

Lighting Design Approaches for the Heritage Conservation of Thai Stupas

Phanchalath Suriyothin

Chulalongkorn University, Thailand

E-mail: sphancha@chula.ac.th

ABSTRACT

Decorative lighting design is one factor enhancing night scenery. The Buddhist stupa is an outstanding cultural heritage example due to its physical form. It is also one of the important elements of the urban landscape in Thailand. This study is aimed at classifying architectural components of stupas through their visual characteristics. It also will analyze the sites and surroundings in Bangkok to find an approach to lighting design that emphasizes stupas' shapes via light, shade, shadow and gradation of light. This paper argues that modern lighting contributes to the conservation of Buddhist heritage in Thailand by emphasizing the central role of the stupa in the night skyline.

Keywords: *Lighting Design Approaches, Thai Stupa, Exterior Lighting, Decorative Lighting Design, Heritage Conservation*

INTRODUCTION

A stupa is a mound-like or semi-hemispherical structure containing Buddhist relics, typically the ash of Buddhist monks, used by Buddhists as a place of meditation.¹ It is an architecture that is outstanding due to its physical forms. As it is the highest structure in most of temples, it draws the attention of people during the day, but often disappears into the dark, night sky. Moreover, it is one of the important elements of urban landscape. Therefore, stupas are important to Buddhist heritage in terms of symbolizing the meaning, thought and spirit.

Stupas are found in most temples all over Thailand.

Their physical characteristics may be varied in each locality across the country according to cultural context, environment and surrounding areas. It is found that there are 272 royal temples in Thailand and 85, or one third of the temples, are located in Bangkok. Some of stupas in these temples are lit at night which not only enhances the beauty of night scenery but also contributes to the safety of people. Moreover, it is a linkage to surrounding communities. Currently stupa images are also part of cities' promotions for tourism as both day and night scenes are used on billboards and brochures. One of a classic example is the temple of dawn, one of the royal temples, on a bank of the Chao Phraya River in Bangkok. (figure 1)

¹ "Stupa" <http://en.wikipedia.org/wiki/Stupa>.



Figure 1:
Pictures of the Temple of Dawn both at dawn and at night time.

A preliminary survey showed that there are 15 royal temples which have their stupas lit at night. Most of these stupas are illuminated using a floodlighting technique via high pressure sodium lamps or metal halide lamps in a simple manner, often in conflict and not sensitive to the architecture of the stupa.

There are not many studies concerning lighting designs for religious buildings, especially stupas. In this study, lighting design recommendations related to stupas' physical appearance, their surrounding areas, lighting design techniques, and related topics were reviewed. Thus, the research leads to further recommendations for approaching lighting designs for Thai stupas in Rattanakosin Period.

Light, shade and gradient of light are important factors that reveal the shape and form of objects according to the direction of light. Various lighting techniques can be employed to articulate stupas' characteristics. The site and the surrounding areas of stupas and the observer's view are also factors that impact the installation of lighting equipment.

Stupas are an essential part of Thai cultural heritage. Therefore, this study aims to classify visual characteristics of architectural components and analyze the site and surrounding areas of stupas in Bangkok. It will also explore an approach to lighting design for stupas at night to emphasize their physical shapes and forms via light, shade, shadow and gradation of light in different contexts, bearing in mind heritage conservation.

STUPAS (PHRA CHEDI)

The Wat or monastery refers to a group of religious buildings that are generally enclosed by a wall with gateways. From an artistic point of view, the principal religious buildings in Thailand are: the Phra Chedi, the Bot and Vihara, the Mondop and Prasat.²

The stupa is known in Siamese as Chedi or Phra Chedi. In Thailand Phra Chedi means a sacred monument or a reliquary. In one wat there may be only one chedi of a fairly large size or there may be several of them of varying sizes and decorative schemes.³

The most common use of a stupa is as a place for sacred relics and as a focus for the devotions of a Buddhist community. Walking with lighted candles clockwise round the Phra Chedi or the Bot is considered an act of merit. Thai Buddhists always perform this ritual on special Buddhist holy days during full-moon nights such as Wisakhabucha day.

A classic example of this event that can describe how important the stupa and Thai heritage are, is a holy night at Assadan Nimit temple on Sichang Island, Chonburi. The temple is situated on top of a hill. It was built in the reign of King Rama V in Rattanakosin period. On Wisakhabucha night, all the local people walk from their homes to the temple to pay respect to the Buddha. They walk with lighted candles clockwise round the stupa every year. The stupa that was built on top of a Western domed church. It is

² Jermsaeatdi, P. Thai Art with Indian Influences. P. 71

³ Ibid. p. 72

not only lit by floodlight but it is also decorated with handmade lighting fixtures designed by local people. The stupa became a center of their thoughts and soul. One can say that this event is both a tangible and an intangible heritage. (figure 2)

Forms of Stupa (Phra Chedi) in Ratanakosin Period

The overall image of stupas in Ratanakosin Period is taller and more slender shaped than the former period. The stupas can be categorized into three types, the Round shaped stupa, the Phra Prang shaped stupa, and the Indented shaped stupa. Each type of stupa has its own characteristics that can be recognized as follows:

The Round shaped stupa or Chedi Klom is derived from the Sri Lanka shape stupa. Its shape which can be divided into 3 main levels; a base the Malai Thao, a middle section that contains the chamber holding relics the Rakhang, and a top level comprising a tapering spire or circular tiers and its platform the Plongchanai, Saohan, and Banlang respectively. Some of Round stupas have a niche, the Sum Choranam, used as a gateway for a staircase to the interior of the Chedi. Above the spire is a lotus bud, Pli Yod. At the culminating point of upper Pli

Yod is another round ball, called the dewdrop, Yad Namkhang, otherwise it can be the Chat or Lukkao.

