



## **Community Engagement for Environmental Lighting and Acoustics in the Manila's University Belt**

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### **Abstract**

Environmental lighting and acoustics is highly compromised in developing countries such as the Philippines. In urban centers such as the City of Manila, the nighttime population which compromises mostly the younger generation experience difficulty in mobility. Furthermore, the exposure to too much noise may render the population indifferent to their surroundings.

España Boulevard is a main thoroughfare connecting the city of Manila's University Belt to the eastern metropolis. The study focuses on examining the current situation of pedestrian infrastructure in the City of Manila where community and pedestrian well being should be a primordial concern in one of the densest cities in the world. Universal design is a basic consideration to support the pressing need for safety and mobility of residents and transients traveling to and from the City of Manila.

This initiative is in consonance with the United Nations Sustainable Development Goal Number 3 on Good Health and Wellbeing as a part of the third UN's SDGs of 2015-2030. This serves as a foundation for programs and projects that concern the general public, specifically pedestrians and communities.

A foot-survey was conducted using downloadable apps on lighting and sound intensity to assess whether they are in compliance with prescribed international standards. Photomontage on urban design proposals are presented as possible imagery of green urbanism solutions in attaining ideal metrics for both environmental lighting and acoustics.

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### **Keywords**

Environmental Lighting; Environmental Acoustics

### **1. Introduction**

Environmental lighting and acoustics are among the many factors that affect pedestrian and community safety. Safety is defined by the Department of Health as the condition of being free from danger and hazard which may cause accident or disease. This paper intends to document and assess the current provisions on environmental lighting and acoustics in the City of Manila, specifically along España Boulevard where high volume of pedestrian traffic is expected being part of the University Belt area.

Street lighting is a key factor to pedestrian safety particularly during evenings. Some commercial establishments provide ample lighting during night time, however not all street corners along España have commercial establishments operating on 24 hours. Noise is also a prevalent result of traffic congestion in the University belt area. How can these factors be mitigated or harnessed through a multi-sector participation?

Community participation is a key ingredient in safety and well-being as influenced through environmental factors including social engagement and a sense of belonging to a community (Maksimowski, 2013).

**Research Questions**

1. What is the current situation on environmental lighting and acoustics along España Boulevard and how can these be measured?
2. How can a multi-sector approach be integrated in addressing environmental lighting and acoustics to address pedestrian safety and community at the local level?
3. How does one quantify the amount of pedestrian traffic that is affected by lighting and acoustics in the city of Manila?

**Methodology**

A foot survey was conducted with the help of light meter and sound meter smartphone applications as tools to measure both lighting and sound intensities. Surveys were conducted in the month of November of 2016 during the morning from 6 o'clock to 9 o'clock, noontime from 11 o'clock in the morning till 1 o'clock in the afternoon and the evenings from 6 o'clock to 8 o'clock to observe sound levels along España Boulevard.

Street lighting was measured during the evenings. Lighting intensity was measured below each lamp post and sound intensity was measure at each corner intersection.

Focus group discussions were also held to engage community leaders in addressing the goal of multi-sector participation. Leaders in the twelve factors affecting community well-being were identified and invited to discuss their experiences, views and programs aligned with environmental lighting and acoustics.

**Conceptual Framework**

All tables should be numbered with Arabic numerals. Every table should have a caption. Headings should be placed above tables, left justified. Only horizontal lines should be used within a table, to distinguish the column headings from the body of the table, and immediately above and below the table. Tables must be embedded into the text and not supplied separately. Below is an example which the authors may find useful.

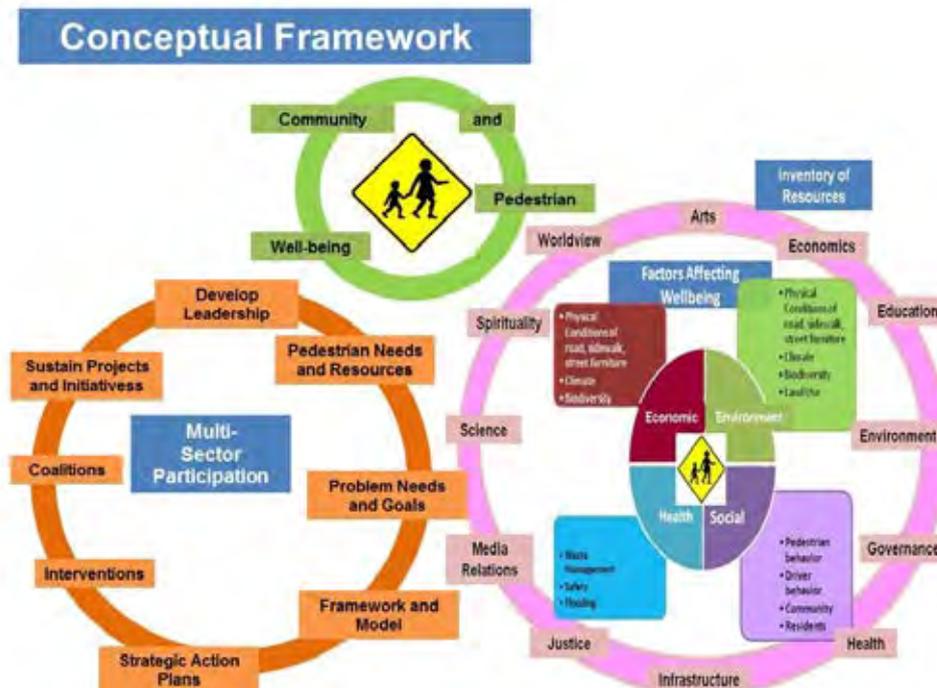


Figure 1. Conceptual Framework on Multi-Sector Participation on Environmental Lighting and Acoustics as a Factor of Pedestrian and Community Wellbeing. Source: Re-illustrated by the Author

Community participation is a vital ingredient in community and pedestrian well-being. The three gears in Figure 1 illustrate that the ultimate goal of community and pedestrian well-being can be propelled by multi-sector participation and full awareness of the resources that are present in the community.

