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Codes and Standards Enhancement (CASE) Initiative

2019 California Building Energy Efficiency Standards

Outdoor Lighting Power Allowances – Final Report

Measure Number: 2019-NR-LIGHT1-F

Nonresidential Lighting

August 2017

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EXECUTIVE SUMMARY

Introduction

The Codes and Standards Enhancement (CASE) initiative presents recommendations to support California Energy Commission's (Energy Commission) efforts to update California's Building Energy Efficiency Standards (Title 24, Part 6) to include new requirements or to upgrade existing requirements for various technologies. The four California Investor Owned Utilities (IOUs) – Pacific Gas and Electric Company, San Diego Gas and Electric, Southern California Edison, and SoCalGas® – and two Publicly Owned Utilities (POUs) – Los Angeles Department of Water and Power and Sacramento Municipal Utility District – sponsored this effort. The program goal is to prepare and submit proposals that will result in cost-effective enhancements to improve energy efficiency and energy performance in California buildings. This report and the code change proposals presented herein is a part of the effort to develop technical and cost-effectiveness information for proposed requirements on building energy efficient design practices and technologies.

The Statewide CASE Team submits code change proposals to the Energy Commission, the state agency that has authority to adopt revisions to Title 24, Part 6. The Energy Commission will evaluate proposals submitted by the Statewide CASE Team and other stakeholders. The Energy Commission may revise or reject proposals. See the Energy Commission's 2019 Title 24 website for information about the rulemaking schedule and how to participate in the process: http://www.energy.ca.gov/title24/2019standards/.

Measure Description

This proposed code change is an update to lighting power allowances (LPAs) for all outdoor applications. It saves energy by extending the use of high efficacy light emitting diode (LED) technology as the basis for LPA calculations for all outdoor areas (Table 140.7-A and Table 140.7-B), which reduces the LPAs. Table 140.7-A (General Hardscape) was updated based on LED performance levels during the 2016 code cycle, however, most changes to Table 140.7-B (Specific Applications) were rejected due to the individual line items not being cost-effective. LED efficacy has continued to grow and costs have continued to drop; all line items in Table 140.7-B are now cost-effective.

In addition to evaluating energy efficiency, the Statewide CASE Team considered lighting performance criteria that affects installation decisions. For example, the Statewide CASE Team received feedback from multiple stakeholders that it was important for warm correlated color temperature (CCT) luminaires in the range of 3000 degrees Kalvin (K) to be able to meet the new LPAs. In addition to stakeholder feedback, there has been a shift in outdoor lighting design towards warmer CCTs in recent years, and many local governments have installed warm CCT outdoor luminaires (3000K to 4000K). As a result, the Statewide CASE Team developed new LPAs that can be met by 3000K luminaires.[1] The Statewide CASE Team has not observed any significant momentum towards installations below 3000K.

[1] This code change does not require 3000K luminaires to be used to meet the LPAs; it ensures that luminaires with CCTs as low as 3000K can be used. Cooler CCT luminaires (CCTs higher than 3000K) have higher efficacies and can therefore be used and meet the new LPAs as well.

Scope of Code Change Proposal

Table 1 summarizes the scope of the proposed changes and which sections of the Standards, Reference Appendices, Alternative Calculation Manual (ACM) Reference Manual, and compliance documents that will be modified as a result of the proposed change.

Table 1: Scope of Code Change Proposal

Measure Name	Type of Requirement	Modified Section(s) of Title 24, Part 6	Modified Title 24, Part 6 Appendices	Will Compliance Software Be Modified	Modified Compliance Document(s)
Reduction of nonresidential outdoor LPAs	Prescriptive	Section 140.7	None	No	None

Market Analysis and Regulatory Impact Assessment

This proposal is cost-effective over the 15-year period of the analysis. Overall, this proposal increases the wealth of the State of California. California consumers and businesses save more money on energy and routine maintenance than they spend for financing the efficiency measure. The proposed changes to Title 24, Part 6 have a negligible impact on the complexity of the Standards or the cost of enforcement.