The Prang shaped stupa or Phra Prang originated from the tower of the Khmer temples. The Phra Prang is square, similar to an Indented shaped stupa. Its base is very high, more than one third of its total height. It rises elegantly from its large base to an elliptical shape with a very fine outline. It has three niches and one entrance door reached by means of a very steep staircase. The interior contains images of the Buddha.⁴ The distinctive elements of Phra Prang are a relic chamber or Rueanthat, two upper tiers named the Chan Klip Khanun, and a finial in the form of Indra's thunderbolt the Nophasun. The Phra Prang has been designed following the Traiphum belief so that one finds a molded lime relief of guardian figures or giants decorating the base of tiers.

The Indented shaped stupa or Chedi Yomum has similar elements as the Round shaped stupa but it has a square base. However, the scale of its Rakhang is smaller than the Round shaped Rakhang due to the transformation from a round shape to a redent shape with or without an indented angle. More indented angles make the form of the Chedi look more like an octagon shape. Furthermore, the element positioned on the circular tiers, Plongchanai, is called lotus-clusters or Bua Klum because its shape is similar to lotus flowers.⁵



Figure 2:
Assadang Nimit Temple on a Wisakhabucha night

⁴ Ibid. P. 74

⁵ Leksukhum S.

Elements of Stupa

From the forms of Thai stupa or Phra Chedi in the Ratanakosin Period, the Pra Chedi consists of three main levels, 1) the base or the plinth (Than) 2) the body where relics are held (Ruean) and 3) the spire (Yod).

This study only focuses on the part of the base attached to the body of the stupa through to the spire. The terrace of the stupa for walking around and the lower part of the base is excluded because those parts of the base may have different functions and various heights effecting the perception of the viewers to the stupa.

The function of Than is to support the other components. In various plans the Than of a stupa may be different in shape; circular, square or octagonal. Different Thans may have different styles and named differently such as Than Pat or Than Bua, Than Sigha, and Than Phaiti,

The elements in the level of Ruen are 1) Malai Thao 2) Rakhang Chedi Klom 3) Rakhang Chedi Yomum 4) Rueanthat and 5) Sum Choranam.

The elements in the level of Yod are 1) Nopphasun 2) Chat 3) Lukkaeo 4) Yad Namkhang 5) Pli Yod 6) Buaklum 7) Saohan 8) Chan Klip Khanun 9) Plongchanai 10) Banlang Chedi Klom and 11) Banlang Chedi Yomum. (figure 3)

Site and surrounding areas of stupa

There are three types of stupas which are characterized by location in the temple. The main stupa or Chedi Prathan, is the largest stupa in the temple and is placed in the prime location, usually in the center of the other stupas. The second type, the Chedi Pracham Mum, are the stupas located in the corners and the stupas located in each direction, Chedi Pracham Tit. These stupas are smaller than the main stupa. The third type is the smallest stupas located throughout a temple. The architectural characteristics of these types of stupas do not have any relationship to their location.

The height of stupas, in the cases studied, range from 8-94 meters. The stupas which are higher than their surrounding environment can be seen easily from the main route such as roads and rivers.

It is found that the higher the stupa, the more elements that can be seen from anywhere around the temple. Stupas that are close to the main route can be seen clearer than the ones located inside the temples. Open-spaces in front of stupas can help their being seen more clearly. The farther the distance of open-space, the more elements can be seen in the visual field.

In the urban context, especially in old towns, buildings are usually not higher than the stupa so that the main view of that stupa is at normal eye level. If the stupa is located in the central business district area (CBD) where there are many high-rise buildings, it can be seen both at a normal eye level and a bird's eye view from those high-rise buildings.

Chedi Phukao Thong is an example of a stupa that was built on a steep artificial hill inside the Wat Saket compound in the old town of Bangkok. The locals called it phu khao as if it is a manmade-mountain. The stupa was built during the reign of King Rama IV in the Ratanakosin period. A relic of the Buddha was brought from India and placed in the stupa. An annual festival is held at Wat Saket every November, featuring a candlelight procession up to Phu Khao Thong to the stupa. Phu Khao Thong is a popular tourist attraction and has become one of the symbols of the city. (figure 4)

DESIGN ELEMENTS

The fundamental design and the geometric forms created with light, and shade and shadow were studied. This was done to analyze which design elements of a stupa could be appropriately lit by various lighting techniques.

Fundamental design elements

As conceptual elements, the point, line, plane, and volume are not visible except to the mind's eye. While they do not actually exist, we nevertheless feel their presence. One can sense a point at the meeting of two lines, a line marking the contour of a plane, a plane enclosing a volume, and the volume of an object that occupies space.

When made visible to the eye on paper or in three-dimensional space, these elements become form with characteristics of material, shape, size, color, and texture. As one experiences these forms in our