The first and highest gear in Figure 1 represents the ultimate goal of community and pedestrian well-being. Well-being is achieved when the community factors (City of Okingpara, 2018) represented in the pink gear, such as the arts, economics, education, environment, governance, health, infrastructure, justice, media relations, science, spirituality and world-wide views are well represented in the different sectors of society. Sector participation is engaged in the orange gear by identifying community pedestrian needs and resources, and establishing the goals to achieve these needs. Goals are arranged in a framework and model to strategize the action plan. Interventions are addressed by forming coalitions to sustain projects and initiatives with the identified leaders (Comiskey, 2009).

In key cities in the metropolis, inclusive mobility is now more actively managed. The ingredients to propel community participation would require profiling and logistical database aligned with the City’s vision and mission to ensure support at all levels of the different sectors.

**Findings**

**Existing Conditions of Environmental Lighting**

Currently there are four dominant kinds of street lamps installed along España Boulevard. These are the solar lamps, three-arm classical promenade lighting, center-island lamps and cobra highway street lights.

1. The Solar Lamps were installed during the current administration, Mayor Joseph Estrada in 2014. This was a public private partnership by Manila City government and Global Goldgoal Inc. a multinational company engaged in renewable energy projects. This is a response to the to answer the reduce power consumption for the local government, which is currently saddled with over P600 million in unpaid electricity bills (Sauler, 2014).

Under the project, the Korean company is to donate a total of 10,000 solar-powered street lights costing P2.2 billion, to the city government. The streetlights, which cost P300,000 each and are expected to last for about 50 years, represent Manila’s “commitment to harness renewable energy sources for the city’s electricity needs.” According to the city government, this project will pave the way for greater environmental awareness as well as significantly reduced electricity costs (Brizuela, 2104).

2. Three-arm classical style promenade lighting were installed during the term of Mayor Alfredo Lim in 2011, coinciding with the quadri-centennial of the University of Santo Tomas. The historical quadri-centennial was a momentous event where international recognition was noted.

3. Center Island lamp posts were installed simultaneously with the three-arm classical style promenade lighting<sup>4</sup>.

4. Cobra highway Street lights with High Pressure Sodium (HPS) Lamps are the most ubiquitous lamp for street lighting on the planet. The lamp is an improvement over the LPS lamp in that it has more acceptable color with the great efficiency of the sodium lamp. The advantages of HPS is that they have good efficiency (lumens per watt), smaller size than LPS or fluorescent, the HPS fits into many fixture types, they have better bulb life than LPS lamps. Their disadvantages are, they still have bad color rendering compared to metal halide and halogen lamps, and they require ballasts (inefficient) that operates a low arc voltage of 52-100V. This reduces the actual efficiency of the lamp when you count the whole system together.

5. Cobra highway Street lights with LED Lamps are those which emit white light and are found to be more efficient lighting because of their clearer color.

Table 1. ESPANA STREET LIGHTING Source: Illustrated by the Jardin,P. 2018

Lighting Typology	Figure 2 2014 Solar Lamps	Figure 3 2011 Promenade Lamps	Figure 4 2011 Center Island Lamps	Figure 5 HPS/LED Highway Cobra Lamps	Total

*Continued on next page*

Table 1 continued

Working	2	6	34	9	51
Not Working	81	103	56	24	264
Total	82	106	90	33	315

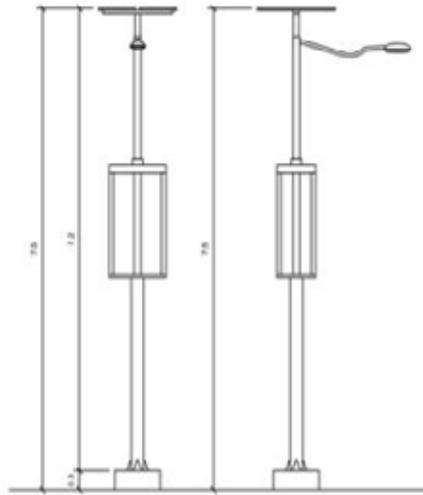


Figure 2.

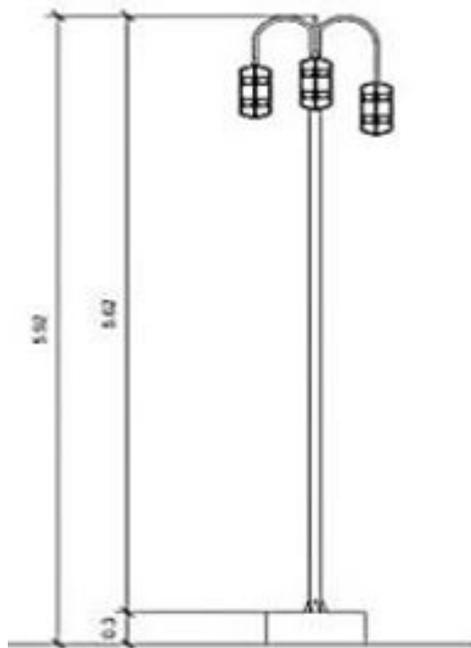


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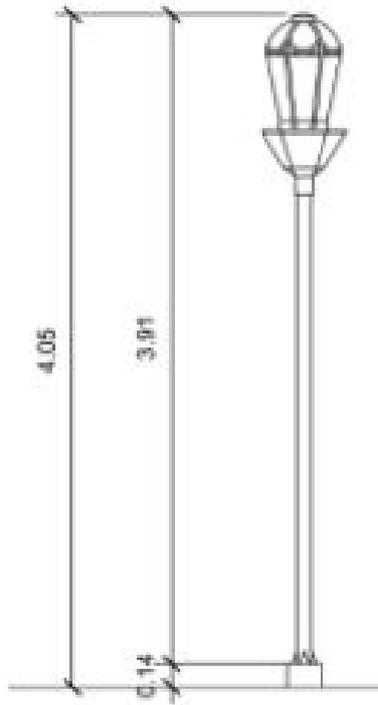