Cost-Effectiveness

The proposed code change was found to be cost-effective for all climate zones where it is proposed to be required. The benefit-to-cost (B/C) ratio compares the lifecycle benefits (cost savings) to the lifecycle costs. Measures that have a B/C ratio of 1.0 or greater are cost-effective. The larger the B/C ratio, the faster the measure pays for itself from energy savings. The proposed requirements are cost effective with very high B/C ratios. The B/C ratio is different for each application within the proposed measure. For certain applications, incremental costs are zero or negative, which means that application is immediately cost-effective.[2] See Section 5 for a detailed description of the cost-effectiveness analysis.

Statewide Energy Impacts

Table 2 shows the estimated energy savings over the first twelve months of implementation of the proposed code change. See Section 6 for more details.

[2] The higher the B/C ratio, the faster a measure pays for itself. If a measure has an infinite B/C ratio, it means that there is no incremental cost (or a negative incremental cost) and the measure is instantly cost-effective.

Table 2: Estimated Statewide First-Year[a] Energy and Water Savings

Measure	First-Year Electricity Savings (GWh/yr)	First-Year Peak Electrical Demand Reduction (MW)	First-Year Water Savings (million gallons/yr)	First-Year Natural Gas Savings (million therms/yr)
General Hardscape (subtotal)	**59.52**	**1.00**	**N/A**	**N/A**
New Construction	15.08	0.25	N/A	N/A
Additions and Alterations	44.44	0.75	N/A	N/A
Specific Applications (subtotal)	**58.43**	**1.36**	**N/A**	**N/A**
New Construction	14.75	0.34	N/A	N/A
Additions and Alterations	43.68	1.02	N/A	N/A
TOTAL	**117.95**	**2.37**	**N/A**	**N/A**

a. First-year savings from all permitted outdoor lighting projects completed statewide in 2020 – including both new construction and alterations.

Compliance and Enforcement

The Statewide CASE Team worked with stakeholders to develop a recommended compliance and enforcement process and to identify the impacts this process will have on various market actors. The compliance process is described in Section 2.5. The impacts the proposed measure will have on various market actors are described in Section 3.3 and Appendix B. The key issues related to compliance and enforcement are summarized below:

- The structure of the code requirements will stay the same with mostly changes to the numbers in tables 140.7-A and 140.7-B.
- The LPA requirements in Table 140.7-A will be easier to interpret as the different requirements for asphalt versus concrete parking lots have their own columns in the table. The current standard has the requirements for concrete hardscapes for Lighting Zone (LZ) 2 and LZ3 in the footnote to the table.
- An LPA multiplier for narrow band spectrum light sources has been added to Table 140.7-A to accommodate the needs of environmentally sensitive areas.

Although a needs analysis has been conducted with the affected market actors while developing the code change proposal, the code requirements may change between the time the final CASE Report is submitted and the time the 2019 Standards are adopted. The recommended compliance process and compliance documentation may also evolve with the code language. To effectively implement the adopted code requirements, a plan should be developed that identifies potential barriers to compliance when rolling-out the code change and approaches that should be deployed to minimize the barriers.

1. INTRODUCTION

The Codes and Standards Enhancement (CASE) initiative presents recommendations to support California Energy Commission's (Energy Commission) efforts to update California's Building Energy Efficiency Standards (Title 24, Part 6) to include new requirements or to upgrade existing requirements for various technologies. The four California Investor Owned Utilities (IOUs) – Pacific Gas and Electric Company, San Diego Gas and Electric, Southern California Edison and SoCalGas® – and two Publicly Owned Utilities (POUs) — Los Angeles Department of Water and Power and Sacramento Municipal Utility District sponsored this effort. The program goal is to prepare and submit proposals that will result in cost-effective enhancements to energy efficiency in buildings. This report and the code change proposal presented herein is a part of the effort to develop technical and cost-effectiveness information for proposed requirements on building energy efficient design practices and technologies.

