Best Practices in Placemaking through Illumination

Jamie Brätt, Gareth James, Ryan Price and Jeremy Sewall
Virginia Tech
Urban Affairs and Planning Program
Spring 2010
# Table of Contents

Executive Summary .................................................................................................................................................. 2

Literature Review .................................................................................................................................................. 4

Signage Ordinances ............................................................................................................................................. 13

LUCI .................................................................................................................................................................... 15

Case Study: The Philadelphia Lighting Plan ........................................................................................................ 17

Case Study: The Lighting Plan of Lyon, France .................................................................................................... 28

Case Study: The Lighting Plan of Putrajaya, Malaysia ............................................................................................ 35

Case Study: The Lighting Plan of Melbourne, Australia .......................................................................................... 48

Images: Lighting Exhibition ..................................................................................................................................... 56
EXECUTIVE SUMMARY

INTRODUCTION

The following study strives to summarize the leading literature and application of lights as placemaking devices that can enhance the public realm. The report does not make specific implementation recommendations. Rather, it points to successful techniques applied in other cities throughout the world and provides references to lighting plans and associations that may be informative for Arlington County, VA.

COMMON COMPONENTS

Across an extensive literature review and four case studies, certain concepts were found throughout.

a) The dynamic nature of light – lighting illuminates a space or building and makes it more vibrant. Lighting also offers a sense of safety and/or significance. However, what constitutes “good design” is a moving target. Unsightly or ill-functioning lights can be a detriment to placemaking.

b) Light and sustainability are not mutually exclusive – both the technologies used in public light and the application or orientation of light (such as lighting that responds to the presence of people) can affect the how “green” a light installation may be.

c) evidence suggests that good public lighting does correlate to economic development, though the directly related returns are difficult to tease out from overall economic growth or community development

D) A lighting master plan is a key component to envisioning and achieving strategies focused on light as a placemaking device. Articulating a lighting hierarchy or character zones is good practice.
LITERATURE REVIEW

There is extensive literature on city lighting. The most prevalent by far is technical in nature, much of it associated with the Illuminating Engineering Society of North America (IESNA). The IESNA’s primary publication, the *IES Lighting Handbook*, is the self-titled “Bible of Lighting” and informs much of industry practice.¹ However, critics of the IESNA claim that the *Lighting Handbook* provides no design guidance for exterior lighting in cities, as of the 8th edition.² Industry professionals tend to focus on technical aspects of lighting and rarely address the use of lighting for “placemaking.”

However, there is a growing body of literature that does examine the placemaking effects of city lighting. This literature has three primary sources. The first category of articles comes from scholarly research, while the second category of research is financed or directly published by lighting companies. A third category of literature can be found in what planning documents are available from cities pursuing unique lighting projects. Examples from all three categories are included in this literature review. In addition to linking lighting with placemaking, this review includes literature regarding the regulation of signs and their relation to lighting.

Scholarly Articles

In Jakle’s history of signage in the U.S., the author notes that “lettered canopies or awnings, brightly backlit by fluorescent tubes, rapidly came into popularity” beginning in the 1980s.³ These were especially popular in places with “strict sign ordinances,” as canopies and awnings fell outside the scope of such regulation.⁴ Such displays produced a reactive movement to regulate signage more closely, inspired in part by the legacy of the City Beautiful movement.⁵

In a separate work, Jakle recounts the history of city lighting. After discussing technical aspects of public lighting, he discusses some of the placemaking efforts cities have undertaken using lighting. He addresses the background of urban lighting festivals, citing the use of fireworks and illuminated gas balloons at the opening of the Brooklyn Bridge in 1883 and the San Francisco “Illumination Festival” held in 1916 “to celebrate completion of the city’s first ornamental street lighting system.”⁶ Conventions were a major driver in leading cities to develop lighting displays to compete for their business.⁷ Beginning with New York City’s “Tree of Light” in 1912, cities started using seasonal lighting to highlight

⁵ Jakle 2004, p. 146.
commercial areas during Christmas, such that “nearly everywhere, December has become a month of special lighting.” The use of floodlighting to illuminate landmarks came into vogue at the turn of the 20th century, with General Electric sponsoring the floodlighting of Niagara Falls in 1908. Starting in the 1920s, “Niagara Falls was regularly lit as a nighttime attraction in the summer months.”

The lighting of Times Square came about due to the new construction of theaters driven out of lower Manhattan by rising property values. These new theaters installed “brightly lit...marquees” to counter the dangerous reputation of the area around Times Square. As illuminated signs proliferated in Times Square, efforts to control them fell flat. The Broadway Association defended the signs, agreeing to a compromise in 1916 with a new city zoning law that allowed “giant signs with relatively few restrictions” on Broadway while prohibiting any large signs from Fifth Avenue. The success of Times Square led in 1982 to the establishment of “a special Midtown Zoning District...for outdoor advertising spectacles.” The new zoning regulations required that 60,000 square feet of sign space be included in the development of “five new skyscrapers.” When Times Square declined over the 1980s, the city sought to preserve its character in 1990 in the face of “a thirteen-acre urban renewal project...which would have converted the area into a sanitized zone of giant office towers,” instead designating the area for similar kinds of signs that made it a center of activity.

Based on the example of Times Square, other cities began experimenting with the addition of brightly-lit central areas, termed “white ways.” The first such “ornamental ‘white way’ was installed in 1905 on Broadway Avenue in downtown Los Angeles.” In 1910 Atlanta incorporated a subdued form of the “white way” on Peachtree Street. Other cities and towns were quick to follow suit, driven primarily by business associations.

Brandston 1994

In Brandston’s keynote address for the City Light 1994 conference, he decried the relighting programs of North American cities, arguing that the selection of High Pressure Sodium bulbs reduces the

---

8 Jakle 2001, p. 139.
18 Jakle 2001, p. 228.
quality of light.\textsuperscript{20} He is critical of the Illuminating Engineering Society of North America and claims that they have reduced the selection of city lighting to a “prescription” that requires no thought.\textsuperscript{21} Brandston recommends the adoption of white lighting such as metal halide, though every application ought to be considered thoughtfully, making qualitative judgments based on what is seen and not merely relying on the use of light meters.\textsuperscript{22}

\textit{Brandi & Geissmar-Brandi 2006}

Brandi and Geissmar-Brandi present one of the most extensive treatments of lighting available in the literature. Their work is intended to be a “guideline for better lighting in urban streets, gardens, squares and buildings.”\textsuperscript{23} Rich in illustrations, their guidebook includes a detailed description of how to implement a “lighting masterplan, urban lighting concept, [or] plan lumière,” all terms used to describe a similar method of using light to create a sense of place.\textsuperscript{24} Included in this description of the process of establishing a lighting masterplan is a brief discussion of how to avoid light pollution, citing “non-directional light or light causing glare” as the primary causes and suggesting that “less light is often better than more.”\textsuperscript{25} Brandi and Geissmar-Brandi describe various kinds of lamps and bulbs, and then provide guidelines for appropriate lighting in particular situations, such as residential neighborhoods or bridges. Several examples are provided that illustrate these guides such as “Bürger” in Bremerhaven and the Hamburg Town Hall, both in Germany; the White City shopping center in London; Terminal II at Munich airport; and other examples from Germany, Austria, and Malaysia.\textsuperscript{26} Included is a brief discussion of the history of city lighting.

\textit{CIE News 2008}

The International Commission on Illumination briefly described the importance of “masterplanning urban lighting” in one newsletter, describing how various lighting applications currently compete and waste “both money and energy resources to outshine each other.”\textsuperscript{27} The reason for this “visual mess” is that “most urban lighting is undertaken by separate bodies such as Highway Departments...Tourist Boards...and the private developer.”\textsuperscript{28} The newsletter indicates that a publication

\textsuperscript{20} Brandston 1994.  
\textsuperscript{21} Brandston 1994.  
\textsuperscript{22} Brandston 1994.  
\textsuperscript{23} Brandi 2006, p. 7.  
\textsuperscript{24} Brandi 2006, p. 25.  
\textsuperscript{25} Brandi 2006, p. 46.  
\textsuperscript{26} Brandi 2006, pp. 94-147.  
\textsuperscript{27} CIE 2008.  
\textsuperscript{28} CIE 2008.
is forthcoming to provide guidance in adopting an urban lighting masterplan, but the document is not listed on the Commission’s website. The article provides a helpful division between “utility” lighting meant to provide security and “architectural” lighting meant to enhance placemaking attributes. It mentions that there are many urban lighting masterplans already in existence, some of which are included in this report as case studies.