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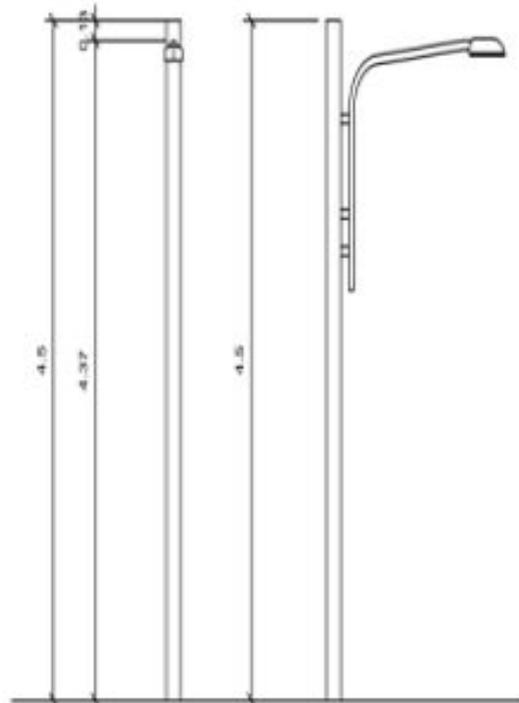


Figure 5.

General Findings:

There is a total of 315 along the stretch of España Boulevard, and only sixteen percent of them are functioning. The Table 1 also shows that more center island lamps are still in good working condition. This is probably because of its location at the middle of the boulevard, that less pilfering can be expected.

HPS/LED highway lamps also have a more units working than the solar and promenade lamps. This could also be attributed to the ergonomic design that makes the lamp more difficult to tamper with.

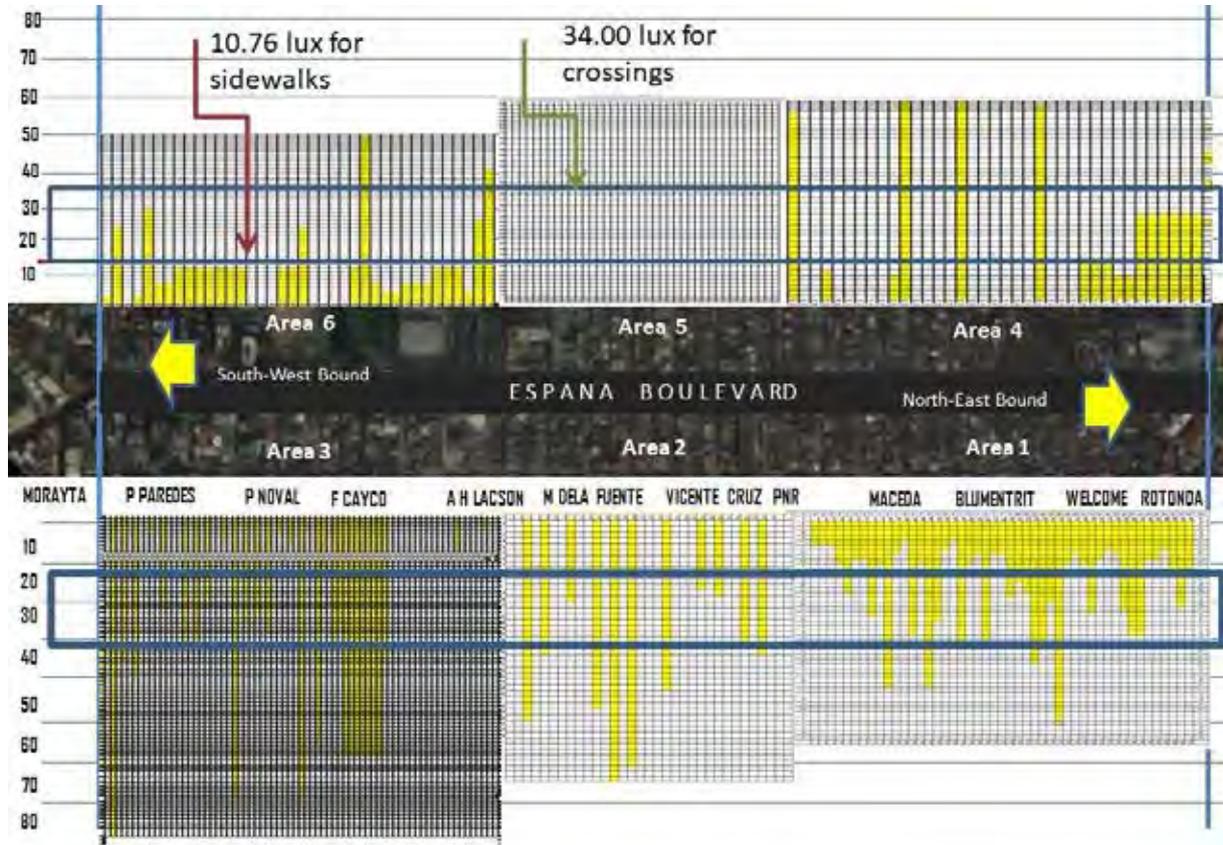


Figure 6. Illumination of Sidewalks on South-West Bound and North-East Bound of España Boulevard in Lux Units Source: Illustrated by the Author on Google Satellite Maps

The study area was divided into 6 sub-areas with Area 1 from Welcome Rotonda to Railroad Tracks at UDMC side, Area 2 is from Rail Road Tracks to A.H. Lacson, Savemore side, Area 3 from A.H. Lacson to Morayta Avenue Torre de Santo Tomas side, Area 4 from Welcome Rotonda to Railroad Tracks at Sun Residence side, Area 5 is from Rail Road Tracks to A.H. Lacson, Ramon Magsaysay side, and Area 6 from A.H. Lacson to Morayta Avenue, UST side.

The cobra-highway lampposts have four different types, with the regular lamppost, the other is attached to electrical posts, one has a shorter arm, and the last type has a pointed luminaire casing. Some of the lamps have white light which we assume as LED lamps and the others are yellow in lights which we assume as High Pressure Sodium lamps.

There are also some globe lamp posts in Area 1 at the intersection of Blumentrit Street, and some suspended lanterns at Area 3 in front of Jollibee fast food at Torre de Santo Tomas. Halogen Uplight Lamps are located in front of Sun Residences at Welcome Rotonda.