The Statewide CASE Team submits code change proposals to the Energy Commission, the state agency that has authority to adopt revisions to Title 24, Part 6. The Energy Commission will evaluate proposals submitted by the Statewide CASE Team and other stakeholders. The Energy Commission may revise or reject proposals. See the Energy Commission's 2019 Title 24 website for information about the rulemaking schedule and how to participate in the process: http://www.energy.ca.gov/title24/2019standards/.

The overall goal of this CASE Report is to propose a code change proposal for outdoor lighting power allowances (LPAs). The report contains pertinent information supporting the code change.

When developing the code change proposal and associated technical information presented in this report, the Statewide CASE Team worked with a number of industry stakeholders including building officials, manufacturers, builders, utility incentive program managers, Title 24 energy analysts, and others involved in the code compliance process. The proposal incorporates feedback received during a public stakeholder workshop that the Statewide CASE Team held on September 8, 2016 and March 30, 2017.

Section 2 of this CASE Report provides a description of the measure and its background. This section also presents a detailed description of how this change is accomplished in the various sections and documents that make up the Title 24, Part 6.

Section 3 presents the market analysis, including a review of the current market structure. Section 3.2 describes the feasibility issues associated with the code change, including whether the proposed measure overlaps or conflicts with other portions of the building standards such as fire, seismic, and other safety standards and whether technical, compliance, or enforceability challenges exist.

Section 4 presents the per-unit energy, demand, and energy cost savings associated with the proposed code change. This section also describes the methodology that the Statewide CASE Team used to estimate energy, demand, and energy cost savings.

Section 5 presents the lifecycle cost and cost-effectiveness analysis. This includes a discussion of additional materials and labor required to implement the measure and a quantification of the incremental cost. It also includes estimates of incremental maintenance costs. That is, equipment lifetime and various periodic costs associated with replacement and maintenance during the period of analysis.

Section 6 presents the statewide energy savings and environmental impacts of the proposed code change for the first year after the 2019 Standards take effect. This includes the amount of energy that will be saved by California building owners and tenants, and impacts (increases or reductions) on material with emphasis placed on any materials that are considered toxic. Statewide water consumption impacts are also considered.

Section 7 concludes the report with specific recommendations with ~~strikeout~~ (deletions) and underlined (additions) language for the Standards, Reference Appendices, Alternative Calculation Manual (ACM) Reference Manual, Compliance Manual, and Compliance Documents.

2. MEASURE DESCRIPTION

2.1 Measure Overview

Exterior lighting accounts for at least eight percent of total commercial lighting energy use (and likely more), which equates to approximately three terawatt hours annually in California (Meyer 2011). This code change proposal would result in significant energy savings by dropping the LPAs for outdoor lighting in new construction and alteration projects.

The proposed code change will impact the prescriptive requirements for outdoor lighting by reducing the LPAs in Table 140.7-A (General Hardscape) and Table 140.7-B (Specific Applications). It is not anticipated that sections of the Reference Appendices or Alternative Calculation Method (ACM) Reference Manuals will be revised.

This proposal was developed using a similar method to what was used in previous code cycles. The current LPA requirements (2016 Title 24, Part 6) are used as a base case for the analyses presented in this report. The 2016 Nonresidential Outdoor Lighting Power Allowance CASE Study, which describes the methodology for the 2016 code cycle is available on the Energy Commission's website.[3] The key differences between the 2016 LPA requirements and the LPA requirements proposed for this code cycle include:

- Proposed technology used to establish the 2019 LPAs is based on luminaires that are cost-effective at the time of the analysis. Costs are expected to continue to decline before the effective date of the standards.
- The efficacies of the products used to develop the 2016 LPAs have been updated for all the major applications that fall under the scope of Table 140.7-A and Table 140.7-B. The standards analysis accounts for typical high-performance equipment, lumen depreciation, equivalent luminaire lumen output comparisons between legacy and LED products, maintenance costs, and the expected lifespan of the products.
- Target illumination levels are based upon current Illuminating Engineering Society (IES) published "Recommended Practice" (RP) documents that set light level guidelines for outdoors spaces, and other industry standards for all target illuminance levels.
- There is a growing body of literature that points to blue-rich light at night is disturbing circadian function for people and animals. Though the results are not fully conclusive, the Statewide CASE Team has developed proposed standards levels based on "warmer" correlated color temperatures (CCTs) (3000K) to align with a growing number of specifications for lower CCTs. Additionally, a number of stakeholders expressed interest in ensuring the new LPAs can be met with 3000K luminaires; the Statewide CASE Team took this into consideration as well when developing the new LPAs.
- In addition to basing proposed standards levels based on 3000K luminaires, the Statewide CASE Team has developed a multiplier for general hardscape that allows the use of narrow band, 580 nanometers (nm) or greater, light sources. These narrow band spectrum light sources

[3] http://www.energy.ca.gov/title24/2016standards/prerulemaking/documents/2014-06-24_workshop/final_case_reports/2016_T24_CASE_Report-Outdoor_LPA-Dec_2014-V3.pdf

have a narrow spectrum band (e.g., only include red light), but they are less efficacious than 3000K luminaires and are only used in environmentally sensitive areas such as sea turtle nesting sites and observatories. The development of this multiplier was based on needs described by stakeholders. The Statewide CASE Team reached out to the International Dark-Sky Association (IDA) to gather additional information and received a similar sentiment describing a need for spectral tuning for environmentally sensitive areas. In the past, low pressure sodium lamps were the only available option for environmentally sensitive areas, but advances in technology are allowing for specific spectral outputs to be used. IDA suggested that allowing the use of narrow band spectrum light sources will be more beneficial than simply allowing warm or "amber" light sources since new research is showing that different narrow bands of light are beneficial to different species. IDA also suggested the multiplier will encourage more research into which specific spectral values will be most beneficial to different sensitive species.

The proposed changes to the outdoor LPAs are based upon the following underlying market factors:

- The Energy Independence and Security Act of 2007 and the California Appliance Efficiency Standards (Title 20) requirements for metal halide lamp luminaires (effective 2015) have driven innovation. Manufacturers are discontinuing probe start metal halide products and less-efficient pulse start metal halide products and increasing production of high-efficacy LED products.
- The efficacies for LED luminaires used in outdoor applications have increased in the past three years.
- The cost of LED luminaires for outdoor lighting has dropped significantly.
- There is a growing consensus that the illuminance requirements for outdoor hardscapes (covered by the requirements in Title 24, Part 6 Table 140.7-A) in IES RP-20-14 may be higher than needed, and they do not account for lighting zones appropriately. Changes to RP-20-14 are currently being considered. If the RP-20 requirements are updated before the 2019 Standards are adopted, the LPA values for Table 140.7-A can be modified to align with the revised RP-20 recommendation. However, the current RP-20-14 was used to develop the LPAs presented in this report.

To support the RP-20 recommended practice development process, the Virginia Tech Transportation Institute is conducting a critical task analysis to determine what is necessary for vehicles and pedestrians to navigate safely in parking lots. The research will determine luminance contrast ratios and spectral analysis required for safe navigation in parking lots. The goal is for the research to be completed in time to inform the RP-20 recommended practice. The Statewide CASE Team is hopeful that the final RP-20 recommended practice will be informed by Virginia Tech's research and the RP-20 recommended practice will be finalized in time to make adjustments, as appropriate, to the proposed Title 24, Part 6 LPA requirements before the 2019 Standards are adopted in May 2018.

2.2 Measure History

Almost all of the LPAs in Table 140.7-B for specific applications (applications other than hardscape) have not been updated since the 2008 Title 24, Part 6 code cycle. With 11 years of progress in light source and luminaire efficacy, Table 140.7-B is ready for dramatic decreases in LPAs.