Cuppes 2009

Cuppes provides an intriguing analysis of how Christmas lights are used in the articulation of local urban identity in the suburbs of Christchurch, New Zealand. Cuppes conducted a series of “semistructured interviews,” media analysis, and organized a focus group in order to probe strong feelings about the lights. She found that the lights “embody the Christmas spirit as well as suburban conformity and surveillance.” In addition, the lights challenged an identity associated with “Englishness” in Christchurch by introducing “Americanization,” defined in this context as “tackiness.” While her emphasis has more to do with the way people identify themselves culturally, the fact that Christmas lights provide such a controversial subject reveals the importance lighting in understandings of place and identity.

Holden

Holden’s brief account of the history of city lighting ties its adoption to City Beautiful White Ways and links the introduction of sodium vapor lamps to the decline of urban spaces. In 1912, the Illuminating Engineering Society was told that “lighting must be made agreeable to the eye,” a directive revisited in 1994 by Brandston. It was during this time that Holden argues that incandescent city lights created such civic pride that through the 1930s such displays were featured on postcards. No longer is that the case. As lighting began to be seen as a way to improve automobile safety and reduce crime, and efficiency became more highly valued, cities turned to sodium vapor lamps. Originally, sodium vapor “had been written off because it painted the landscape an eerie pinkish orange.”

29 http://www.cie.co.at/div5/info/d5publ.html
30 CIE 2008.
33 Cuppes 2009, p. 28-29.
34 Holden, p. 59.
35 Holden, p. 61.
36 Holden, p. 60.
37 Holden, p. 60-61.
acceptance leads Holden to conclude that “urban light, which had briefly created remarkable city environments, has become a catalyst in their change, and arguably their erosion.”

Schwartz

Schwartz provides an architectural view of light, focusing on strategies “designers can use to accommodate local light and shadow.” Emphasizing the way buildings interact with sunlight, he describes four such strategies: orientation and attitude, structure and enclosure, ornament and detail, and animation. He highlights the importance of the relationship between lighting and the built environment by quoting Le Corbusier: “The history of architecture is the history of the struggle for light.” Schwartz’s article is evidence of the fact that architects have been aware of light’s placemaking qualities for centuries, but that most of their efforts have been focused on presenting structures in daylight.

Seitinger and Feldmeier

Seitinger and Feldmeier introduce the concept of a new kind of lighting technology that could transform the way people and cities use light, called “Urban Pixels.” Using LED lighting, Urban Pixels are solar-powered and thus provide a “self-powered distributed network.” The article provides technical specifications for the lighting units, and concludes by acknowledging some limitations but arguing that “Urban Pixels demonstrates the potential for an autonomous lighting and display network that links existing urban spaces and improves the quality of these environments through subtle informational and playful interventions.”

Seitinger

Seitinger argues that programmable digital display surfaces could be used to “eliminate the distinction between urban lighting and display technology.” Creating programmable surfaces would allow the “reshaping of urban form throughout the evening” while “responsive systems would facilitate interactions among urban residents.” She recommends the use of the Urban Pixels system described in

---

38 Holden, p. 62.
40 Schwartz 1992, p. 16.
41 Schwartz 1992, p. 16.
42 Seitinger and Feldmeier, p. 1.
43 Seitinger and Feldmeier, p. 2.
44 Seitinger and Feldmeier, p. 4.
45 Seitinger, p. 1.
46 Seitinger, p. 1.
another article, and calls for interdisciplinary efforts between stakeholders in lighting to improve the quality of urban lighting design.

Tillet

In East New York, Brooklyn, Tillet implemented an experimental pedestrian lighting scheme to evaluate how it affects pedestrian behavior and “people’s impressions of the neighborhood.” \(^{47}\) Tillet and her colleagues carefully observed pedestrian behavior in the neighborhood and decided to introduce lighting interventions on a “well-traveled route to community destinations and a landmarked church,” rather than targeting potential crime spots. \(^{48}\) The initial evaluation of the lighting scheme was positive, as Tillet had incorporated “fragile decorative fixtures that depend on community protection against vandalism” and none had been broken six months after installation. \(^{49}\)

Frenchman and Rojas

Frenchman and Rojas provide an overview of the Digital Mile project in Zaragoza, Spain, sparked by the completion of a new high-speed rail line connecting the city to Barcelona and Madrid. In the corridor between the former rail station and the new one, the tracks were undergrounded, freeing a valuable piece of property. \(^{50}\) While the Digital Mile incorporates many more design elements than just lighting, lighting is an integral part of the concept. \(^{51}\) Features included are memory pavement that illuminates based on pedestrian pathways, digitally mediated facades, digital space that “incorporates media into pavement, wall surfaces, building edges and street furniture,” and moveable screens that act similar to awnings. \(^{52}\)

Industry

Cochrane

In an article sponsored by Philips Lighting, Cochrane provides a brief overview of the British concept of the 24-hour city and lists several major placemaking light installations. Two of the driving factors behind the 24-hour city concept are the use of light for spectacular events and a shift towards

\(^{47}\) Tillet 1997, p. 87.
\(^{48}\) Tillet 1997, p. 84.
\(^{49}\) Tillet 1997, p. 87.
\(^{50}\) Frenchman and Rojas 2006, p. 17.
\(^{52}\) Frenchman and Rojas 2006, p. 23.
the “continental European culture of using the public realm as an extension of leisure space.”⁵³ He cites a “dearth of legislation and government guidance on strategic civic lighting” in Britain, though a new road lighting standard was in the works.⁵⁴ He lists Glasgow’s “City of Light” scheme as a good example of a lighting masterplan, and then provides examples developed by the firms Speirs and Major Associates and Philips Lighting. Cochrane also mentions that permanent fixtures might be less able to create a memorable experience due to their concern for safety and functionality, while “one-off” events are better able to “redefine the perception of a place.”⁵⁵

**Gordon**

Philips Lighting conducted extensive research in a project termed “city.people.light,” published in a book by the same name. First published in 1998, Philips conducted a follow up study in 2006, asking questions of architects and planners such as, “can light influence urban strategies and urban life?”⁵⁶ Their findings include the importance of energy management, contrasting challenges in countries with advanced economies versus those still developing, digitalization, more subtle approaches to lighting, and wireless technology.⁵⁷ In addition, Gordon includes a set of case studies from the Victoria and Albert Museum Garden in London to Roe Highway in Western Australia.

**Schréder Group**

The Schréder Group published an article to discuss their participation in implementing the lighting plan for Bordeaux. Included are short interviews with various stakeholders in the process. Roger Narboni defines a lighting plan as “a plan of action produced on the basis of a lighting development master plan...to compile an inventory of the existing state of lighting in a city.”⁵⁸ The process included input from the director of an observatory, who was able to provide guidance for avoiding light pollution. The lamps used in the project are described in detail. Another interviewee, Froment, said that the lighting plan was an initiative of the Mayor of Bordeaux.⁵⁹

---

⁵³ Cochrane 2003.
⁵⁴ Cochrane 2003.
⁵⁵ Cochrane 2003.
⁵⁷ Gordon 2007, p. 16.
⁵⁸ Schréder Group.
⁵⁹ Schréder Group.
Planning Documents

*Seattle Center Master Plan Urban Design Principles*

In a list of urban design principles dated November 2006, Seattle Center’s Master Plan calls for light fixtures to “reinforce a sense of place, support the programmed activities at Seattle Center and facilitate pedestrian access,” along with street furniture and paving.

*Seattle Citywide Design Guidelines*

A review draft of the Seattle Design Guidelines dated January 2010 addresses lighting in several sections. In the Public Life chapter, the guidelines call for safety and security lighting “including pathway illumination, pedestrian and entry lighting, and/or security lighting,” and generally promote the use of lighting to create active and interesting pedestrian spaces.\(^{60}\) In the Materials subsection in the Design Concept chapter, lighting is to be used to “increase site safety and highlight architectural or landscape features.”\(^ {61}\)

---

\(^{60}\) Seattle Citywide 2010, p. 13.
\(^{61}\) Seattle Citywide 2010, p. 27.
REFERENCES


Schréder Group GIE. "The Urban Light." Schréder Group GIE.