Figure 1 shows that of the 6 study areas more lampposts and intensive illumination is experienced in Area 6 which across the University of Santo Tomas. This is due to the presence of restaurants, convenience stores, dormitories and other commercial establishments.

Area 5 does not have any lamp posts working during the time of the survey, and merely shares illumination from

commercial establishments across the street and the center island lamps. Billboards also provide much needed street lighting to as much as 80 lux. The required illumination for pedestrians along commercial areas should receive at least 1 foot candle which is equivalent to 10.76 lux according to the American National Standard Practice for Roadway Lighting. In the Philippines, Housing and Land Use Regulatory Board standards merely mention street lighting at 50 meters apart, but do not prescribe the required lighting intensity for pedestrian safety and well being.

Table 2. Detailed Typology of Street Lights along España Boulevard Source: Illustrated by Jardin, P. 2018

Figure 7	Figure 8	Figure 9
SINGLE PROMENADE LAMP POST	SOLAR WITH ADVERTISEMENT PANEL	SOLAR WITHOUT ADVERTISE- MENT PANEL
Figure 10	Figure 11	Figure 12
GLOBE LAMP POST	LAMP POST (SHORT ARM)	REGULAR LAMP POST
	Figure 13	Figure 14
	LAMP POST (POINTED HOUSING)	LAMP (MOUNTED ON ELEC- TRICAL POST)
Figure 15	Figure 16	Figure 17
OVERPASS SUS- PENDED LANTERN	3-ARM PROMENADE LAMP POST	CENTER ISLAND LAMP POST

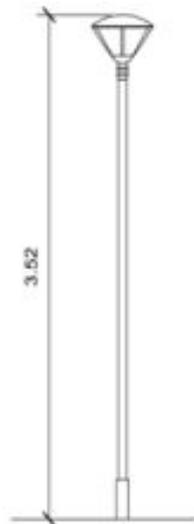


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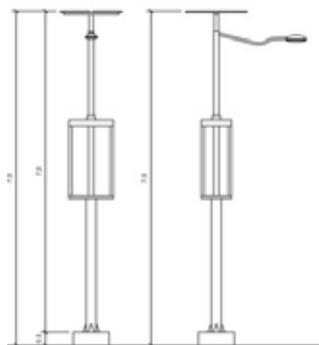


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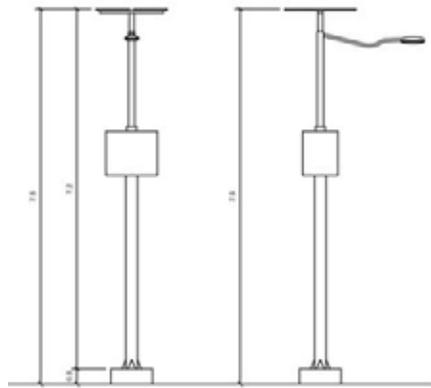


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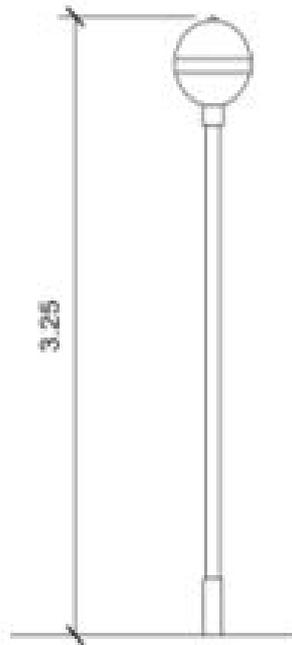


Figure 10.

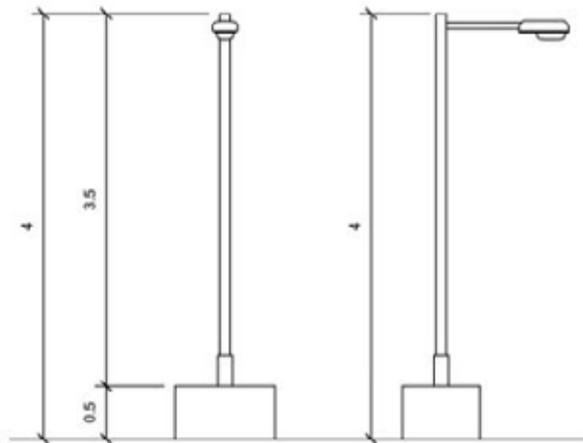


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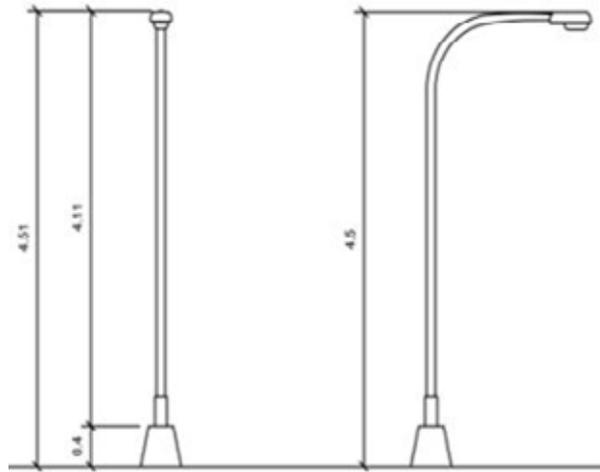


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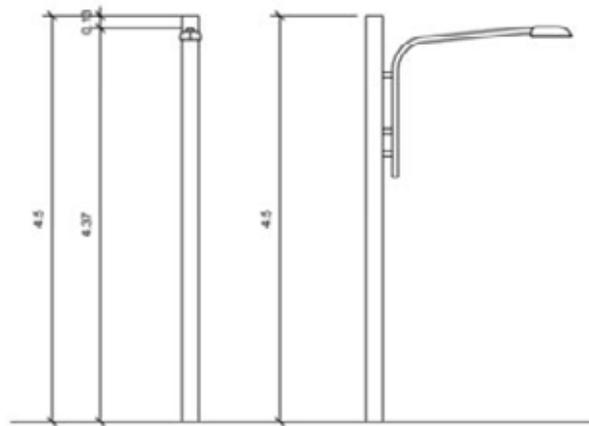