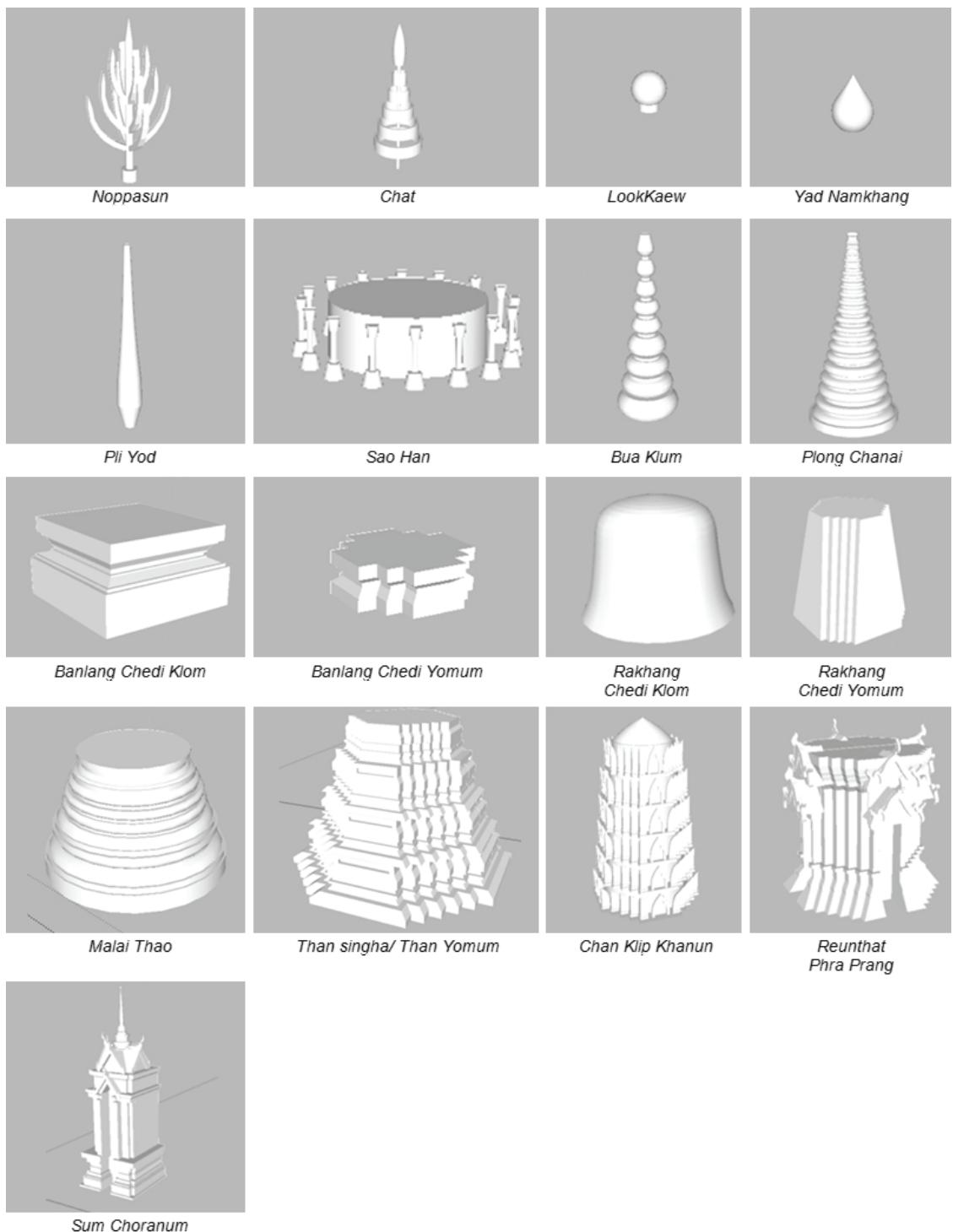


Figure 3:
3D of stupas' elements
by Thanadech Thomprasert



Figure 4:
Illuminated stupa on the Golden Mountain on the left side of the picture
 environment, one should be able to perceive in their structure the presence of the primary elements of point, line, plane, and volume.

A point has no direction. To visibly mark a position in space or on the ground plane, a point must be projected vertically into a linear form as a column, obelisk, or tower, or in this case, the top elements of stupa such as Lukkaeo, and Yad Namkhang. Though the shape of these elements is different, in relation to stupa, their size is as small as a point from a distance.

A point extended becomes a line. Conceptually, a line has length, but no width or depth. Whereas a point is by nature static, a line describing the path of a point in motion is capable of visually expressing direction, movement, and growth.

Any such columnar element is seen in plans and therefore retains the visual characteristics of a point such as Pli Yod, a slender tapering spire. One can also perceive Pli Yod as a line from a distance. However, one can also see the plinth of Phra Chedi or Than with many superimposed tiers as many lines on top of each other when viewed frontally, while Saohan, columns surrounding on top of Banlang can be perceived as a group of small vertical lines from a distance.

A line extended in a direction other than its intrinsic direction becomes a plane. Conceptually, a plane

has length and width, but no depth.

Shape is the primary identifying characteristic of a plane. It is determined by the contour of the line forming the edges of a plane. Because one's perception of shape can be distorted by perspective foreshortening, one sees the true shape of a plane only when viewing it frontally. One can perceive elements of a stupa in different shapes such as Chedi Klom as a round, half circular shape, Chedi Yomum as a tapering top-cut triangular shape.

In the composition of a visual construction, a plane serves to define the limits or boundaries of a volume, if architecture as a visual art deals specifically with the formation of three-dimensional volumes of mass and space, then the plane should be regarded as a key element in the vocabulary of architectural design.⁶

The primary shapes can be extended or rotated to generate volumetric forms or solids which are distinct, regular, and easily recognizable. Circles generate spheres and cylinders; triangles generate cones and pyramids; squares generate cubes. In this context, the term solid does not refer to firmness of substance but rather to a three-dimensional geometric body or figure.⁷ One can perceive elements of a stupa in different forms such as Chedi Klom as a half sphere, Chedi Yomum as a tapering pyramid, the top part of Pra Prang as a bullet, Banlung as a cube, and Bua Klum and Plong Chanai as a cone.

The supplementary properties of a plane, its surface color, pattern, and texture, affect its visual weight, and stability.

The finishing materials of stupas may be different depending upon the design. However, maintenance is one of the criteria for the decision making so that most stupas' materials are easy to clean such as marble, granite, ceramic tiles, and mosaic tiles, painted white or painted gold.

Geometric forms created with light

Light is not perceptible without form—even the

⁵ Leksukhum S.

⁶ Ching, F. D. K. Architecture: Form, Space, and Order. New Jersey, 2007. P.3

transparent form of swirling smoke-to reflect it. Conversely, form is not perceptible without light. One relies on light to provide the majority of our information about one's surroundings. Light is an architectural material, but an intangible one.

