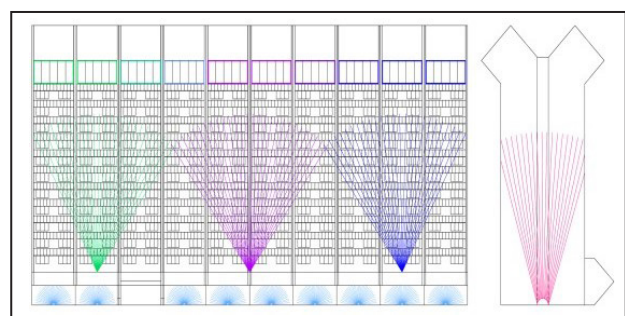


Figure 3 Illumination of Laleh Hotel (tracing by Shokoufeh Sabbaghi).

the building and could offer a general view of the modernist perspective of the building.

4.6.4 Illumination of Iran Carpet Museum

Iran Carpet Museum is located on north Kargar Street, at Fatemi intersection in the middle of a garden which somehow overshadows the building of the museum. The lighting has been provided with yellow lamp light behind the columns of the building. Whereas the position of the building of the museum retreats from the street ground line, the entrance too retreats from the sidewalk. The landscaping of the museum entrance despite its proper flooring, use of boxwood, designed small gardens and portal lights does not distinguish this important building during the night since only the portal has been illuminated. There is a need for designed illumination both for the entrance and the building itself.

4.6.5 Illumination of the Museum of Contemporary Arts

The architecture of this museum which is located on the western corner of the Laleh Park is a combination of traditional and modernist architecture and also is based on philosophical thought. The beautiful figures of the museum have been inspired by traditional Iranian windward which can be seen through its entrance at Kargar Street. The relatively suitable lighting of the museum entrance and figures of the building decorate the sidewalk, entrance and surrounding of the museum even beyond its working hours.

The Museum of Contemporary Arts has the best lighting as compared with other distinguished buildings of the district. However, the scanty light of the attractive sidewalk around the museum is supplied only by the reflection of the light around the building and the illumination issues of the eastern sidewalk of Kargar Street are applicable here, too.

4.6.6 Lighting of Laleh Park

Lighting of Laleh Park, except for the gates and the pool, is limited to the pathways. The height of the post lamps of the park are either short with shades glowing with cool mild white light or tall and multi-pronged with the same light. The two big pools of the park have attractive and vivid lighting.

Both entrances of the park have proper and sufficient lighting which characterizes the park. Using the principles mentioned in the “Standards of lighting of distinguished buildings” section, particular shrubs and trees of the park can be lighted in a way to be seen as a silhouette and create a different environment. More emphatic lighting of the park entrances and physical harmony between the form of the lamps of entrance and sidewalk is also recommended.

4.6.7 Illumination of the Building of Aria Hospital

Illumination of Aria Hospital is an example of improper illumination. The lights which have been used are strong violet and red that are only acceptable for ceremonial occasions and they are not principally recommended for permanent lighting. Illumination standards for distinguished buildings do not suggest these colors. The light sources are not installed so that they can display the overall volume of the building but they only illuminate selected parts of the building. Therefore the observer cannot perceive the overall mass of the building, architectural features and noticeable elements of the building because of the poor illumination.

4.6.8 Illumination of the Building of Agriculture Ministry

The Agriculture Ministry located on Keshavarz Boulevard, is a tall tower with a modern architecture and a translucent façade. None of the standards such as considering a strong light with a high intensity at the upper end of the building as compared with the lower end, transparency of the facade at night with a scanty local light from inside toward outside are observed and the lighting of the continuous and monotonous western wall is poor and improper. It is interesting to know that even during the Revolution Anniversary Celebrations (marking the triumph of the Islamic Revolution in Iran) when most important administrative buildings are illuminated with ceremonial and decorative lightings, this building remains completely dark.

5 Discussion

The findings of the present research show the weak points of the case study district. Illumination of the afore-mentioned streets on the driving part is

not much contradictory with the standards. However sidewalks of most of the streets lack suitable lamps and sufficient light. Some commercial retailers have installed lamps in front of their shops in order to attract attention, make distinction and provide illumination. This is particularly seen in the sidewalks of Fatemi Street. Relative darkness of the sidewalks of other streets is also perturbing. It is only in Vali-Asr Street that sidewalk lamps are installed in a harmonic manner which unfortunately do not need to be turned on due to the intensity of the light reflecting from commercial retailers' windows.

As mentioned for the middle path of Keshavarz Boulevard it should be noted that although most of the weak points of the foot path's lights have been removed over the previous year, problems such as disharmony of the form of lamps on a single path, use of colorful lampshades without sufficient light and disharmonic form of the lower and upper lamps on a single post still persist in this foot path.

The building of the Agriculture Ministry totally lacks lighting. Lighting of the Interior Ministry stands far away from the standards of the distinguished buildings while lighting design of a building with these protruding and recessed elements principally requires special delicacy which has not been complied. This is also true about the Noor Mosque on Fatemi Square and due to the incorrect lighting, totality of the mosque's architecture has been diminished and its consistency disrupted. Illumination of the Aria Hospital both due to the manner and place of installation of light resources, and the color of the lights cannot be approved. In illumination of the Carpet Museum and the Museum of Contemporary Arts, problems are not as serious as the afore-mentioned buildings. However there are some weak points which should be removed. Light at the Leleh Park is close to the standard level although beauties of the park may become more apparent and the setting may become more attractive with a more accurate light designing.