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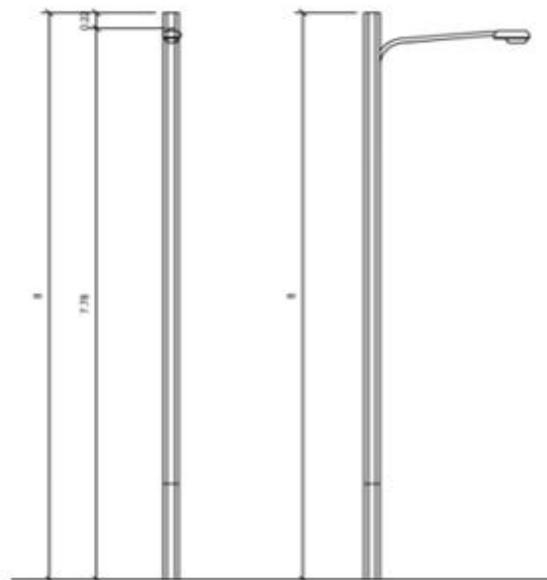


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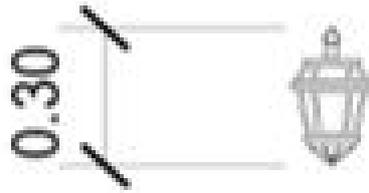


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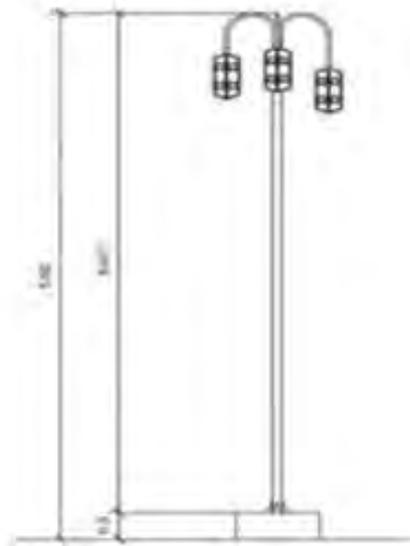


Figure 16.

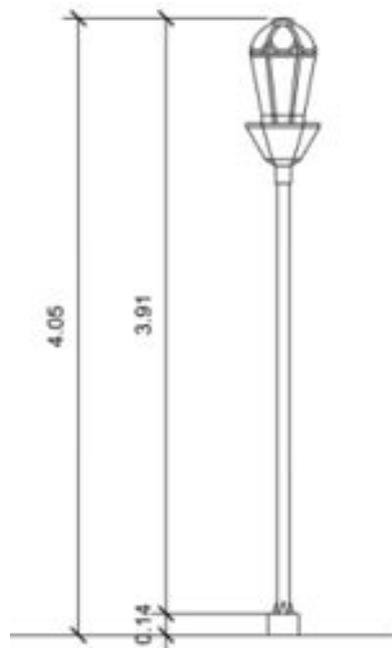


Figure 17.

The goal for environmental lighting is to achieve standards of pedestrian lighting at 10.76 lux average horizontal distance and 34 lux at intersections (TAC Australia, 2006).

Barangay leaders have noted that solar lamp post require constant maintenance to remain in good working condition. DPWH personnel also noted that the solar lamps along Espana Boulevard are not appropriated because the sun's rays are over-shadowed by tall buildings, and tree branches. Street lighting for Espana would require heavy-duty lamp posts with longer duration for maintenance. In the western cities they usually change their lamps periodically in three years to ensure that they are in good working condition.

Other possible renewable sources of energy for street lighting could be with wind harnessed from the passage of vehicles, however, slow moving traffic might not be able to sustain complete power requirements. Heavy pedestrian traffic and crime incidence in the area may prove advance mechanism vulnerable to vandalism and petty crimes. Waste to energy can also be explored as a viable power source however the technology would require specialized consultants in this endeavor.

Incidence of electrocution in the area would need to review the specifications of the lamp posts to comply with safety standards, and periodic maintenance would also have to be practiced. In other countries, warning signs are also posted on the lamp posts so that pedestrians will avoid direct contact with the street lights.

Studies also show that blue color street lights make pedestrians feels safer because they can distinguish facial features of people clearer than those with areas with yellow hues. However, studies also show that there may also be implications with too much glare caused by of LED lights.

Existing Conditions of Environmental Acoustics

Urban street noise has been widely assessed as a contributor to a multitude of health issues in the different cities of the world. Studies show that exposure to more than 70 decibels (McAlexander et al, 2015). for a prolonged period of time has significant implications to human health (Benfield, 2008). A detailed listing of observed noise levels are provided in Annex 3 -Table 6. These were measured using a decibel app that was downloaded from smartphones and observations made during the morning, noon and evening in November of 2017.

Tabulated data show the proliferation of noise along España Boulevard, a major thoroughfare that experiences heavy traffic. Critical to high level of noise would be the Rail Road area (Prudencio to Algeciras Area 5) with as high as 107 decibels in the evening, AH Lacson during the mid-day and evenings with 100 decibels in Area 3 , the Trabajo Market area in M dela Fuente and Ramon Magsaysay, with as much as 109 decibels in evening when the sidewalks are transformed by street vendors to selling areas in Area 5, the bus stop in front of UST can be as noisy as 102 decibels in the morning as shown in Area 3.

Goines and Hagler write that noise levels above 80 decibels “are associated with both an increase in aggressive behavior and a decrease in behavior helpful to others.” Depending on the duration of exposure, hearing impairment can begin at around 85 dB, “roughly equivalent to the noise of heavy truck traffic on a busy road (Goines and Hagler, 2007).