SIGNAGE ORDINANCES

In order to better understand how Arlington County’s signage ordinance differs in respect to its regulation of lighting, three other signage ordinances were examined from Philadelphia, Pittsburgh, and Providence. The definition of a sign in the Arlington ordinance is very broad:

“Any word, numeral, figure, design, trademark, flag, pennant, twirler, light, display, banner, balloon or other device of any kind which, whether singly or in any combination, is used to direct, identify, or inform the public while viewing the same from outdoors.”

In contrast, Philadelphia defines a sign as follows:

“Any structure or device, whether or not attached to a building, which is primarily calculated to advertise and communicate.” Excluded are advertising matter on vehicles, pedestrians or newsstands; information required by law; public notice of sale or rent; and unilluminated signs placed in the front of a building with the name and brief description of business.

Pittsburgh defines a sign as follows:

“Any surface, fabric or device bearing lettered, trademarked, pictorial, or sculptured matter designed to convey information visually and expose to public view the identity of a business, organization, building, or commercial product, service, or activity; or any structure designed to carry the above visual information.” Pittsburgh specifically excludes holiday decorations and works of art that are non-promotional in nature from its definition.

Providence defines signs by purpose, as “such signs are intended to advertise goods, identify services, facilities, events or attractions available on the premises where located, to identify the owner or occupant or to direct traffic on the premises.”

A cursory examination of these signage ordinances reveals that a major difference between these jurisdictions is the intent of the sign. While Philadelphia, Pittsburgh, and Providence all define a sign as an object meant to advertise and communicate, Arlington treats any device used to “direct, identify, or inform” as a sign. Without specifying advertisement as a critical component of signage, Arlington’s ordinance is more comprehensive in objects covered.
REFERENCES

Arlington County Board. "Zoning Ordinance, Section 34. Nameplates, Signs, and Other Displays or Devices to Direct, Identify, and Inform." Arlington County, Virginia: Arlington County, Virginia.


LUCI

Lighting Urban Community International (LUCI) was founded in 2002, and is described as an ‘international network bringing together cities and lighting professionals engaged in using light as a major tool for urban, social and economic development, with a concern for sustainability and environmental issues’. It is chaired by Lyon in France, a city that introduced its first lighting plan in 1989, and it was originally composed of fifteen members. Today, LUCI has around sixty member cities and thirty associate members, typically universities and private companies that have an established interest in the lighting field.

LUCI’s three main objectives are as follows:

- Making use of light as a tool for urban development
- Promoting an urban identity by means of artistic and technical choices
- Taking into account environmental and sustainable development issues

LUCI has four sub-commissions, the diverse nature of which serves to demonstrate the range of expertise that is brought together under the LUCI umbrella. The first of these is Urban Strategies and Lighting, which is chaired by Liege (Belgium) and which focuses on the ‘evolution of urban forms and lifestyles’ and ‘on the relationships individuals establish with their environment’. The second is Culture and Lighting, which is chaired by Glasgow (Scotland) and which considers lighting’s role in the promotion of artistic creation, heritage and regeneration. A third, Technological Prospects and Trends, is chaired by Shanghai (China). It aims to develop and stay abreast of the latest innovations in urban lighting. The fourth and final LUCI sub-commission, Sustainable Development, is chaired by Eindhoven (Holland) and aims to promote energy-efficiency throughout all aspects of members’ urban lighting activity.

Aside from disseminating all the expertise that is gathered through LUCI’s various commissions to its member cities, LUCI also organizes meetings, conferences and exhibitions all over the world to facilitate the sharing of best practice in the urban lighting arena. One such event, City under Microscope, takes place at least once per year and gives the host city the chance to showcase its strategy and methods through presentations and field visits. In the last five years, featured cities have included Budapest (Hungary), Moscow (Russia) and Montreal (Canada). A related element of LUCI’s activity is the LightLinks competition, sponsored by Thorn Lighting, which “encourages cities from low and high income countries to create partnerships by offering a prize of up to €20,000 ($26,600) for equipment.”
A partner organization of LUCI is the Professional Lighting Designers’ Association (PLDA), ‘a voluntary federation of lighting designers and consultants that have an international presence’. Its members work together to raise the levels of actual and perceived professionalism in the field of urban lighting. LUCI member cities can take advantage (usually free-of-charge) of the PLDA’s services in the following areas:

- Finding appropriate lighting designers in their local area
- Development of a Lighting Master Plan and assistance with its coordination
- Lighting design concepts for significant buildings and structures
- Landscape lighting projects
- Lighting around water
- Lighting for roads, urban squares, and public open spaces
- Environmental lighting and “green” systems
CASE STUDY: THE PHILADELPHIA LIGHTING PLAN

Methodology for the Case Study

Unlike the lighting plans presented in all the other case studies featured in this report, the Philadelphia Lighting Plan has not been brought together in one overarching document. Philadelphia’s plan exists more as a series of coherent and yet distinct initiatives, all devised by the same organization. Thus, the case study has been developed through scrutiny of the following five sources of information:-

2. *Center City Digest* article (2003) about the lighting plan by Paul Levy, Executive Director of the Philadelphia Center City District that was responsible for developing and implementing the plan
4. A short email questionnaire completed by Mr. Levy for the purposes of conducting this case study
5. Capital Funding information supplied by Mr. Levy (but also available in the public domain)

Genesis of the Philadelphia Lighting Plan

Philadelphia’s Center City District (CCD), a business improvement district, was created in the early 1990s to make the center city safer and cleaner and transform it from a nine-to-five district to one that would be vibrant twenty-four hours a day. Basics such as street-cleaning, tree-planting, adding directional signage and building an effective partnership with the police were to be among the first focus areas for the new organization. The impulse for the desire to effect such a transformation of the center city may be best encapsulated by a Bob Hope joke that was recounted in one of his obituaries: “Philadelphia is so quiet at night that once I was arrested for disturbing the peace just for cracking my chewing gum outside.”

However, quietness was far from being the only problem that the city was experiencing at the time. To put this case study into its appropriate context, it is important to recognize that Philadelphia had suffered greatly from depopulation in the preceding decades. It was host to a wide range of issues that may be grouped together under the term ‘urban blight’, and it is instructive to note that John Kromer’s book, *Fixing Broken Cities*, arose from his experiences as a member of the city’s staff during the 1990s (indeed, the book’s second chapter focus on the role played by the CCD in Philadelphia’s upturn in fortunes).

The CCD was chartered by the city and was initially funded through mandatory property assessments, private donations and some state funds. While lighting was not originally considered to be
part of its remit, a $26 million bond issue to tackle capital improvements enabled the organization to widen its scope considerably. Mr. Levy had learned of the ambitious lighting plans that were commonplace in European cities such as Paris and Lyon, and he believed that making Philadelphia the first American city to embrace the concept could greatly enhance his organization’s chances of meeting its objectives.

Given the relative lack of enthusiasm for public financing of lighting initiatives in America, Mr. Levy faced quite a challenge. He recounts that, “Getting started was not easy. For years, city engineers focused on lighting just roadways for cars. Poles were placed 100 to 150 feet apart, leaving it to the headlights of cars to compensate for dark zones between.” Furthermore, installing pedestrian-oriented lighting is around a third more expensive than lighting an equivalently-sized block with the standard highway poles, so even an incremental transition (i.e. replacing the poles as and when they reach the end of their useful lifecycles) is hardly appealing to those charged with balancing the books of cash-strapped cities like Philadelphia.

Rather than trying to persuade the city to adopt an incremental approach that would take many decades to have the desired effect, Mr. Levy advocated bolder action, recommending that all of the fixtures that only lit the roadway should be torn down and replaced with new pedestrian-scale poles. While the merits of his proposal – discussed later in this study – won wide acceptance and the bond issue meant that the project already had much of its financing in place, Mr. Levy still had to win over the city engineers. He explained to them that as most Center City roads are narrow, pedestrian-oriented lighting would be sufficient to light the roadways as well as the sidewalks. With the engineers suitably reassured regarding the safety of Mr. Levy’s proposal, the CCD had the green light to develop and implement its lighting plan.