The LPAs in Table 140.7-A for hardscape illumination were updated for the 2016 Standards, using light levels based on the IES RP-20-14. Since the last code cycle, the efficacies for LEDs used for hardscape illumination have increased while the cost for LEDs has dropped (Energy 2016) (U.S. Department of Energy 2016). The United States Department of Energy (DOE) estimates that LED prices for outdoor applications (area and roadways, parking lots, garages, and building exteriors) will drop by approximately 36 percent from 2016 to 2020 (U.S. Department of Energy 2016). These changes represent potential additional energy savings for hardscape illumination.

2.3 Summary of Proposed Changes to Code Documents

The sections below provide a summary of how each Title 24, Part 6 documents will be modified by the proposed change. See Section 7 of this report for detailed proposed revisions to code language.

2.3.1 Standards Change Summary

This proposal will modify the following sections of the Building Energy Efficiency Standards as shown below. See Section 7.1 of this report for the detailed proposed revisions to the code language.

SECTION 100.1 – DEFINITIONS AND RULES OF CONSTRUCTION

Narrow Band Spectrum: is a limited range of wavelengths (nm) concentric to a dominant peak wavelength in the visible spectrum. The limited range of wavelengths shall be within 20 nm on either side of the peak wavelength at 50 percent of the peak wavelength's relative spectral power, and within 75 nm on either side of the peak wavelength at 10 percent of the peak wavelength's relative spectral power.

SECTION 130.2(b) – OUTDOOR LIGHTING CONTROLS AND EQUIPMENT

(b): The language in this section removes ambiguous language that guides the application of backlight/uplight/glare (BUG) ratings per IES RP-15-11 Addendum A to outdoor luminaires and modifies language so BUG rating requirement now apply to lower-wattage outdoor luminaires.

SECTION 140.7 – REQUIREMENTS FOR OUTDOOR LIGHTING

Table 140.7-A: This table includes modified LPA values and adds separate columns for asphalt and concrete for Lighting Zone (LZ 2) and 3. The values for concrete used to exist in a footnote, but have now been added to the table itself. Footnote 2 has been edited appropriately. Footnote 3 is a multiplier to be used for narrow band spectrum light sources where required by local and state laws. The multiplier doubles the LPA values to allow the use of the less efficacious narrow band spectrum light sources where required for environmentally sensitive areas – observatories and habitats for sensitive nocturnal animals.

Table 140.7-B: This table includes modified LPA values. During the 2016 code cycle, lower LPAs for this table were rejected due to cost-effectiveness concerns (with a few exceptions). The updated LPA values are expected to reduce nighttime electricity use and replace pulse-start metal halide (PSMH) and fluorescent sources with LED as the light source used for LPA calculations. New lower LPAs are proposed for some applications that were accepted in the 2016 code cycle as well, since the efficacy of LED products for outdoor applications improved.

2.3.2 Reference Appendices Change Summary

The proposed code change is not expected to modify the appendices of the standards.

2.3.3 Alternative Calculation Method (ACM) Reference Manual Change Summary

The proposed code change is not expected to modify the Nonresidential ACM Reference Manuals.

2.3.4 Compliance Manual Change Summary

The proposed code change requires revisions to Section 6 of the Nonresidential Compliance Manual. If the proposal is accepted, the Energy Commission will need to update the values in the examples and tables representing General Hardscape LPAs and Specific Application LPAs.

2.3.5 Compliance Documents Change Summary

Compliance document NRCC-LTO-03-E will need to be revised to account for different LPAs between asphalt and concrete for Table 140.7-A General Hardscape.

2.4 Regulatory Context

2.4.1 Existing Title 24, Part 6 Standards

Exterior lighting power is already regulated in the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90.1, ASHRAE 189.1, and Title 24, Part 6. This code change increases stringency of existing exterior LPAs in Title 24, Part 6.

2.4.2 Relationship to Other Title 24 Requirements

No other portions of Title 24, Part 6 are expected to be directly affected by this code change. There is some overlap with the Title 24, Part 6 code change proposal for outdoor lighting controls, but only because both deal with exterior lighting. The potential savings associated with the reduction of lighting power allowances is impacted by the improvements to controls requirements.