The light that renders form visible is always changing. The nature of day light is change, both qualitative and quantitative change. The nature of typical electric light is constant, but electric lighting sources are turned on and off with regularity, and can be dimmed. Form remains constant; light changes. Forms are perceived as stable, however, due to perceptual processes.⁸

Le Corbusier said that, "... cubes, cones, spheres, cylinders or pyramids are the great primary forms that light reveals to advantage; the image of these is distinct and tangible within us and without ambiguity. It is for this reason that there are beautiful forms, the most beautiful forms."⁹

As for stupas, Chedi Klom can be illuminated to identify its curved form with gradient light. Prang shaped stupas can be illuminated to display the indented shape and form on each side. Indented shaped stupas, similar to a Prang shaped stupa, can be illuminated to display the indented shape and form.

The perception of shade and shadow

The visual elements of appearance include line, outline, plane, volume or mass, light and shade, colour and texture. These elements in combination create a visual composition and they are seen by the eye because they are received as values of light. A change in the directional or colour values of lighting may alter the values of light reflected from an object, and there will then be a change in its appearance.¹⁰

Shadows occur through the interaction of light and opaque objects. Visual systems define objects

and their location in relation to their surroundings. Shadow can give two-dimensional objects three-dimensional quality. In the majority of cases an object is disposed through a combination of self-shadow and cast shadow. A self-shadow provides information about the object itself, whereas a cast shadow indicates how far the object is away from the viewer and the object's relationship to other objects in the space.¹¹

A pilot study on the correlation of lighting and the architectural elements of stupas was done along with other related research. Case studies of existing stupas' lighting designs were also reviewed.

Lighting pattern, shade and shadow can be designed by controlling the direction of light. In the case studies of 30 stupas, it was found that the stupas were lit to reveal superimpose tiers from the bottom to the top so that horizontal lines of light and shadow were alternately perceived.

Moreover, the distance of the luminaries is another factor affecting the power of shadow. A pilot study shows that light which grazes a surface has the power to render a material's textures and patterns through high contrast. Such an effect can be used to enhance the visual reading of a material or surface. A brick or rough texture wall grazed with up-lighting will appear complex, dramatic, and tactile. The same wall illuminated with diffused, direct light will appear flat and even, its corners and cracks virtually erased.

EXTERIOR LIGHTING

Exterior lighting serves many purposes and can communicate prestige, safety, symbolism, and recognition. Whatever the application, distinctive and well designed lighting is one of the best ways to draw the attention and make a favorable impression on the viewer. When properly applied, light can help enhance the intrinsic charm, beauty, and utility of any setting. With the loss of natural light at night, often the identity of a building is destroyed. Proper

⁸ Millet, M. Light Revealing Architecture.

⁹ Ching, F.D.K. Architecture: Form, Space, and Order. New Jersey, 2007. P. 42

¹⁰ Williams, R. G. Lighting form.

¹¹ "The Perception of Shadow". Professional Lighting Design. Oct/Nov 2008.

lighting can strengthen or subdue major elements of a building or a group of buildings. Well planned nighttime lighting can make an important contribution to the success of any urban planning project.¹²

Exterior lighting design and criteria

The daylight appearance of an exterior will help in understanding what should be or should not be emphasized at night.

A careful analysis of the building, its surrounding areas and its social implications is essential before decisions are made as to how lighting should be approached. This is not to suggest that the nighttime view should imitate the appearance of the building during the day, but rather the inverse. In analyzing what is most appropriate, the significant features of the building should be emphasized.

The view of the building, whether from close up or at a distance, must be studied, because the available viewing angles have a direct influence on the possible and desirable location of equipment. When assessing its visual accessibility, the problem of glare and the location of equipment are often determinants in the design, as to what can and should be achieved.¹³

It is important to emphasize the three-dimensional quality of the building. Early floodlighting techniques relied on throwing the maximum amount of light towards the façade of a building from a frontal direction, reducing the natural modeling associated with daylight. The nighttime appearance was flattened and resembled a cardboard cut-out. The lesson learned is to initiate a more subtle approach, emphasizing a building's form. This can be achieved with less light from fewer light sources placed at an angle to the façade, to create shadows, which increase modeling.

Access to luminaries is important. In urban environments if luminaries are too easily to accessible, the chances for vandalism can be increased. If they are not easily accessible, then maintenance standards may be compromised. The long-life lamp type is also needed to be considered.

Exterior-quality equipment needs to be made to a higher standard than interior ones, to withstand extremes of weather, and ingress of water.

What the luminaries will look like during the day should be kept in mind. Too large and unpleasant designed light fixtures may work well in the dark environment, but create a visual imperfection during the day. In-ground luminaries may be one solution. They are also invisible during the day and less tempting to vandals.

Glare should always be avoided. If it is impossible to place light sources in situations where this cannot be done then they should be omitted. Glare raises the adaptation level of those viewing the building to a point where it is no longer possible to enjoy the nightscape.¹⁴

Guidelines for light pollution were also reviewed. If the brightness of the environment is low, the risk of producing disturbing obtrusive light is high, consequently the luminance and intensity limits are stricter. In brighter surroundings, the risks are lower, because the contrasts between any possible obtrusive lighting and the bright surroundings are smaller, so the limits are therefore less strict. Four different categories or zones of lighting environments are defined as E1 to E4 and given in Table 1. Stricter limits are given for the lower E zones.¹⁵

A review from "City Marketing with Light" indicates that if the object illuminated is located in a semi bright surroundings, the average luminance of stupa should range between 10-13 cd/m². While in

¹² Lighting Techniques. www.bethlehem-pa.gov/feature/highlightSouthEast...

¹³ Phillips, D. Lighting Historic Buildings. Oxford: Architectural Press, 1997.

¹⁴ Phillips, D., Lighting Historic Buildings.