**Implementing the Philadelphia Lighting Plan**

The priority for the plan was to provide pedestrians with uniformly well-lit sidewalks, and it was decided this could best be achieved by installing 1,474 pedestrian-scale lighting fixtures at regular intervals on 120 downtown blocks (the area for which the CCD is responsible includes a total of 220 blocks). In this instance, it was decided that ‘pedestrian-scale’ meant 16-feet-high. Crucially, fixtures at such a height are below the canopy of the street trees in this area of Philadelphia, unlike the standard 20-feet-high poles. Even after the decision was taken to roll out the plan without delay, it was clear that it would take a matter of several years for all 1,474 fixtures to be installed, which left the CCD with the difficult task of deciding which blocks should be prioritized. Aesthetics, safety, economic development
and other factors could all legitimately have been used to determine the phasing, but in this case, those areas with existing retail, hospitality and entertainment offerings were targeted in order to spur the evening economy. Surprisingly, perhaps, no changes were made to local ordinances (and apparently there are still no plans for ordinances to be amended, even though the lighting plan continues to grow in scope and scale).

As previously mentioned, the bond issue meant that much of the financing for the first incarnation of the lighting plan was in place. However, the CCD sought to secure contributions from private enterprises and charitable organizations, thereby increasing the number of stakeholders with a vested interest in the plan’s success and decreasing the risk associated with an over-reliance on a single source of funding. The CCD emphasized the likely safety benefits and the potential for boosting the evening economy, and from 1996, the Department of Streets agreed to accept responsibility for maintaining the new pedestrian-oriented fixtures wherever they replaced the traditional roadway lights.

While contributions from charities and businesses appear to have been insignificant in the early years of the plan’s implementation, support from such organizations has proved vital to the lighting plan’s evolution. This is especially true since 2004, as the capital funding information on the following page clearly demonstrates.
Evolution of the Philadelphia Lighting Plan

As a result of the positive reception for the early stages of the plan’s implementation, the CCD soon looked at ways in which it could further use lighting to improve the vibrancy of Philadelphia’s streetscape. Apart from making the obvious move to roll out the installation of the pedestrian-oriented lighting fixtures to the remaining parts of the district (it has now installed in excess of 2,100 lamps across more than 152 blocks), the CCD decided in 2001 to focus upon the boulevard known as the Benjamin Franklin Parkway. The Parkway, a primary destination for 3 million visitors each year, was conceived as part of the City Beautiful movement that influenced urban planning and architecture in North America around the turn of the twentieth century.

While never fully executed, the 1.1-mile-long boulevard had been modeled on the Avenue des Champs-Élysées in Paris, lending a historical legitimacy to Mr. Levy’s decision to look to French capital for inspiration (though Mr. Levy has also made it clear that present-day Philadelphia is not Paris, particularly when it comes to building facades and ownership structures).
Much of the funding for the Benjamin Franklin Parkway plan came in the form of a grant from the Pew Charitable Trust, which contributed $3 million after analysis demonstrated the Parkway was unacceptably dangerous for all users and its impressive architecture was ‘almost invisible at night’. The other major contributor was the Commonwealth of Pennsylvania, which granted the CCD with $2.1 million from its Department of General Services and $200,000 from its Department of Community and Economic Development. While the original lighting plan had considered aesthetic considerations, improved safety for pedestrians was always present as either a fundamental reason for the program. The Benjamin Franklin Parkway plan moved beyond this, notes Mr. Levy: “We had a really interesting experience, starting to use light for more than functional purposes, but using it to light architecture and sculpture.”

The CCD was accustomed to working closely with the Department of Streets, but it now enlisted the help of other partner organizations including the Fairmount Park Commission, the Art and Historical Commissions and several of the cultural institutions on the Parkway. In 2003, it appointed local consultancy The Lighting Practice as its principal lighting firm, and it completed the assemblage of its project delivery team by enlisting architects, landscape architects, civil engineers, construction managers and various contractors. The lighting plan for the Parkway was very much a collaborative effort.

The Benjamin Franklin Parkway plan was designed to make the boulevard more appealing to pedestrians after dark. On a functional level, this again meant that there was a need to establish uniform levels of lighting along the Parkway, but the width of the roadway meant that the previous approach of ‘dual purposing’ one fitting for pedestrians and vehicles was impractical. Instead, new and historically appropriate lighting poles were installed for both pedestrians and automobilists. There are 222 pedestrian-scale fittings (15-feet-high in this instance) and there are 132 new roadway lights that are twice that height. The new fittings are shown below in this photograph taken from Mr. Levy’s presentation:
New light fixtures along main thoroughfares in Philadelphia

Other important aspects of the plan included illuminating fourteen major public sculptures along the Parkway by the use of metal halide sources rating between 70 and 150 watts, and lighting the facades of a dozen buildings such as the Philadelphia Museum of Art and the Free Library. The lighting of the facades was deliberately simple and was mostly achieved through the use of metal halide sources. The projection methods devised were more complex; for example, the lighting of City Hall involved projecting from light sources on seven adjacent buildings, as depicted in another of Mr. Levy’s slides:
November 2004 Lighting of City Hall
From 7 adjacent buildings

Center City District
The plan considered each building on an individual basis, weighing up the different levels of visibility that could be achieved by installing lights at different heights on the façade against the costs involved. The framework for this analysis is summarized by the following slides taken from Mr. Levy’s presentation:
Proposed & actual

Crown façade = $31,500

Upper façade = $18,900

Mid Level Façade $15,300
Impact of the Philadelphia Lighting Plan

Mr. Levy may have been inspired by the strategies borne of the French preoccupation with the aesthetic and artistic value of lighting (art for art’s sake) but he knew that in America, at least, a lighting plan’s success would largely be judged in terms of its impact on economic development. It was likely with some relief, therefore, that he was able to reel off the following set of statistics in 2003:

(From 1992-2002)
- Downtown restaurants serving dinner at night jumped from 65 to 192
- Outdoor cafes increased from 0 to 104
- Hotel room increased in number by 55%
- More than 4,000 apartments were created in center city through the conversion of vacant buildings (with 1,000 more in the pipeline)

(From 1990-2000)
- Employment in Philadelphia’s hospitality industry grew by 30% (resultantly, it generated $368 in annual salaries to city residents and over $10.5 million in wage taxes)
- 70% of residents moving into higher-end downtown apartments came from outside the city

While Mr. Levy recognized there must have been many contributing factors to the aforementioned trends, he maintained the installation of the new lighting in the center city was one of the main drivers for the city’s resurgence: “More pedestrians ventured out, retailers and restaurants expanded evening hours, and bright windows and sidewalk seating further animated the street. A virtuous circle ensues as ever more people choose to live downtown near work and the thriving arts and entertainment scene.” This statement links the ‘city as theatre’ concept popularized by Jane Jacobs to Richard Florida’s influential creative class theory that emphasizes how a city’s economic health is largely dependent on its ability to attract young, creative types. Mr. Levy proudly proclaimed that a third of Philadelphia’s downtown residents were aged between 18 and 29 and that 79% of all center city residents aged between 25 and 34 were college graduates, far higher than the city average of 27%.

In light of such impressive economic returns being attributed (at least in part) to the impact of a lighting plan, we asked Mr. Levy the following question:

“Might it be possible for a city with less available funding from the sources [available in Philadelphia] to raise the capital required through a TIF?”

His answer was emphatic: “Absolutely yes.”
Rather than relying solely on these economic indicators with their problematic causality to determine the success of the lighting plan, the CCD conducted a community survey in order to canvass views on the new lighting installations. 90% of the email comments that they received were positive, though the 10% that were less favorable were consistent in their criticism, asserting that the lights were garish and made Philadelphia seem more like ‘Vegas East’.

As well as gauging public opinion of the lighting plan, it is necessary to consider whether it had any impact on crime, which was one of the original objectives when the plan was first developed back in the early 1990s. Mr. Levy cited a lighting plan in London that claimed an investment in town center lighting could result in savings fifty times larger than the original investment, due to the costs of crime and insurance to local authorities, businesses and individual victims. While Mr. Levy did not have such an impressive statistic at his disposal concerning the situation in Philadelphia, he nonetheless asserted that fewer crimes were committed on ‘sidewalks that are well lit’ in the center city.
CASE STUDY: THE LIGHTING PLAN OF LYON, FRANCE

Methodology for the Case Study

This case study has been developed using the following three sources of information and images:

1. The lighting section of Lyon’s website (in French, but Google Translator works reasonably well): http://www.lyon.fr/vdl/sections/fr/urbanisme/plan_lumiere_1
2. A retrospective account, Lyon City of Light, 1989-2009, that has been translated into English and was provided to us by Lyon’s Department of Public Lighting
3. The new Lighting Plan (Le nouveau Plan Lumière) that was launched in 2004. This is available in French only and was also provided to us by Lyon’s Department of Public Lighting.