2.4.3 Relationship to State or Federal Laws

There are existing Title 20 and federal standards for outdoor lighting products. Specifically, the Statewide CASE Team has considered the existing Title 20 and federal standards related to efficiencies for metal halide luminaires and the impact of these standards on efficacy trends for the baseline outdoor lighting products. However, this proposal changes allowable outdoor lighting power levels for specific area types and does not set efficiency requirements for individual lighting products.

2.4.4 Relationship to Industry Standards

The proposed LPAs were developed with IES recommended light levels used as the minimum for modeling. IES is currently considering updates to its lighting recommendations in RP-20-14 (parking lot and garage lighting), thus the proposed measure will need to take the new illumination levels into consideration if adopted. The RP-20 revision adoption may come too late for 2019 Title 24, Part 6 to consider. In the meantime, this measure uses the current RP-20-14 levels for modeling the proposed LPAs.

2.5 Compliance and Enforcement

The Statewide CASE Team collected input during the stakeholder outreach process on what compliance and enforcement issues may be associated with these measures. This proposed code change is not expected to update the compliance documents for outdoor lighting LPAs or the compliance methods. The proposed code change makes an adjustment to existing requirements. The Statewide CASE Team does not expect there to be any compliance and enforcement challenges or issues. The Statewide CASE Team has interviewed stakeholders to identify potential barriers to code compliance and enforcement. This proposed code change is expected to update the compliance document NRCC-LTO-03-E to account for different LPAs between asphalt and concrete for Table 140.7-A General Hardscape. The proposed code change is not expected to change the compliance methods. The proposed code change makes an adjustment to existing requirements. The Statewide CASE Team does not expect there to be any compliance and enforcement challenges or issues. The Statewide CASE Team has interviewed stakeholders to identify potential barriers to code compliance and enforcement. Appendix B presents a detailed description of how the proposed code changes could impact various market actors.

3. MARKET ANALYSIS

The Statewide CASE Team performed a market analysis with the goals of identifying current technology availability, current product availability, and market trends. The Statewide CASE Team considered how the proposed standard may impact the market in general and individual market actors.

The Statewide CASE Team gathered information about the incremental cost of complying with the proposed lower LPAs. Estimates of market size and measure applicability were identified through research and outreach with stakeholders including utility program staff, Energy Commission staff, and a wide range of industry representatives who were invited to participate in utility-sponsored stakeholder meetings held on September 8, 2016, March 30, 2017, and June 22, 2017. The Statewide CASE Team also used an online survey to help inform the proposal; see Appendix J for more information on the online stakeholder survey.

3.1 Market Structure

According to a 2014 DOE report, LEDs accounted for nine percent of the outdoor lighting market in 2013. DOE forecasted that LEDs will represent 75 percent of all outdoor lighting sales by 2020 and virtually all outdoor lighting sales by 2025 (Navigant Consulting 2014). Many manufacturers are discontinuing legacy products, especially pulse start metal halide (PSMH) and compact fluorescent lamp (CFL) products. Lithonia, Hubbell, and Eaton are examples of major manufacturers that historically produced legacy products (HID and fluorescent), but have shifted more towards LED product offerings. Many other manufacturers also have been involved in this transition, including the emergence and growth of companies that only produce LED products, such as Cree and Evluma. There are now thousands of different LED product types available to supply dozens, if not hundreds of different application needs. Publicly available product listings, such as the Department of Energy (DOE) Lighting Facts program, the DesignLights Consortium's Qualified Product Lists, and others, demonstrate wide product availability.

3.2 Technical Feasibility, Market Availability, and Current Practices

The market is heading towards more efficient luminaires due to the rapid improvement of LEDs and the continued reduction in costs. LEDs continue to be adopted and are replacing other lighting technologies. LED is quickly becoming the standard for many applications, so there are no challenges expected in terms of technical feasibility or market availability as a result of the proposed measure.