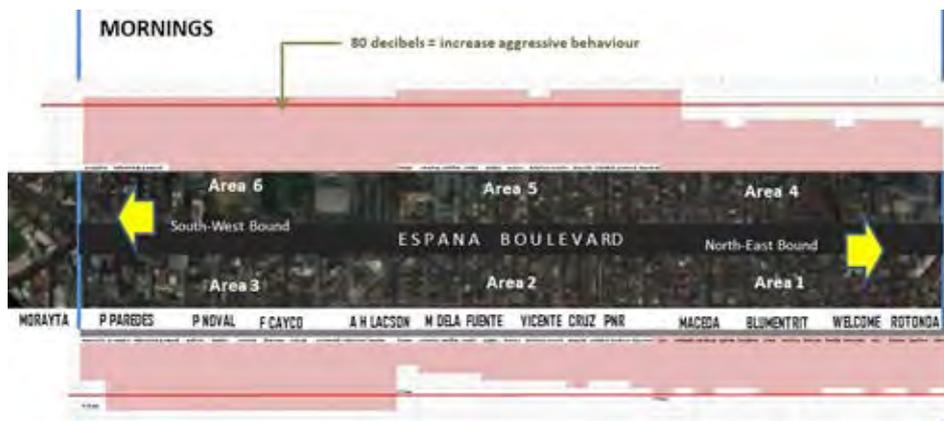


Figure 18. Sound Levels During a Weekday Survey 6am- 8am in Decibels Source: Illustrated by the Author on Google Satellite Maps

During weekday mornings from six to eight in the morning more than fifty percent of Espana Boulevard is experiencing noise that increases aggressive behavior. This is due to the morning rush for people to get to school and work on time. It is quite noticeable that even though drivers are going through a school zone, a number of them do not refrain from blowing their horns which aggravates the noise situation.

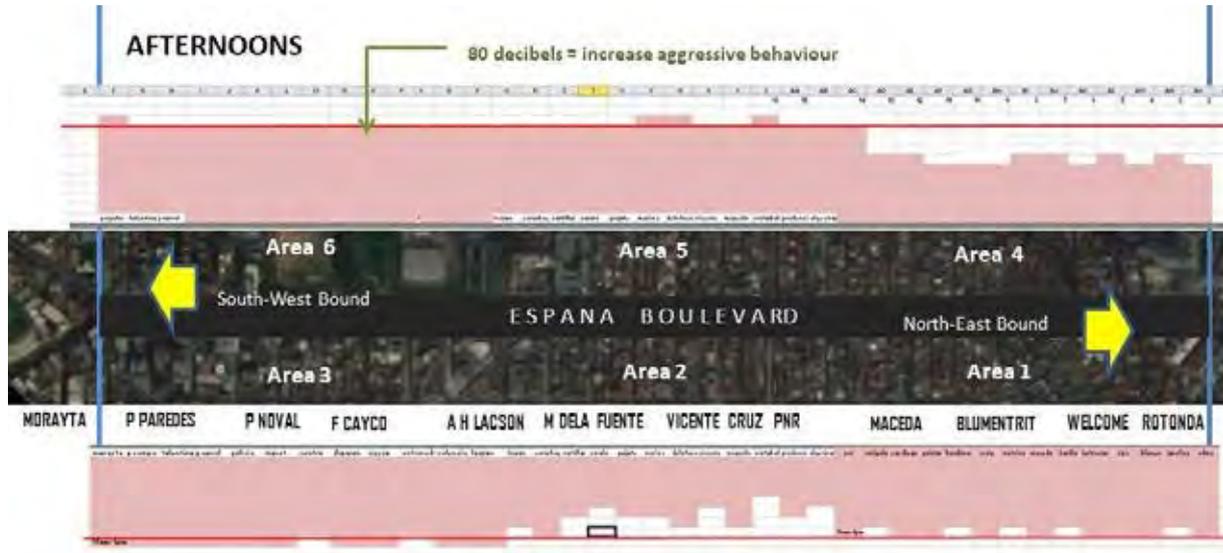


Figure 19. Sound Levels During a Weekday Survey 11am- 1pm in Decibels Source: Illustrated by the Author on Google Satellite Maps

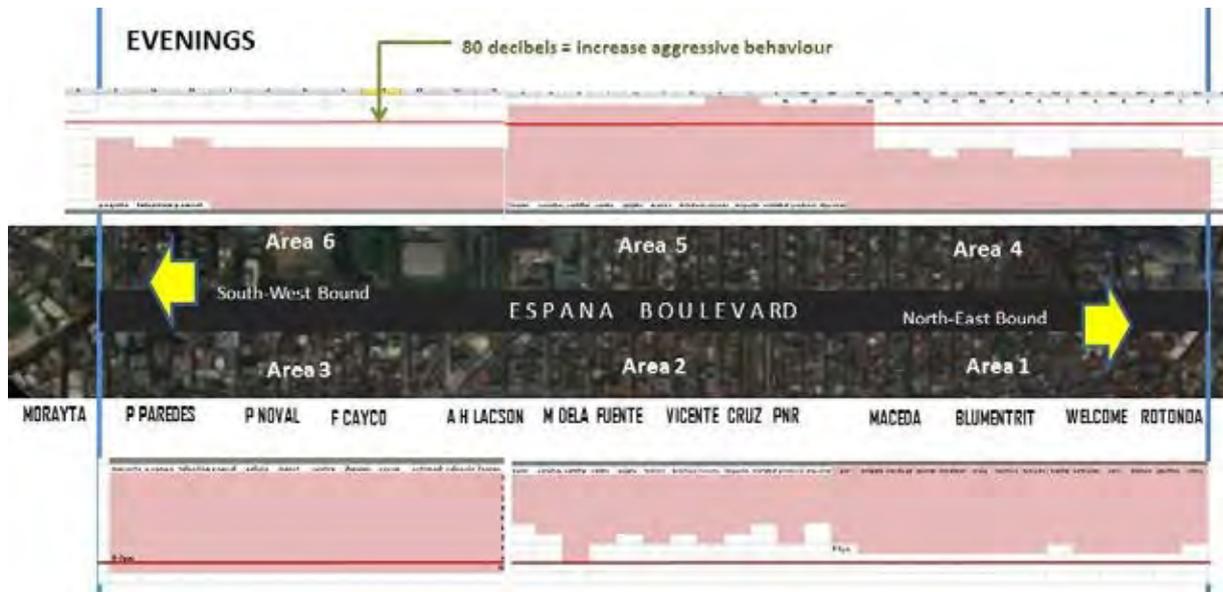


Figure 20. Sound Levels During a Weekday Survey 5pm- 7pm in Decibels Source: Illustrated by the Author on Google Satellite Maps

Afternoons on weekdays are similar to the morning situation with noise levels making little difference. Evenings however appear to be quieter as the school day and workday ends

## 2. A multi-sector approach in addressing environmental lighting and acoustics to address pedestrian safety and community at the local level

Pedestrian needs and goals

The goal for environmental lighting is to achieve standards of pedestrian lighting at 10.76 lux average horizontal

distance and 34 lux at intersections. Environmental acoustics require lesser than 80 decibels urban noise throughout the day.