Where text from the lighting plan has been translated by the author of this study but may be open to different interpretations, endnotes containing the original text and the page number have been included.

The First Lighting Plan (1989)

Lyon, as befits the city that gave the world the Lumière brothers, is considered to be one of the true pioneers when it comes to unlocking the transformational potential of urban lighting. Lyon launched its first formal lighting plan in 1989, it called for the establishment of LUCI (Lighting Urban Community International) in 2002, and since 1999 it has achieved worldwide fame and praise for its annual ‘Festival of Light’ (note that the Festival of Light does not form part of this case study). The impetus for Lyon’s 1989 lighting plan stemmed from a desire to move beyond seeing lighting as simply a safety requirement, instead considering the contribution it could make to the city’s aesthetics, ambiance and visual well-being.
The plan was launched with a decision to illuminate 250 sites, many of them historic buildings. Later, more than 50 new sites were added, and the lighting plan became an integral consideration during the design phase of new projects and developments. According to Gilles Buna, Lyon’s Deputy Mayor who is responsible for City Development and Quality, the lighting plan was an unmitigated success: “Representing a magnet for tourists, the pride of local citizens, an undisputed area of competence and an economic lever, lighting has become an integral part of the urban landscape of Lyon.”

**The New Lighting Plan (2004)**

Despite the success of the original lighting plan, a decision was made in 2004 to update it for a new era. Mr. Buna assembled a working group of ‘professional experts, academics, technicians, designers and associations’,¹ and the group developed a new plan based on the following objectives:

1. Encourage new forms of creativity
2. Integrate new technical possibilities
3. Make better use of lighting in urban or social developments
4. Prevent the risks of producing a cacophony of light
5. Reduce energy consumption and light pollution”
The plan outlines the ways in which the various elements of the city should be treated, making it clear that this is far from a one-size-fits-all strategy. The rivers (the Rhône and the Saone) and some parks are designated as ‘calm zones’. These are areas in which it is deemed appropriate to maintain a certain level of darkness by opting for more discreet lighting, although the boats on the Rhône should be illuminated.

According to the plan, extra attention should be focused on lighting certain bridges that offer exceptional views of the city, and any other sites that might be suitable for ‘night-time contemplation’, such as Annociade Gardens. The architectural landscape, from the Basilica at Fourvière to the towers of the Part-Dieu commercial center, should continue to be illuminated, and other major projects that are still in their development stages should be taken into account. Particular attention should be paid to the relationship of these buildings with the rest of the city – the aim is to integrate them without undermining their potential. The points at which people enter and depart from the city should be illuminated, as should the TGV (high-speed train) station in northern Lyon and some bike paths. Lines of more intense lighting should be added to certain light rail and trolley-bus routes.

Not only does the plan differentiate the various elements of the city, but it also introduces the concept of district lighting plans, an approach that respects and augments the characteristics of different areas of Lyon. For example, colored lighting might be used in the vicinity of the city hall on certain days of the week, because such a strategy would help to capture the dynamic nature of that particular neighborhood. A similar initiative might be appropriate in the Duchère area, the site of an ambitious redevelopment project, but this strategy would have to be determined through consultation with local citizens. In retail areas, one might adopt a similarly collaborative approach to develop a district lighting plan that integrates the street-lighting strategy with high quality displays in the shop windows.

‘The framework of the new Lighting Plan’, depicts the way in which the lighting plan is customized to suit the requirements of the various elements and districts of the city:
The new lighting plan is designed to complement the ‘rhythms of the city’, and this means considering more factors than the level of darkness when deciding on the appropriate level of illumination. Dusk, for example, can be an enchanting time of day as long as the lights do not shine too early or too brightly. The ability to exhibit such restraint is particularly relevant in the context of the first objective listed at the outset of this case study – to encourage new forms of creativity.
The plan notes that technological advancement has given rise to new light sources and highly sophisticated electronic management tools that might allow us see our society, literally and figuratively, in a whole new light. While such a development is desirable to a point, the artists and designers who seek to harness the power of the new technology should remember that less can be more; the objective is not to illuminate the whole city, but to use lighting in a manner that respects time and space.

The plan outlined the following measures to encourage new forms of creativity:

1. Establish an artistic management group with a high level of creative expertise
2. Engage neighborhood associations and partner-organizations to enhance projects in terms of their development, image, identity and events
3. Involve artists and designers with diverse approaches and support their technical competence with assistance from government bodies as required
4. Commence a study into the construction of new kinds of urban furniture that integrate the technological and aesthetic developments

**The New Plan and Sustainable Development - Intelligent Lighting**

One of the most fundamental additions to the new lighting plan is the emphasis that it places on sustainable development, an emphasis that is given the label *intelligent lighting*. This concept is expanded on in the retrospective account of the lighting strategy, which discusses the “possibility of detecting movement and systematically implementing timed control.” This would “enable lighting when ‘someone is there’ and would be applied on the scale of a street or square.” According to the plan, it is no longer acceptable to illuminate the city without considering the consequences: “Certain experts denounce the violation of the night sky, the waste of energy, the harmful effects on man and nature...

Additionally, studies confirm that the number of light sources per capita has grown considerably in the last ten years.” The new plan embraces sustainable development and intelligent lighting in various ways, for example:

1. Phasing out old lamps in favor of more energy-efficient versions (e.g. replacing incandescent lamps with LEDs and T8 fluorescent tubes with T5 tubes)
2. Avoiding the use of lamps that contain lead or mercury
3. Recycling all old lamps
4. Permanently decreasing the lighting levels in certain areas of the city
5. Developing lighting schedules that take into account use, time and season
6. Ensuring that only energy-efficient vehicles are used by lighting maintenance staff
7. Installing solar panels in certain new buildings to offset the energy used to illuminate them
8. Keeping parks and gardens partly in shadow to protect biodiversity
9. Illuminating eco-friendly aspects of the city’s infrastructure such as bike paths and wind turbines
10. Participating in a European energy management initiative, the Green Light program
Examples of low-impact lighting solutions

Mr. Buna asserts that “it is now vital to have access to materials that consume less energy and provide better ecological performance, as well as to progressively eliminate light pollution.” He believes the new approach is paying dividends: “Light better, consume less... The entire lighting network of the City of Lyon, cultural highlighting and street lighting included, currently costs each inhabitant 11€ per year... The goal of the lighting system is to attain the level of consumption existing before 1989, when the first Light Plan was implemented.” Indeed, energy consumption levels suggest that the intelligent lighting approach is working: “Between 2005 and 2009, the City of Lyon decreased its consumption by seven million KWh (20%) even though light sources grew to include 67,600 lamps.”

The New Plan and Experimentation

The new plan makes several references to Lyon’s pioneering role in the field of urban lighting, and there is a clear belief that the city has a responsibility to remain at the leading edge by systematically experimenting with new ideas. The plan states that research will be conducted in the following areas:

1. How lighting impacts on and is perceived by the visually impaired (a 2005 study tested different lighting systems in collaboration with sixty-two people from associations for the visually impaired; it concluded that sidewalks require sufficiently intense and uniform lighting, and that street furniture must be signaled more clearly)
2. How people perceive different kinds of lamps and especially different colors of lighting
3. The use of innovative materials such as self-cleaning glass
4. Testing systems to remotely monitor, manage and vary the output of the lighting’
For each study, a partnership will be established with researchers and experts from the field in question, and the study will be carried out according to agreed protocols for implementation and evaluation. It is thus hoped that Lyon will continue to enhance the experience of its citizens and visitors through its creative use of lighting, and that other cities around the world will be able to benefit from its research.