¹⁵ Bommel, W. V. City Beautification and Emotion.

Table 1: Lighting Environmental Zones

Zone	Surrounding	Lighting Environment	Examples
E1	Natural	Intrinsically dark	Natural parks or protected sites
E2	Rural	Low district brightness	Industrial or residential rural areas
E3	Suburban	Medium district brightness	Industrial or residential suburbs
E4	Urban	High district brightness	Town centres and commercial areas

bright surroundings, the average luminance of stupa should range between 13-16 cd/m² whereas the CIE allows an average luminance on the building surface in the medium to high ambient brightness in urban residential areas (E3-E4) around 10-25 cd/m².¹⁶

The luminance and the impact of the illuminated building or monument are significantly influenced by the degree of reflection, which decreases through the effect of pollution. However, if the effect of pollution is reduced, then the darker and rougher characteristics of the original material are highlighted. Accordingly, the luminance must be adjusted in order to achieve the same luminance and/or the same perceptive impression.

Furthermore, IESNA guides indicate that the luminance ratio of the building illuminated and its surroundings should be less than 20:1. An exception is made for building located in commercial areas or where night activities take place then the luminance ratio will be higher. Buildings in the areas with intrinsically dark landscapes allow the brightness ratio to be less than 20:1.¹⁷ These figures may be applied to stupas in Bangkok.

Over-illumination and light pollution are growing problems. They not only create ecological problems but also waste energy. Keeping luminance contrast in a ratio as specified guideline would help reduce these problems. (figure 5)

Exterior lighting for historic building and heritage conservation

Historic buildings and monuments should be lit in a

manner that indicates their specific character, age and if it can be expressed practically, the historic significance.

The size of the building or the monument along with its setting will often dictate an approach involving lighting from the ground or highlighting from concealed luminaires mounted on the structure. A combination of the two approaches can have a stunning effect. Concealed highlighting should be used to pick out arches, reveal statues and other architectural features and used as a fill light to unite the highlight areas. Careful consideration should be given to the background in deciding luminance levels; often a small amount of light is needed to create an effect.

Floodlighting schemes for ancient stupas are similar, in general, to those for historic buildings. Account should be taken of the effects of erosion. If surfaces have been destroyed, or partly destroyed, the lighting should be designed to achieve an effect without indicating an apparent cause.

The splendor and magnificence of a stupa can be revealed to the full by close and continuous co-operation between the project architect, the lighting designer or engineer and, where appropriate, the archaeologist, whose chief concern is the preservation of the ancient stupa.

It may be that the lights only needs to be on for part of the night, or for some days of the week. The time when the lights are on can be restricted to those hours when there will be an audience to see it. Lighting stupas only when necessary reduces energy use, reduces maintenance costs of the equipment and reduces the overall impact on the stupa's fabric.

¹⁶ Licht.wissen 16. City Marketing with Light.

¹⁷ Rea, M.S., editor. The IESNA lighting handbook: Reference & application. 9th ed. New York, 2000.



Figure 5-1



Figure 5-2

Figure 5:

Figure 5-1 It is not an over-exposure photograph but over-illuminated object compared to figure 5-2

Lighting equipment should not be attached to the fabric of the building unless special permission has been given; cable routes must avoid archaeological remains.¹⁸

In general, the size, weight and style of luminaries should be considered in relation to the building, whether they are located in front or mounted on the structure. The fixture should be as small as possible in relation to the desired light output. Some ancient stupas may require the use of custom designed fixtures in order to avoid damage to the fabric.¹⁹

Good exterior lighting can offer environmental and psychological benefits for viewers. It can help instill a feeling of civic pride in the population of town or city.²⁰ Famous stupas in Bangkok such as Phra Prang Wat Arun, Chedi Phukao Thong, Wat Saket, have light schemes which draw attention to city landmarks for tourists, and generates pride in Bangkok people.

Moreover, decoratively lit stupas can create an awareness of religion in surrounding communities since local people tend to forget the importance

¹⁸ CIBSE. Lighting Guide: The Outdoor Environment LG6:1992. Mayhew McCrimmon: Essex, 1991.

¹⁹ Ibid. p. 181

²⁰ Gardner, C. and Hannaford, B. Lighting Design. 1993. P. 176

of religion. It seems as if they spend their nights in shopping centers or entertainment complexes due to the rapid expansion of urban development. Good lighting designs for stupas may also raise people's mind and spirit if the intangible heritage can be interpreted.

Lighting design techniques for exterior buildings

The direction and distribution of light has the capacity to accentuate or negate the presence of objects and form. What is perceived as three-dimensionality is simply patterns of brightness and darkness in contrasted to one another.

There are many different techniques to illuminate a building; from behind or in front, from the side, from above or below, or combinations of these techniques. The job of lighting designers is to develop the optimum lighting solution to highlight the intentions of the design concept of each project.

Apart from the way the luminaries are focused, there are a number of other factors that play a significant role. Since a stupa is a solid piece of architecture, specific details can be illuminated in different ways according to its shapes, forms, surface materials and colour temperature. Typical lighting techniques are described as follows:

The use of the term "floodlighting" for all exterior lighting symptomizes the problem. Floodlighting is usually regarded as throwing as much light as possible at the surface of a building. Context is rarely considered. For example, a building standing alone against dark background will require much less light than one located amongst other lit buildings, each with its own sources of competing light.²¹

If we want to decrease visible shadows and minimize surface details, such as texture, front lighting should be used as it falls on the architectural elements from the viewer's position. Front lights tends to minimize the apparent shape and volume of a building. A good use for front lighting is when the structure or space does not rely on depth and texture, and if it is comprised of strong colours. This technique provides

the most information for the viewer while being easy to implement.