3.3 Market Impacts and Economic Assessments

3.3.1 Impact on Builders

The Statewide CASE Team does not expect that builders will be adversely impacted by a single proposed code change or from the sum of the proposed changes to Title 24, Part 6. Builders could be impacted by a shift in demand for new buildings and by construction costs, but the Building Energy Efficiency Standards are not considered a major factor in projected growth. Demand for new buildings is driven more by factors such as the overall health of the economy and population growth than the cost of construction. The cost of complying with Title 24, Part 6 requirements represents a very small portion of the construction process and total building value. Increasing the building cost by a fraction of a percent is not expected to have a significant impact on demand for new buildings or the builders' profits.

While some training and education can help ensure the workforce, including designers and those working in construction trades, know how to comply with the proposed requirements, workforce training is not unique to the building industry, and is common in many fields associated with the production of goods and services. Costs associated with workforce training are typically accounted for in long-term financial planning and spread out across the unit price of many units as to avoid price spikes when changes in designs and/or processes are implemented.

However, because the market is experiencing a rapid shift towards LEDs, builders are already familiar with the technology. Since the proposed code change is simply increasing the stringency of current regulations, builders will not need to learn any new processes or compliance methods.

3.3.2 Impact on Building Designers and Energy Consultants

Adjusting design practices to comply with changing building codes practices is within the normal practices of building designers. Building codes (including the California Building code and model national building codes published by the International Code Council, the International Association of Plumbing and Mechanical Officials and ASHRAE 90.1) are typically updated on three-year revision cycles. As discussed in Section 3.3.1, all market actors should (and do) plan for training and education that may be required to adjusting design practices to accommodate compliance with new building codes. As a whole, the measures the Statewide CASE Team is proposing for the 2019 code cycle aim to provide designers and energy consultants with opportunities to comply with code requirements in multiple ways, thereby providing flexibility in how requirements can be met.

Building designers will need to comply with this code change by ensuring new outdoor lighting systems meet the new LPA requirements. This will not have a large impact on building designers since the market is quickly shifting to higher efficacy LEDs and many manufacturers are discontinuing legacy products. Designers may need to adapt outdated designs to meet lower LPAs without compromising lighting quality for the future occupants, but the proposed modifications do not limit design options beyond lower LPAs. There should be ample options to design lighting systems that provide the appropriate quality lighting for the application or task.

3.3.3 Impact on Occupational Safety and Health

The proposed code change does not alter any existing federal, state, or local regulations pertaining to safety and health, including rules enforced by the California Division of Occupational Safety and Health. All existing health and safety rules will remain in place. Complying with the proposed code change is not anticipated to have adverse impacts on the safety or health of occupants or those involved with the construction, commissioning, and maintenance of buildings or surrounding outdoor areas.

3.3.4 Impact on Building Owners and Occupants

Building owners and occupants will benefit from lower energy bills. As discussed in Section 3.4.1, when building occupants save on energy bills, they tend to spend it elsewhere in the economy thereby creating jobs and economic growth for the California economy.

Occupants and building owners will benefit from reduced maintenance time and costs since LEDs have a substantially longer product lifetime over legacy products. Additionally, the proposed code change allows the use of warm color temperature (3000K) luminaires which reduces occupants' exposure to blue light at night. As described in Section 2.1, there is growing evidence that suggests that exposure to blue light at night can have detrimental effects on both people and animals.

3.3.5 Impact on Building Component Retailers (Including Manufacturers and Distributors)

The Statewide CASE Team expects LED manufacturers to benefit from increased demand for high efficacy products and experience decreased demand for lower-efficacy legacy products. This aligns with broader market trends. The Statewide CASE Team has noted that many manufacturers are already discontinuing production of legacy products.

3.3.6 Impact on Building Inspectors

The proposed code change is unlikely to affect building inspectors since only the stringency of existing requirements is changing.