ENDNOTES

From the original text

i chercheurs, experts, professionnels, techniciens, associations, et concepteurs (page 4)

ii (1) ouvrir le champ de la creation, (2) intégrer les nouvelles possibilities techniques, (3) mieux utiliser la lumière dans un souci de développement urbain ou social, (4) prévenir les risques de cacophonie lumineuse, (5) réduire les consommations énergétiques des lampes et les pollutions nocturnes (Page 4; numbered list added to suit the structure of this case study)

iii l’on cherchera à [les] intégrer, sans surenchère (page 6)

iv Constituer à la Ville de Lyon une direction artistique avec une connaissance large des créateurs; Mobiliser les acteurs des quartiers (associations, partenaires…) pour enrichir les projets en termes de mouvement, d’image, d’identité, d’activités; Solliciter des créateurs de sensibilités différentes et renforcer leur compétence technique par l’assistance de bureaux d’étude si nécessaire; Lancer une étude sur la fabrication d’une nouvelle ligne de mobilier urbain intégrant les évolutions esthétiques et technologiques. (Page 10; numbered list added to suit the structure of this case study)

v Les tests de système de télégestion et de télésurveillance et de variations de puissance. (Page 16)
CASE STUDY: THE LIGHTING PLAN OF PUTRAJAYA, MALAYSIA

Methodology for the Case Study

This case study has been developed using the following sources of information and images:

1. The City of Putrajaya Lighting Masterplan 2002 Parts 1-3. The plan available in its entirety on the City of Putrajaya website at: http://www.ppj.gov.my/portal/page?_pageid=311,1&_dad=portal&_schema=PORTAL#4670

2. The lighting section of Putrajaya’s website: http://www.ppj.gov.my/portal/page?_pageid=311,1&_dad=portal&_schema=PORTAL#1740


Introduction

Before presenting an analysis of Putrajaya’s lighting strategy, it’s important to set the context of the city’s formation. In June of 1993, the Malaysian government selected the area that is now Putrajaya to be the new Federal Government Administrative Center for Malaysia. The shift of administrative functions out of the historic capital of Kuala Lumpur was in response to overcrowding and congestion of Malaysia’s largest and most prominent city.

The government also sought to balance and disperse development outside of the Kuala Lumpur metropolitan area and the surrounding Klang Valley. The government’s vision for Putrajaya was to create a vibrant, intricately planned, dense, urban community that would not only house government functions, but also nurture innovation, Malaysian culture, and provide a high quality of life for its residents.

By 1994, an elaborate three year planning effort was underway to create the Putrajaya Master Plan, which literally was to be the blueprint for building the city from scratch. Construction began in the summer of 1995 on the massive development which became Malaysia’s largest project in history costing an estimated $8.1 billion for the initial phase alone. Putrajaya was planned as a “garden city” with approximately 37% of its land area reserved for open space. The city was also known as an “intelligent
city” based on its rigorous sustainability standards and location in Malaysia’s Multimedia Super Corridor. As of 2009, the estimated population of Putrajaya was 65,000. As government infrastructure continues to expand, and private development follows suit, the population is expected to grow upwards of 330,000 in the coming decades.

**The Putrajaya Lighting Master Plan**

In keeping with Putrajaya’s identity as a comprehensively planned urban community, a lighting master plan was created in 2002 to enhance the city’s evening ambiance and overall nighttime presentation. Putrajaya’s Lighting Master Plan consists of three main sections; general background, lighting policies, and design guidelines for individual elements.

The background section frames the importance of the lighting master plan on Putrajaya’s development as the administrative center of the Malaysian Federal Government. The plan acknowledges Putrajaya’s unique position as an “emerging city” and emphasizes the strategic role of urban lighting on the city’s desired “nightscape postcard image.” The plan is recognized as a critical tool for facilitating impactful lighting design as the city continues to grow in population and stature. Much of the background section of the plan is dedicated to assessing the current lighting infrastructure. This appraisal is conducted primarily from a holistic design perspective.

While significant illumination already exists on the city’s roads, buildings, and landscapes, the plan describes the current situation as “visual disorder.” The plan also notes that “there is a fine balance between creating a visual sense of night time liveliness and creating a scene that lacks clarity and legibility,” inferring that the latter is representative of Putrajaya’s current nocturnal atmosphere. Most of the lighting installations within Putrajaya were designed on a unilateral basis and essentially diminish the collective nightscape of the city. Specific lighting fixtures are also identified as problematic, most notably the globe light which emits light in 360 degrees.
Light pollution in Putrajaya’s Botanic Garden caused by globe lighting

Lack of uniform street lighting is also identified as a primary concern for the city. Road surface coverage within the government building precinct, for example, is inconsistent and obstructed by decorative light enclosures. Other notable issues highlighted by the assessment include, ineffective building and structure lighting, light pollution caused by improper fixture trajectories, and widespread use of high-pressure sodium light.

Night sky pollution around the Office of the Prime Minister

Putrajaya’s Lighting Master Plan proposes nine lighting policies that are designed to alleviate the existing lighting issues, establish a standard for future lighting infrastructure, and create a unique
nightscape for the city. According to the plan, the basic intent of the policies is to create a “nightscape that is cogent, attractive, environmentally successful and economic.” Each policy has a separate subsection within the plan that further explains policy objectives and implementation guidelines. Many of the policies are also supplemented with visual representations of the desired outcomes, and reference tables that organize policy specifics. The policies presented in the plan are simplistic and somewhat vague, yet detailed enough to provide an adequate framework for lighting decisions.

The final section of the plan provides in-depth measures for design and implementation of specific elements prescribed within the nine policies. This section is geared toward practitioners, and contains data-rich lighting design guidance that serves as a resource for architects, developers, and planners.

**Notable Themes of Putrajaya’s Lighting Strategy**

**Focus on Design**

A significant portion of Putrajaya’s Lighting Master Plan is focused on urban lighting design features and techniques. The master plan calls for lighting design that portrays themes of “unity, simplicity, and dignity.” A design-oriented tone is established early in the introductory paragraph as proper lighting design is linked directly with the fundamental urban design principles of the city. Several design principles such as creating a sense of visual unity, careful use of contrast, and particular attention to the texture and color spectrum of local building materials are specified as integral to accomplishing the overall vision for the city’s nightscape.

As mentioned above, design also plays a major role in the infrastructure assessment. The plan isolates a number of specific examples of faulty lighting design and arrangement that hinder the desired evening presentation of the city. The following list provides a summary of the noteworthy design elements prescribed by the plan:

- **Use of varying shades and intensities of white light.** This technique can accentuate desired features and provide a unique sense of place for prominent landmarks. The plan suggests using higher white light values in central nodes and plazas within residential areas, as well as on important government buildings. A hierarchy of buildings with prescribed light intensities is provided as a template for achieving the desired result (Figure 3).
Hierarchy of Illumination

<table>
<thead>
<tr>
<th>Group</th>
<th>Description</th>
<th>Average Luminance (Candela per square meter)</th>
<th>Maximum Luminance (Candela per square meter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Buildings, groups of buildings, structures or other elements that form vista terminations, nodal points, are easily visible from significant distances, and/or are considered to be landmark buildings</td>
<td>20-50 cd/m²</td>
<td>200 cd/m²</td>
</tr>
<tr>
<td>B</td>
<td>Buildings that form street walls between important landmarks or districts, buildings with architectural significance, landmarks not visible from significant distances, and/or other key buildings</td>
<td>10.25 cd/m²</td>
<td>150 cd/m²</td>
</tr>
<tr>
<td>C</td>
<td>All remaining buildings, structures and elements that justify lighting for civic, architectural or commercial reasons</td>
<td>5-10 cd/m²</td>
<td>60 cd/m²</td>
</tr>
</tbody>
</table>

- **Limiting use of colored lighting to festive occasions and state holidays.** While the plan recognizes the effectiveness of colored lighting to invoke excitement and stimulate mood, the second policy resolutely depicts the negative aspects of permanent colored lighting. According to the plan, colored lighting overpowers the natural shade of structure materials and subtle architectural elements, distorts the scale of buildings, tires the human eye, and is considered inappropriate in historical and religious atmospheres. The plan provides five visual examples of appropriate and inappropriate use of colored lighting on buildings (Figure 4, Figure 5).
Appropriate usage of color lighting to illuminate buildings

1. Composition of coloured lighting scheme has been well thought through, and focal point highlighted with contrasting coloured light. Temporary installation for light and sound festival.

2. Coloured light enhances architectural form of building, and creates calm serene night time image.
   (Note: coloured fit with blue light, as per proposed festival lighting scheme in Putrajaya Lighting Masterplan)

3. Lighting scheme is installed within building. Colour of façade materials unaffected by lighting.

4. Again, light fittings are restricted to the internal of the building, so materiality of architecture is unaffected by coloured light. Contrasting white light highlights roofline feature, enhancing architectural statement.