The negative side of front lighting is that the architecture can look boring due to loss of volume and depth. Textures and details are minimized, architectural objects become flat with few shadows. Also, a front-lit object may look too bright and the background too dark, creating unwanted shadows and uneven illumination.

If we want to emphasize shape, form, or silhouette to show the architecture in a striking or unusual way back lighting is a good solution. An object can be back lit by point source or by diffused lighting. Silhouettes are easy images to process because they are inherently two-dimensional.

The disadvantage of this technique is the lack of detail on a dark subject. Also, the background may be too bright, and there might not be adequate space behind the object to place the luminaries.

Back lighting from a point source in nature happens in early morning or late afternoon on a sunny day without clouds as we usually see the image of Temple of Dawn in some books or ads.

Side lighting is a very useful technique. It occurs when light falls mainly on one side of an architectural object. Side lighting increases the sense of dimension, depth, volume, shape, texture and pattern, and produces more shadows. It emphasizes details and textures of an illuminated surface.

Side lighting works well when objects have varying textures on different planes and it sculpts a three-dimensional object. It can also separate the subject from the background. This technique may be too severe for some objects, creating contrasts that are too bright and/or too dark.

Top lighting, or down lighting comes from overhead and selectively illuminates objects and defines their importance. In the natural environment this situation may occur outdoors at noon. This lighting technique is very efficient for illuminating horizontal surfaces.

Top lighting needs a high position to illuminate an object. Most stupas, especially the main stupa,

²¹ Gardner, C. and Hannaford, B. Lighting Design. 1993. P. 178

are generally the highest object compared to their surroundings. However, it is rather difficult to be done since there are no buildings higher than the stupa.

One form of down lighting used in landscape lighting is moonlighting. This effect can be achieved by placing a wide-beam projector above in the trees, or on the top of a building and directing it downwards to create soft, ambient light. This technique is designed to imitate moonlight; it casts shadows on the ground and makes for a very pleasant walking environment.

Up lighting is an unnatural technique to create drama. This technique involves placing the light source beneath the object and directing it upwards. This technique will highlight a specific architectural element, such as column, sculpture or tree, but generally will not provide as much ambient light as down lighting. Up lighting tends to be possible in many cases.

Grazing uses up-lighting or down-lighting techniques to create an interesting, visual effect upon vertical surfaces such as walls, columns and vertical planes. It highlights the object's texture. The only difference is the position of the light source; above, below or from the side. The light source is usually placed as close to the vertical surface as possible to deepen the shadows on surface texture. This is achieved by focusing the luminaries so that the edge of the beam skims across the surface, casting little shadows produced by the texture. The required beam spread depends on the size of the surface being grazed.

Projecting coloured images and graphics onto vertical or horizontal surface is a type of front lighting. The architecture is used as a decorative element or a screen surface. The decision to apply this technique should be linked to the context of the site. Many times work of this kind is viewed as light art rather than architectural lighting design. This technique should always be applied with care.²²

Attention should always be paid to the characteristics of the object's materials to be illuminated. Light works differently with different materials. Reflectance plays a substantial role in the appearance of a surface. More light bounces off lighter colours. Dark colours absorb light; therefore, a higher level of luminance is needed to produce the same effect.

Different surfacing materials require different light sources; warm light sources for warm stonework or brickwork, cool light sources for white stone or concrete. There may be a case for exceptions as in the use of festive lighting. However, this should be done for sound and well-thought-out reasons, and not be accidental.

Colour to most people has always been highly symbolic. There are colours which have a special meaning or which we reserve for definite purposes and special occasions. Correctly used, coloured light may express the architectural character of a building or an object.

Lighting for Buddhist religious buildings

At night Thai temples are generally utilized in the evening during 6-8 pm. The funeral hall is used for prayers during funerals; the temple pavilion is used for listening to sermons or practicing the dharma. On Buddhist holy days and traditional Thai festivals such as the beginning of Buddhist lent, Wisakhabucha day, Songkran festival, and New Year's celebration, the activities in temples may continue from daytime till midnight which is called a "temple fair".

However, lighting design concepts for Thai stupas on regular nights and special occasions should be different depending on the activities, the concepts and the importance of each occasion. This study is focused only on lighting design for regular days. Special occasions and celebrations are excluded since each event has different concept ideas and activities.

The aims of Buddhists who come to temples are normally to make merit, the pay homage to Buddha, donate in memory of ancestors or persons who previously enacted worthy deeds, dharma study, pray for funeral, cremation, and find peacefulness. These are intangible heritage of Buddhists.

Religions have often described spiritual essence as mystical white light. Religious traditions believe in an entity that is infinite, all-powerful and perfect, beyond change and growth. Light is a principal element in

²² Zielinska K. M., "Techniques for enhancement and visual change". Professional Lighting Design. P. 43-45

religious architecture since most religions directly relate knowledge and wisdom to light.²³

Nit Hincharanan described lighting for Buddhist architecture in a preface of a book *In Praise of Shadow* translated into Thai by Suwanna Wongwaisayawan. The preface was partially extracted from a paper written by Somdet Krom Phraya Damrong Rachanuphap, who appreciated the interior illumination of Phra Vihara at Wat Pra Phutachinrat, a structure that was built during Sukhothai period.

He visited Phra Vihara in 1892. When he reached the door and was looking through the Vihara, which was totally dark, the only bright object he could see was Pra Phutachinrat, a golden Buddha image which looked as if it were floating in the air. This effect was caused by daylight coming through the entrance door. He was impressed and became faithful right away.

After renovation, when he visited this Vihara again, he found that the interior was not as dark as earlier. When entering that space in the daytime, he did not feel as impressed as before.²⁴

Dr. Vannapa Pimviriaykul's dissertation "Light in Thai Places: A Cultural Interpretation of Thai Buddhist Architecture" was reviewed. It is found that lighting is a key factor that affects the awareness of Buddhists and gives a sense of place. Lighting phenomenon from the study can be categorized into four issues; Light of Kwam Sa-ngob (peace), Light of Kwam Sak-sit (Sacredness), Light of Admiration, and Light of Modernity.