6 Conclusion

Upon providing the basic definitions the present article tried to explain the standards of lighting and illumination of streets, boulevards, foot paths, sidewalks, cycling routes and green spaces.

The correct method of illumination of distinguished urban buildings in general and irrespective of their functions was also expressed. In the case study of the central district of Tehran the lighting of the important and busy streets such as Vali-Asr, Fatemi, Hejab, Kargar as well as Keshavarz Boulevard was examined and their weak points were mentioned. Also the method of illumination of certain distinguished buildings of the district was criticized against the principles and criteria of illumination of such buildings. The above-mentioned distinguished buildings had a wide range of functions. Two ministries, two museums, a mosque and a hospital were among such buildings whose illumination was compared with the standard lighting. The method of lighting of the Laleh Park was also compared with the criteria and standards.

There was not much discrepancy in lighting and illumination of some cases among which it can be mentioned: Lighting of driving bands and sidewalks of Vali-Asr Street, illumination of the middle foot path of Keshavarz Boulevard and illumination of the Laleh Park. The sidewalks of other streets were scantily lighted and in some cases dark. This would cause insecurity in pedestrians and disrupt utilization of the sidewalk where there is a possibility of strolling due to the adjacent functions (like the eastern sidewalk of Kargar Street). There are many cases of inconformity between the illumination of the distinguished buildings of the district and those principles and criteria of lighting which was discussed in details in the previous sections.

We conclude that the reason for the serious disharmony which is seen in a limited central district of a city, relates to the lack of a light master plan which not only sets regulations and criteria for each and every urban element but also helps to harmonize and integrate the illumination and lighting of diverse elements of urban environment. Regulations complied based on this design would gradually eliminate the discrepancies and fortify the standards.

Meantime, the process of trial and error which involves expenses and time and can practically be seen in the process of illumination of the middle foot path of Keshavarz Boulevard, can be avoided. Preparation and implementation of a light master plan for Tehran is a need pointed out by experts for many years. Such a plan would not only remove the

existing weak points but also lead to a necessary unification in lighting of the distinct urban elements resulting in a more beautiful, more efficient and more consistent city.

7 References

- A.A.U. IES, 2011. *Standard for the design of high-performance buildings*. Atlanta, ASHRAE and U.S. Green building council.
- Aminzadeh, B. 2009. Urban lighting and its role in designing Sanative landscapes. *In: INTERNATIONAL CONFERENCE OF URBAN LIGHTING, 1, Proceedings*, Tehran, p.78-88.
- Brandi, U. & Geissmer-Brandi, C. 2007. *Light for cities, Lighting design for urban spaces*. Berlin, Birkhauser, 168 p.
- Carlen, M. & Benya, J. 2004. *Lighting design basics*. Indianapolis, Wiley & Sons, 256 p.
- Gardner, C. & Moluni, R. 2008. *A development in using light, architectural recount*. Tehran, Danesh Parvar Publications, 31 p.
- Gideon, Z. 1986. *Space, time, architecture*. Tehran, Elmi-Farhangi Publications, 545 p.
- Habibi, S. M.; Habibi, R.S. & Javadi, R. 2009. Urban lighting and considerations of urban planning, *In: INTERNATIONAL CONFERENCE OF URBAN LIGHTING, 1, Proceedings*, Tehran.
- Harris, C. & Dines, N. 2003. *Time saver standards for landscape architecture*. New York, McGraw-Hill, 134 p.
- Li, Q.; Yang, G.; Yu, L. & Zhang, H. 2005. A survey of the luminance distribution in the nocturnal environment in Shanghai urban areas and the control of luminance of floodlit buildings. *Lighting Research and Technology*, 38(3): 185-189.
- Licht, D. 2007. *Lighting for safety on roads, paths and squares*. Frankfurt, Fordegermanschaft, 44 p.
- Longcore, T. & Rich, C. 2004. Ecological light pollution. *Frontiers in Ecology and the Environment*, 2(4): 191-198.
- Mahvash, M. 2004. Architectural space, technology, light. *Architecture and Urbanism Memari-va-shahrsazi*, 74: 27-38.
- Okhovat, A. 2009. Comprehensive plan for lighting of the city of Shiraz; methods, approaches, opinions. *In: INTERNATIONAL CONFERENCE OF URBAN LIGHTING, 1, Proceedings*, Tehran.
- Pakzad, J. 2006. *Manual of designing urban spaces in Iran*. Tehran, Payam Sima Publication and Planning Company, 132 p.
- Pakzad, J. & Souri, E. 2013. *Manual of lighting of urban places*. Tehran, Armanshahr Publications, 106 p.
- Paskovic, A. 2012. *Urban lighting: Planning for public spaces in Vancouver's Southeast False Creek*. Washington, DC: Island Press, 79 p.
- Taghvaei, M. ; Varesi, H. & Darki, A. 2013. *Urban lighting, opening a window to human imaginations*. Tehran, Tehran University Press, 500 p.
- Van Santen, C. 2006. *Light planning in the urban context*. Berlin, Birkhauser, 127 p.