5. Coloured light utilized as advertising for upmarket hotel. Normal scene utilizes white light. At certain times of day the festive day lighting ‘show’ is run. Permanent ‘temporary’ installation.
Inappropriate usage of color lighting to illuminate buildings

- **Minimize light pollution in the night sky through good design.** Light pollution can be generated by faulty design such as inaccurate fixture trajectory, overpowering light intensities, and reflective glare. Figure 6 provides a matrix of the different forms of light pollution recognized by the international lighting standards organization Commission Internationale de l’Eclairage (CIE) which is the recommended standard of the Putrajaya plan.
Light Pollution Matrix

<table>
<thead>
<tr>
<th>Pollution Type</th>
<th>Definition</th>
<th>Causes</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sky Glow</td>
<td>Wasteful throw of lights into the night sky contributing to light pollution.</td>
<td>Misdirected light into the sky</td>
<td>Modifying the direction of light projection exclusively onto the intended object</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wide angle projection on building facades</td>
<td>Narrowing the projection angle such that only the facade plane is illuminated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Luminaire with light escaping above the horizontal plane (such as globe lighting)</td>
<td>Install shields or reflectors, also known as &quot;cut-offs&quot; on luminaries to limit upward throw of light</td>
</tr>
<tr>
<td>Light Trespass</td>
<td>Intrusion of light into a neighboring building or space causing loss of privacy.</td>
<td>Misdirected light onto a neighboring lot</td>
<td>Modifying the direction of light projection exclusively onto the intended object</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wide angle projection onto a neighboring lot</td>
<td>Narrowing the projection angle such that only the building, object, or plane is illuminated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unshielded luminaire</td>
<td>Install shields or reflectors to block light from intruding into neighboring lot</td>
</tr>
<tr>
<td>Glare</td>
<td>Diminished visibility due to unprotected or reflected light. Two distinct categories of glare exist. Disability Glare refers to loss of visibility cause by glare from a source of bright light. Discomfort Glare refers to discomfort experienced by the human eye in response to varying and contrasting levels of lights.</td>
<td>Overpowering light intensity</td>
<td>Downgrade light intensity to appropriate level based on illumination intent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unshielded luminaire</td>
<td>Install shields or reflectors to block light from escaping intended plane</td>
</tr>
</tbody>
</table>

- **Use of appropriate scale, tone, and wattage for street lighting in residential areas.** Putrajaya’s plan specifies appropriate residential lighting design that will create a safe, inviting atmosphere within the city’s residential neighborhoods. Street lights in residential areas are not to be higher than the buildings (Figure 7). Additionally, a low-wattage warm tone product should be used.
Current and proposed residential street lighting height

Lighting to Create a Sense of Place

Another notable tactic of the Putrajaya lighting strategy is the use of lighting to creating a sense of place within key areas of the city. Isolating specific areas allows Putrajaya to establish unique nocturnal spaces that create a lasting visual impression of the city. The dynamics and vitality of the community can be significantly altered through the use of calculated lighting design techniques. The areas identified within the plan for specialized strategies are the Core Island (location of the Federal Government buildings), the lake/waterway system, pedestrian parks, and the city’s road gateways.

Much of the proposed lighting infrastructure within these areas will have multiple design layers that are unified into one illuminated landscape. An example of the layering technique can be seen within the Central Blvd. corridor on the Core Island. The plan calls for varying lighting intensities and tones for the lighting infrastructure based on the purpose of the illuminated space. A list of these variations is noted below:

- Central Blvd street lights -- highest intensity, cool white appearance
- Connector and side road street lights -- medium intensity, warm tone
- Pedestrian sidewalk lights -- low intensity, warm tone
- Corridor entrance and Central Blvd light posts — LED cluster columns and beacons
- Decorative lighting – illuminated ground level colonnades
- Tree/Landscape lighting – subtle use of colored lighting
- Buildings – illumination of roof cornices

The combination of these individual lighting schemes along the same corridor establishes an aura of significance, and identity within the space. Figure 8 depicts a visual rendering of the corridor’s multi-faceted lighting approach.

Central Boulevard Schematic Lighting Plan

The Putrajaya Lake and surrounding waterways are another key space that will be defined through specialized lighting techniques. These bodies of water represent a significant topographical feature of the city, and are the focal point for many of the community’s recreational activities. The proposed lighting scheme for the lake varies depending on the primary use of each section. The portion closest to the Core Island will have lighting components that accentuate its presence in relation to the land. Colored LED marker lights will be installed along the lake’s edge on existing pedestrian pathways.

Floating light sculptures, fountains, water jets, and other submerged lighting features will be installed in the water recreation areas. Some of these fixtures will be permanent while others will be temporary festive decorations. The high boat traffic throughways will have illuminated buoys, and no lighting will be installed in ecologically sensitive areas of the lake or surrounding protected wetlands.
Similar to the buildings and structures, a lighting hierarchy for water has been established to ensure the appropriateness of future installations. Figures 9 and 10 illustrate possible light arrangements for festive occasions in the lake.

Illuminated buoys and light strings during a sailing/rowing festival
Illuminated buoys and bridges during a light show

Accentuating Gateways

Putrajaya’s lighting plan pays considerable attention to the cities major gateways. The primary goal of the third policy is to create visually appealing entrances into the city from its major road arteries. The plan calls for structures that would be eye-catching during the day and night. Six periphery gateways and ten Core Island bridge gateways are identified as in scope for lighting elements. Lighting infrastructure on the bridges would also have varying color capabilities that would be utilized during festive occasions.

Ensuring Future Implementation

The Putrajaya plan not only provides cutting edge design recommendations, but also proposes an elaborate administrative infrastructure capable of ensuring the desired lighting elements become a reality. Three policies lay the groundwork for lighting implementation, regulation, and maintenance. Key personnel gaps are identified, job descriptions are presented, and qualifications of ideal candidates are prescribed. Furthermore, a detailed statutory framework is proposed that would be granted to a central governing entity called the City Lighting Network (CLN). This system guards against potential
deviation from the desired lighting presentation, and promotes uniformity with regard to the quality of future lighting infrastructure.

**Conclusion**

The Putrajaya model differs somewhat from other cities embracing urban lighting strategies in that the primary focus is not on retro-fitting or replacing existing infrastructure, but on fostering adequate lighting design in future developments. In this sense, Putrajaya has more or less a clean slate from which to build its nocturnal ambiance. This unique position enables Putrajaya to proactively monitor the evolving lighting schematic and adjust as desired. While the level of detail prescribed by the plan provides clear direction for developers and planners, the specificity could require future updating based on evolving technology, tastes of the public, and funding prohibitors. Putrajaya’s lighting strategy provides an array of cutting edge design strategies that will undoubtedly manifest into a truly unique environment as the city matures and expands.
CASE STUDY: LIGHTING PLAN OF MELBOURNE, AUSTRALIA

Methodology for the Case Study

This case study has been developed using the following sources of information and images:


Introduction

Melbourne’s Lighting Strategy 2002 was created in response to a clause in the City’s 1999 master plan (City Plan 1999) calling for a “comprehensive and integrated urban Lighting Strategy.” The Melbourne approach is built on a combination of past lighting project experiences and modern cutting-edge technology and design. An important characteristic of the strategy is that the scope extends throughout the entire city. While some prominent areas are targeted with specific policies, the document strives to improve lighting infrastructure in the city as a whole. The primary themes of Melbourne’s lighting strategy are discussed below.

Designing the Luminous City

The Melbourne lighting strategy aims to tap into the expressive potential of urban lighting design to enhance the city’s evening image. Close attention is paid to the relationship between illumination and human perception, and the plan tailors several key strategies that intend to use this relationship to its advantage. The plan notes that transformation within the city from day to night should provide both familiarity and surprise.

Key elements that are used for navigation during the day such as important paths, nodes, and landmarks need to be clearly visible at night. Enhancing this transition period “following the working day” with various lighting techniques can expand and encourage activity into the evening hours.
Essentially, evening navigation through the city should be clear and effortless, and lighting pays a major role in achieving this goal.

The plan also acknowledges that lighting can be used for pleasant surprises in that it often “reveals elements and relationships that are recessive by day.” More specifically, these surprises can be achieved through careful manipulation of spatial associations which can be done “playfully or provocatively.” The plan cautions that planners and designers should be cognizant that results are “engaging rather than alienating.”

The plan also pays particular attention to the importance of landmarks. Landmarks are not only useful from a navigational perspective; they can also be utilized to define a neighborhood or even the entire city. Tactful illumination techniques can reinforce a landmark’s significance and value. The Melbourne strategy provides thorough guidance on identifying landmarks that merit illumination, and the types of lighting that should be used on these structures.