These categories of light express an attitude through interior lighting; subdued lighting can make the observer relaxed and awed. Accent lighting is used to highlight an important feature and dim light is used as an ambient.

Colours mentioned in Dr. Vannapa Pimviriaykul's dissertation are white and gold. White is the ultimate in lightness. It is all the colors combined (light). White's positive meanings include: purity, faith, birth, cleanliness, perfection, innocence, peacefulness, and empowerment.²⁵

The meanings of gold are warm, opulent, expensive, radiant, valuable, and admired.²⁶ At the uppermost level, the colour gold is associated with higher ideals, wisdom, understanding and enlightenment. It inspires knowledge spirituality and a deep understanding of the self and soul.²⁷

White light on white material such as marble or white-painted surface and warm-white light on yellowish or gold material such as yellow coloured ceramic tiles or gold mosaics surface would be appropriated. Such light not only enhances the colour of surface material but it also refers to knowledge, wisdom, relaxing, being faithful, peace, sacred, and admiration.

GENERATING A LIGHTING DESIGN FOR A STUPA

Generating a lighting design for a stupas starts with classifying the type of stupa through its visual characteristics. Next, analyzing its site and surrounding and then selecting appropriate lighting techniques to reveal or enhance the characteristics of that stupa.

Each type of stupa shares common characteristics that we can categorize from its main elements. The following are the three types of stupas found in the Rattanakosin period. (figure 6)

1. Round shaped stupa or Chedi Klom
2. Prang shaped stupa or Phra Prang
3. Indented shaped stupa or Chedi Yomum

²³ Dugar A. M. "The essence of lighting religious buildings". Professional Lighting Design. P.36

²⁴ In Praise of Shadow.

²⁵ Feisner E. A. "Colour"

²⁶ Eiseman L. Consumer reaction to colour. P.55

²⁷ "colour gold" www.empower-yourself-with-color-psycho-ology.com/colour-gold.html

Next, decisions based on the following are made as to which elements or which parts of the stupa should be emphasized:

1. Identify the uniqueness of finished materials, surface colours and texture, the overall forms, height and size of the stupa.
2. Select main elements or forms to reveal or enhance its characteristics.
3. Select minor elements to enrich its appearance, if more details are needed.
4. Select appropriate lighting techniques to illuminate the characteristics and the uniqueness of the stupa.

Because lighting design is related to fundamental principles of design and composition, the following emphasis should be put on design elements:

1. Emphasis on outline, contour and silhouette, use backlighting technique
2. Emphasis on 2D plane, shape of stupa, use front lighting technique
3. Emphasis on 3D form, form of stupa, use side lighting or grazing techniques

The site and surrounding areas should be taken into consideration since they affect viewing angles, direction of light, light distribution, shading and shadow. The characteristics of site can be identified as follows:

1. Stupa is located in a large open-space and can be seen clearly from the main route
2. Stupa is located in a smaller open-space and shorter distance from the main route
3. Stupa that has an obstruction or is in a very tight space so that it cannot be seen clearly from the main route

The characteristics of surrounding areas can be categorized as follows

1. Stupa is situated in a low-rise building area, mostly old urban areas
2. Stupa is situated in a city center, CBD or surrounded by medium to high-rise buildings

Other design criteria that should be taken into consideration include the illumination and luminance of stupas, luminance ratio of stupa and its background, light distribution curve of luminaries, glare prevention, luminaries and lighting equipment installation, energy conservation, heritage conservation, and lighting pollution.

CONCLUSIONS

To effectively design lighting for Thai stupas the characteristics of the stupa should be identified. Next, the site and surrounding areas of the stupa should be analyzed, and finally, appropriate lighting techniques for the stupa within its setting should be applied.

The scale of the stupa is important. On large stupas the main elements should be gradually lit with the minor elements highlighted. While, small scale stupas may be lit by only one luminary which can generally cover the whole stupa.

Stupas are generally viewed from a main road or a river, thus the surface of stupa facing in that direction should be emphasized.

The setting of stupas is an important factor as to where luminaries and other lighting equipment are to be installed because these objects may be in the visual field. They should be installed harmoniously within the context and should not obstruct a route or circulation. Glare should be avoided, especially to pedestrians and drivers

The direction of light can dramatically transform one's perception of a stupa in space, sculpting it to stand out or meld into its surrounding environment.

Lighting designs for stupas should be proposed to light designers and related offices, perhaps the Fine Arts Departments of universities and the Bangkok Metropolitan office to ascertain if the designs can be applicable in the future. Lit stupas could become future tourist attractions and become landmarks in local communities in Bangkok.

The valuable Thai heritage of stupas, temples, traditional buildings, intangible culture and tradition are all integrated and should be conserved. Good lighting designs would be one way to protect cultural values, authenticity and integrity of Thai heritage.