Multi-sector approach an inventory of resources

Focus Group Discussions were held to engage community and agency leaders in the different sectors from September 2016 to July 2017, that was facilitated in the Planning subjects of Third Year and Fourth Year students of the College of Architecture.

Of the different sector leaders and stakeholders it was suggested by DPWH District Engineer Medel Chua, that a detailed program of activities and a Master plan for the development of España Boulevard should be drafted to guide future projects within the study area.

A resource person on Media Relations would have to be identified, at the moment we are proposing an interactive website to engage a wider reach of stakeholders to participate in the proposed activities and projects. A study webpage on Facebook is currently being developed to organize the different contents that will be included in the webpage. The webpage's tag line is "LOVE BIG BIG" which stands for Loop of Vibrant Espana Barangays, Inter Government agencies and Businesses Improvement Group.

A memorandum of understanding has been signed between the researcher, DPWH and City Councilor Atty. Wardee Quintos on collaborative studies on this research

Pedestrian Traffic That Is Affected By Lighting and Acoustics in The City Of Manila

Pedestrian traffic was calculated based on research gathered from interviews and barangay profiles that were collected from the respective barangays and the Barangay Bureau of the City of Manila. This shows that almost a hundred thousand people are directly affected by the conditions along España Boulevard.

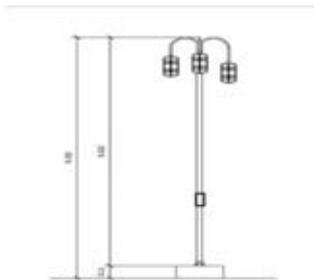


Figure 21. Provide Safety Warning on Lampposts Source: Re-illustrated by Author, 2018



Figure 22. Safety Warning on Lampposts Source: Photo by the Author of lamppost along Wexford Heights Business Improvement Area, Toronto 2017

Design Initiatives

Environmental Lighting

Street lighting is part of the identity of urban places like Espana Boulevard the city of Manila. Lampposts are integral in placemaking and placemarking cities that make each experience uniquely memorable.

Academicians have expressed concerns on installing more modern designs of the lampposts which appear to be not in theme with the “historical theme “of the boulevard, similar to installation of solar lamp posts which did not last long too.

Because of poor maintenance of lampposts these may have been the cause of electrocution of some pedestrians during rainy weather. Periodic maintenance should be observed considering some of the lampposts have existed for more than seven years. In cities like New York and Toronto, lampposts are maintained every three years periodically including the change of luminaires.

In the city Barcelona, lampposts are equipped with sensors, to unnecessary exposure to LED lights. Medical studies have shown that although LED lights are cost efficient, there are also implications in one’s health for being exposed too long.

Lighting innovations today harness alternative forms of energy. While the attempt to harness solar energy was shortly outlived, other possibilities should still be explored. In Malvern Hills, England, they are now using dog poo to power street lamps. Ten bags of dog poo will power two hours of lighting.



Figure 23. UK’s First Dog-Poo Powered Streetlamp Photograph by Nic Fleming

Source:<https://www.theguardian.com/environment/2018/jan/01/stools-to-fuels-street-lamp-runs-on-dog-poo-bio-energy-waste>

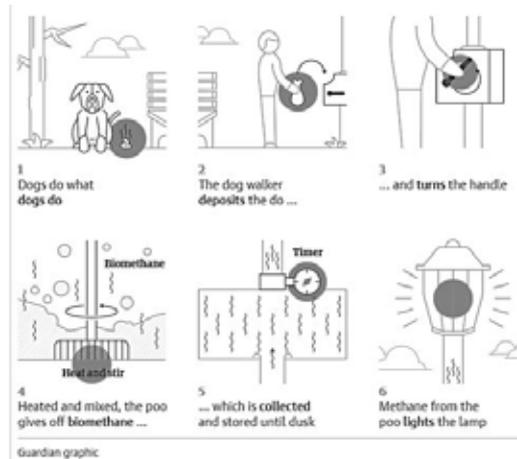


Figure 24. How 10 bags of Poo Could Give Two Hours of Light Graphic by Guardian Source: <https://www.theguardian.com/environment/2018/jan/01/stools-to-fuels-street-lamp-runs-on-dog-poo-bio-energy-waste->

Environmental Acoustics

Bio-acoustics can decrease noise from around 10 decibels to as much as 30 decibels with dense foliage. Greeneries not only reduce noise, but they also filter air pollution and lessen urban heat island effect.



Figure 25. Photo by De Guzman, Manzo, et al. Existing Waiting Shed across Ramon Magsaysay High school



Figure 26. Image by De Guzman, Manzo, et al. Proposed Interventions of hedges on plants boxes and road median with low trees



Figure 27. Image by Naraja, Gallardo et al. Urban Farming at Existing Plant Boxes can bring the Community Together with Shared Resources



Figure 28. Images by De Vera, Geronimo, et al. Integrating green architecture such as green walls and grasspavers can also alleviate the noise situation in the community.

### **3. Conclusion**

#### **3.1. Environmental Lighting**

In first world countries like the US and Canada, there are clear standards on roadways and pedestrian sidewalk illumination that promote safe communities. In the Philippines, the Housing and Land Use Regulatory Board (HLURB) PD 957, merely stipulates a 50-meter distance of lampposts for illumination along roadways.