Street and sidewalk lighting represents the backbone of any lighting strategy as the majority of the outdoor activity and movement occur on these features. The Melbourne strategy proposes two hierarchies, use and form, that should be considered when designing street and sidewalk lighting infrastructure. The plan calls for lighting that varies in intensity, frequency, and size based on characteristics such as width, traffic volumes (vehicular and pedestrian), primary activities, and notoriety. A diagram depicting the relationship between lighting and street width is provided below. Uniform application of these standards articulates spatial relationships, and ensures adequate illumination exists across the city.
Lastly, to design a “luminous city” special attention must be attributed to the city’s assets. The Melbourne strategy prescribes enhanced illumination in distinct neighborhoods, parks, and waterways. Maximizing the use of these elements during the evening hours helps the city create a memorable...
nocturnal environment. This strategy can also stimulate the evening economy in areas such as shopping districts and restaurant corridors.

**Safety and Amenity**

The Melbourne strategy examines safety and amenity considerations as one entity. The two are intermingled in that adequate lighting amenities forge a feeling of safety, and the level of safety, real or perceived is largely determined by the quality of the surrounding lighting amenities. In this sense, it can be derived that providing superior lighting design and placement strategies will increase overall safety.

Good design involves more than simply coverage and brightness. Strategic placement along the street and sidewalk edge provides increased awareness of potential vehicular-pedestrian dangers. Use of lamp shields minimizes glare and increases visibility. Minimizing contrast between over-lit and under-lit areas provides visual continuity and ease of navigation. The Melbourne plan also prescribes the use of white light as opposed to yellow light. White light has several distinct advantages over yellow light.

White light is known to reveal natural surface colors and presents a more accurate sense of shape and size. Additionally, the human eye is more sensitive to white light, so lower levels of lighting are required to illuminate surfaces, which ultimately equate to lower energy consumption. This coupled with the superior technology of metal halide (white light) compared to high pressure sodium (yellow light) creates a more energy efficient product.

The efficiency aspect of white lighting aligns with Melbourne’s citywide greenhouse gas reduction initiative (30% reduction by 2010). However, it’s important to note that the benefits of white lighting do come with a cost. Replacing yellow light with white light is estimated to be approximately $15 per fixture, and white light costs approximately $10 more to maintain per year. When multiplied by the thousands of lights lining Melbourne’s streets these expenses add up quickly and prove to be a major implementation obstacle as noted in the 2005 Sustainable Public Lighting Action Plan.

The Melbourne plans also promotes the use of blue-white light in residential areas. Blue-white lighting is softer and less intrusive than white light, and also maintains higher levels of energy efficiency through metal halide technology. The Melbourne strategy reserves high pressure sodium lighting for industrial areas where minimal pedestrian activity is intended. Figure 2 depicts the proposed distribution of white, blue-white, and yellow street lighting.
Lighting Distribution Map

Attracting the Evening Crowd
Melbourne’s lighting strategy pays close attention to harnessing the power of evening activity. The plan outlines policies on both a macro and micro scale that aim to increase the liveliness of its streets at night. Lighting should play a major role in existing cultural events and festivals. These lighting schemes should be agile and temporary in design such that the maximum element of surprise can be obtained. An example of this strategy can be seen in the centrally located Federation Square, which was illuminated in electric blue and pink for a recent New Year’s Eve celebration.

Top – Founders Square standard lighting schematic.
Bottom – Founders Square New Year’s Eve lighting schematic

Additionally, Melbourne’s plan calls for an annual “festival of light” similar to those in Western Europe. The festival will be held during the winter solstice when nights are the longest and coexist with holiday shopping promotions. From a macro perspective, the Melbourne strategy proposes a “civic signature” on the central business district’s skyline. This lighting presentation would require a coordinated effort among its prominent towers. While this could prove to be a difficult task as many of these properties currently compete for recognition with elaborate lighting schemes (Figure 4), the
collective result “could project a coherent image” of the skyline’s evening presence. While the plan does not specify an individual design scheme, it does target a specific population of building (those exceeding 50 stories in height) that should be assembled within the overall lighting schematic.

Competing lighting schemes and resulting sky glow of Melbourne’s skyline

On a micro level, the Melbourne strategy targets window dressings and calls for “promoting more attractive retail frontages.” Increasing the creativity of window displays can add variety to the street edge and engages passing pedestrians late into the evening. A major component of this initiative is incentivizing shop owners to keep their display windows illuminated after store hours.

*Designing a Sustainable City*

Sustainability constitutes a significant component of the Melbourne lighting strategy. Emphasis on the environment is part of the city’s culture. Melbourne weaves sustainability targets and policies in a multi-disciplinary fashion through several strategy and master plan documents. Public lighting has been put under the microscope in Melbourne because it emits a majority of the city’s greenhouse gases (57% in 2003-2004).

As with many emission reduction strategies, the Melbourne sustainable lighting plan is a multi-faceted approach consisting of technology improvements, design best practices, and increased recycling capabilities. The *Sustainable Public Lighting Action Plan 2005-2010* was published as a supplementary document that expands on the sustainability targets outlined by the *Lighting Strategy 2002* document. The 2005-2010 action plans provides a tangible roadmap for achieving Melbourne’s emissions reduction goals through sustainable public lighting.
Research conducted by the city has indicated that sustainable public lighting practices can potentially decrease overall emissions by up to 60%. This potential impact would be monumental on overall energy efficiency and sustainability, which explains why there is such an acute focus on building a sustainable lighting infrastructure. From a design perspective, the plans call for controlling stray illumination and over-lighting which represent wasted energy and are attributed to light pollution and sky glow. Subtle design modifications such as decreased light intensity, and calibrated fixture trajectories can vastly improve energy efficiency and minimize unwanted visual externalities. From an energy perspective, the strategy is simple, use less energy to light the public domain.

Technology plays a major role in accomplishing this portion of the sustainability plan. Transitioning to metal halide lighting fixtures is the primary proposal to reduce energy consumption. As mentioned in the Safety and Amenity section, metal halide lighting is more expensive than the existing high pressure sodium lighting. The 2005-2010 action plans notes that this cost barrier prohibits implementation of a bulk replacement strategy. As research continues to capture the true benefits of this technology, the proposed strategies will need to be modified to achieve the intended results.

Conclusion

Melbourne’s lighting strategy provides substantial direction and framework while remaining nimble and flexible. Technology can improve, political interpretation can change, and public desires can fluctuate, but the basic guidance and goals of safety, sustainability and design maintain their applicability. The sustainability focus is particularly notable given the specificity and scope. Based on the future outcome, Melbourne’s Sustainability Public Lighting Action Plan could serve as a model for other green-minded cities. The city prides itself on “low-key,” simplistic urban design that is “distinguished by quality and understated elegance.” Melbourne’s lighting strategy perpetuates this characteristic with functional lighting solutions that also contain tactful elements of originality.
Temporary lighting exhibitions are often incorporated into trade shows for lighting technologies in Europe and the Middle East. Philadelphia has also made large strides in both temporary and permanent façade lighting. This technique demonstrates new lighting applications and their ability to influence the public realm, while building support for innovative lighting among the community.

A lighting installation of 100 LED lights behind the opera hall in Wallanlage

Inner city Hauptwache is transformed into a special lighting exhibition
Lyon, France: LUCI December 2004

Exciting, but expensive & temporary

chercheurs, experts, professionnels, techniciens, associations, et concepteurs (page 4)
(1) ouvrir le champ de la création, (2) intégrer les nouvelles possibilités techniques, (3) mieux utiliser la lumière dans un souci de développement urbain ou social, (4) prévenir les risques de cacophonie lumineuse, (5) réduire les consommations énergétiques des lampes et les pollutions nocturnes.

Constituer à la Ville de Lyon une direction artistique avec une connaissance large des créateurs; Mobiliser les acteurs des quartiers (associations, partenaires...) pour enrichir les projets en termes de mouvement, d'image, d'identité, d'activités; Solliciter des créateurs de sensibilités différentes et renforcer leur compétence technique par l’assistance de bureaux d’étude si nécessaire; Lancer une étude sur la fabrication d’une nouvelle ligne de mobilier urbain intégrant les évolutions esthétiques et technologiques.

Les tests de système de télégestion et de télésurveillance et de variations de puissance.