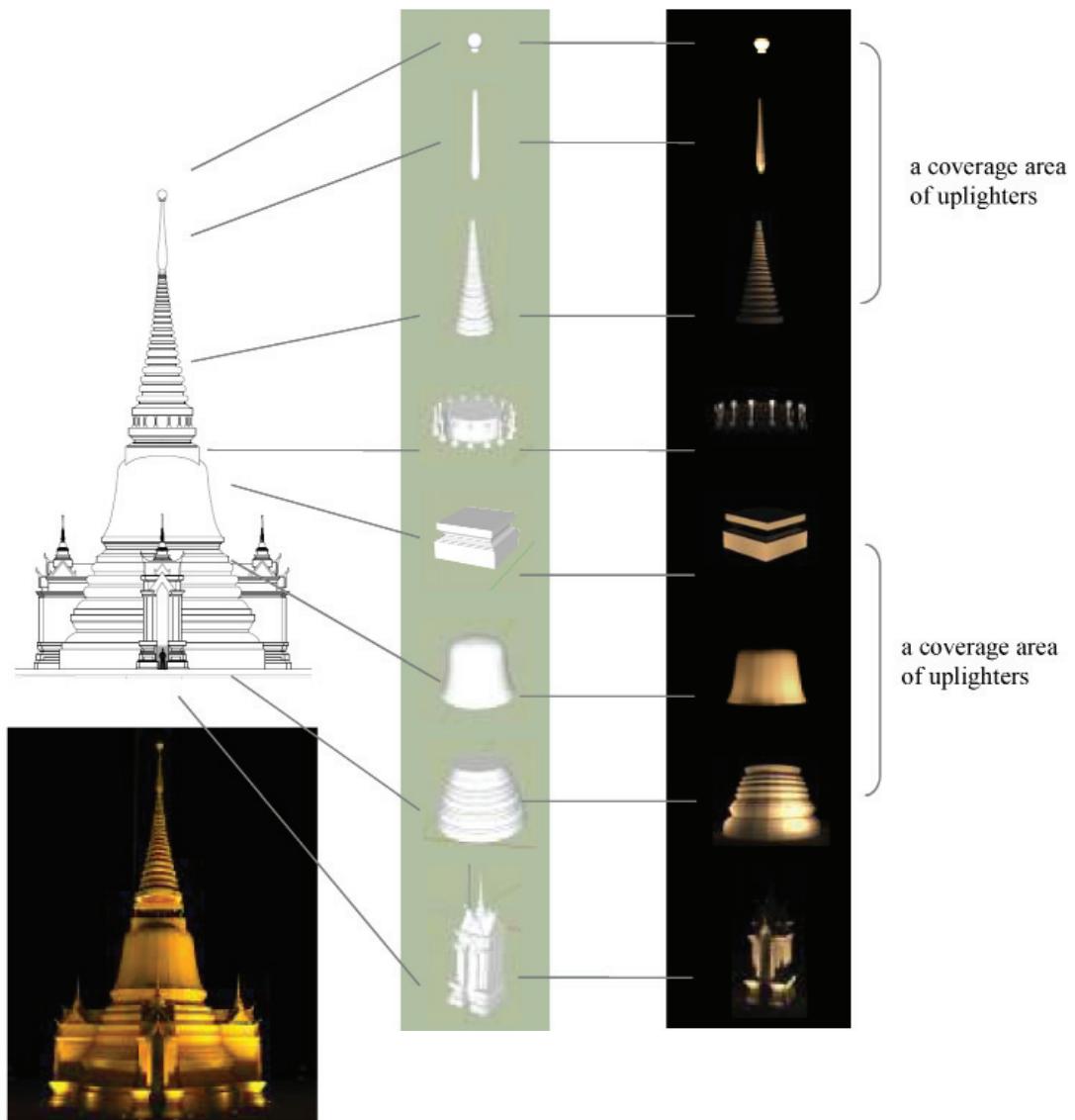


Figure 6:
An example of stupa lighting: a case study of Phrasri Ratana Chedi, Wat Phrasri Ratana Sadsadaram by Thanadech Thomprasert

REFERENCES

“Colour Gold” (BE 2538) www.empower-yourself-with-color-psycho-ology.com/colour-gold.html Leksukhum, S. Chedi. Bangkok: Matichon.,

Cultural Heritage Conservation 2000-2004 (2007) Clung Wicha Press.

Dugar, A. M. (1993) “The Essence of Lighting Religious Buildings”. Professional Lighting Design.

Gardner, C. and Hannaford, B. Lighting Design.

INTERPRETATION. 2nd ICOMOS Thailand General Assembly and International Symposium 2007.

Jermsawatdi, P. (1979) *Thai Art with Indian Influences*. Abhinav Publications: New Delhi.

Descottes, H. and Ramos, C. E. (2011) *Architectural Lighting: Designing with Light and Space*. New York: Princeton Architectural Press.

Lien, C. "Visual Perception in Lighting". December 12, 2003.

"Lighting Design Basic: Lighting Techniques" Professional Lighting Design. Jan/Feb 2006.

"Methods of Architectural Lighting" <http://www.bethlehem-pa.gov/feature/highlightSouthBeth/chapters/Report%20-%20Chapter%203.pdf>.

No. N. P. (1986) *On History and Photographs of Buddhist Pagodas and Stupas in Thailand*. Moang Boran: Bangkok,.

"Phukao Thong" http://en.wikipedia.org/wiki/Wat_Saket.

Rea, M.S. (2000) IESNA.

Sonthiwan Intralib. (1991) An Outline of the History of Religious Architecture in Thailand.

"Stupa" <http://en.wikipedia.org/wiki/Stupa>

Sthapitanonda, N. and Mertens, B. (1991) *Architecture of Thailand: A Guide to Traditional and Contemporary Forms*.

Tanizaki, J. translated from the Japanese by Thomas J. H. and Seidensticker E. G.. *In Praise of Shadows*. Jonathan Cape: London.

Tanizaki, J. translated from the Japanese by Suwanna. (1994) *In Praise of Shadows*. Tantawan: Bangkok,

"The Essence of Lighting Religious Buildings" Professional Lighting Design p. 36-41. No.49 Apr/May 2006.

Thomprasert, T. (2011) "Lighting Design Approaches for Thai Stupas in Bangkok". A Master Degree Thesis, Department of Architecture, Chulalongkorn University

UNESCO. Asia Conserved: Lessons Learned from the UNESCO Asia-Pacific Heritage Awards for Williams, R. G., Lighting for Color and Form..Pitman: New York, 1954.

Zielinska, K. M., "Techniques for Enhancement and Visual Change". Professional Lighting Design.