There is a pressing need to provide pedestrian lighting along the stretch of España Boulevard where most of the lighting systems are now not functioning. This affects the safety of the predominantly younger generation pedestrians who are easily preyed on by untoward incidents.

As of to date the University of Santo Tomas has increased the hours of lighting of its perimeter luminaires. In an interview by the students in November 2016, the perimeter lighting was only turned on during special occasions such as Paskuhan and Holy Week before. However, since commencement of this research, a number of stakeholders have taken positive action to address the lack of lighting in the area. Academicians have also expressed their desire to keep the historical theme in design of the street lamps.

Manila City Government has also tried to revive the solar street lights by feeding the lamps regular electricity, but had not been successful in this attempt. Ramon Magsaysay High School has now better perimeter lighting which also adds illumination on the sidewalks. The Promenade Lamps in front of the University have also been revived but still seem insufficient.

The Center Island Lamps have already been a trademark of España's identity along with the Promenade lamps they are best to be maintained and retrofitted to conserve existing possible resources. The Solar Lamps however are best suited in areas that are more accessible for regular maintenance such as municipal and barangay roads.

There are currently on-going improvements to install LED streetlamps which have been proven to be more cost efficient for densely populated areas.

#### **3.2. Environmental Acoustics**

Multiple researches have also been written on the effects of environmental lighting and acoustics on community perception. Data gathered in this research show that lack of available lighting systems and regulations on urban noise may affect the willingness of pedestrians and the community to be pro-active and participative in their society. Furthermore urban noise exceeds the 80 decibel benchmark of comfort that can manifest aggressive behavior to those exposed for a long period of time.

Strict enforcement of the traffic rules should be enforced to mitigate unnecessary blowing of horns in school zones, and observance of designated traffic lanes for public utility vehicles, motorcycles and turning vehicles. Green architecture, public benefit features incentives can be awarded by the local government to also mitigate noise in the community.

As urban settlements have continued to grow and agglomerate into mega-cities, there is a clamor for more responsive systems to support non-motorized forms of transportation for sustainable and low carbon emission lifestyles. Good street lighting and acoustics will encourage more people to walk which is best for local businesses and engaging communities.

### **4. References**

1. Maksimowski, Sophie. "Pedestrian Sundays and community well-being in Kensington Market, Toronto" ICASP Think Piece. December 2013. [improvcommunity.ca/sites/improvcommunity.ca/files/research\\_collection/1066/pedestrian\\_sundays.pdf](http://improvcommunity.ca/sites/improvcommunity.ca/files/research_collection/1066/pedestrian_sundays.pdf)
2. City of Okingpara South Australia. "Community Wellbeing Framework". Community Wellbeing Monitor Trending Report #2. August 29 2012. p. 2.

[onkapingacity.com/monitor/Community%20Wellbeing%20Monitor%20Trending%20Report%202.pdf](http://onkapingacity.com/monitor/Community%20Wellbeing%20Monitor%20Trending%20Report%202.pdf)

3. Comiskey, Ann M. "Macomb County Prevention Coalition Meeting December 17, 2009" Troy Community Coalition. December 17, 2009. p. 11. [mcosa.net/www/SPF.../Ann%20Comiskey%20Presentation.ppt](http://mcosa.net/www/SPF.../Ann%20Comiskey%20Presentation.ppt)
4. Sauler, Ericka. "Manila's '10,000 solar lamps' project sees first light". Inquirer.Net. January 19, 2014. [newsinfo.inquirer.net/565821/manilas-10000-solar-lamps-project-sees-first-light#ixzz4oQgan0qc](http://newsinfo.inquirer.net/565821/manilas-10000-solar-lamps-project-sees-first-light#ixzz4oQgan0qc)
5. Brizuela, Maricar. South Korea Company installs more street lights in Manila. Inquirer.Net. February 18, 2014. [newsinfo.inquirer.net/578837/south-korea-company-installs-more-street-lights-in-manila#ixzz4oQiq6GDN](http://newsinfo.inquirer.net/578837/south-korea-company-installs-more-street-lights-in-manila#ixzz4oQiq6GDN)
6. -, Lagalag. "España Boulevard Circa 2011". Directions on Web. June 3, 2011. [directionsonweb.blogspot.ca/2011/06/espana-boulevard-circa-2011.html](http://directionsonweb.blogspot.ca/2011/06/espana-boulevard-circa-2011.html)
7. Ibid
8. Whelan, M. and DeLair, Rick. The Miracle of Electricity and Engineering. The Edison Tech Center. 2013.. [edisontechcenter.org/SodiumLamps.html](http://edisontechcenter.org/SodiumLamps.html)
9. McLean,-. Transport Accident Commission of Australia Roadway Pedestrian Illuminance Levels for Sidewalks, Guide for the Design of Roadway Lighting. 2006. [sunshinecoastronomy.files.wordpress.com/2015/01/dmd-roadway-lighting.pdf](http://sunshinecoastronomy.files.wordpress.com/2015/01/dmd-roadway-lighting.pdf)
10. McLean,-. Transport Accident Commission Intersection Lighting. Guide for the Design of Roadway Lighting. 2006. [sunshinecoastronomy.files.wordpress.com/2015/01/dmd-roadway-lighting.pdf](http://sunshinecoastronomy.files.wordpress.com/2015/01/dmd-roadway-lighting.pdf)
11. McAlexander,-, Gershon,-, and Neitzel,-. Street-level noise in an urban setting: assessment and contribution to personal exposure. Environmental Health, BioMed Central. 2015. [ncbi.nlm.nih.gov/pmc/articles/PMC4350859/](http://ncbi.nlm.nih.gov/pmc/articles/PMC4350859/)
12. Benfield, -. Just How Bad Is Noise Pollution for Our Health? City Lab. 2012. [citylab.com/design/2012/05/just-how-bad-noise-pollution-our-health/2008/](http://citylab.com/design/2012/05/just-how-bad-noise-pollution-our-health/2008/)
13. Goines, -, and Hagler, -, Noise Pollution: A Modern Plague. Southern Medical Journal. Volume 100: March 2007, pages 287-294. [nonoise.org/library/smj/smj.htm](http://nonoise.org/library/smj/smj.htm)