3.3.7 Impact on Statewide Employment

Section 3.4.1 discusses statewide job creation from the energy efficiency sector in general, including updates to Title 24, Part 6. These changes have negligible impact on employment. Installation labor is approximately the same for both legacy and LED light sources.

3.4 Economic Impacts

The estimated impacts that the proposed code change will have on California's economy are discussed below.

3.4.1 Creation or Elimination of Jobs

In 2015, California's building energy efficiency industry employed more than 321,000 workers who worked at least part time or a fraction of their time on activities related to building efficiency. Employment in the building energy efficiency industry grew six percent between 2014 and 2015 while the overall statewide employment grew three percent (BW Research Partnership 2016). Lawrence Berkeley National Laboratory's report titled *Energy Efficiency Services Sector: Workforce Size and Expectations for Growth* (2010) provides details on the types of jobs in the energy efficiency sector that are likely to be supported by revisions to building codes.

Building codes that reduce energy consumption provide jobs through *direct employment*, *indirect employment*, and *induced employment*.[4] Title 24, Part 6 creates jobs in all three categories with a significant amount attributed to induced employment, which accounts for the expenditure-induced effects in the general economy due to the economic activity and spending of direct and indirect employees (e.g., non-industry jobs created such as teachers, grocery store clerks, and postal workers). A large portion of the induced jobs from energy efficiency are the jobs created by the energy cost savings due to the energy efficiency measures. Wei, Patadia, and Kammen (2010) estimate that energy efficiency creates 0.17 to 0.59 net job-years[5] per GWh saved. By comparison, they estimate that the coal and natural gas industries create 0.11 net job-years per GWh produced. Using the mid-point for the energy efficiency range (0.38 net job-years per GWh saved) and estimates that this proposed code change will result in a statewide first-year savings of 118 GWh, this measure will result in approximately 45 jobs created in the first year. See Section 6.1 for statewide savings estimates.

3.4.2 Creation or Elimination of Businesses in California

There are approximately 43,000 businesses that play a role in California's advanced energy economy (BW Research Partnership 2016). California's clean economy grew ten times more than the total state economy between 2002 and 2012 (20 percent compared to two percent). The energy efficiency industry, which is driven in part by recurrent updates to the building code, is the largest component of the core clean economy (Ettenson and Heavey 2015). Adopting cost-effective code changes for the 2019 Title 24, Part 6 code cycle will help maintain the energy efficiency industry.

Table 3 lists industries that will likely benefit from the proposed code change classified by their North American Industry Classification System (NAICS) Code.

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[4] The definitions of direct, indirect, and induced jobs vary widely by study. Wei et al (2010) describes the definitions and usage of these categories as follows: "*Direct employment* includes those jobs created in the design, manufacturing, delivery, construction/installation, project management and operation and maintenance of the different components of the technology, or power plant, under consideration. *Indirect employment* refers to the ''supplier effect'' of upstream and downstream suppliers. For example, the task of installing wind turbines is a direct job, whereas manufacturing the steel that is used to build the wind turbine is an indirect job. *Induced employment* accounts for the expenditure-induced effects in the general economy due to the economic activity and spending of direct and indirect employees, e.g., non industry jobs created such as teachers, grocery store clerks, and postal workers."

[5] One job-year (or ''full-time equivalent'' FTE job) is full time employment for one person for a duration of 1 year.

Table 3: Industries Receiving Energy Efficiency Related Investment, by North American Industry Classification System (NAICS) Code

Industry	NAICS Code
Nonresidential Building Construction	2362
Electrical Contractors	23821
Manufacturing	32412
Other Nonmetallic Mineral Product Manufacturing	3279
Industrial Machinery Manufacturing	3332
Electric Lighting Equipment Manufacturing	3351
Engineering Services	541330
Building Inspection Services	541350
Advertising and Related Services	5418
Commercial & Industrial Machinery & Equip. (exc. Auto. & Electronic) Repair & Maint.	811310

The rapid expansion of LED technology has been disruptive to the status quo in the lighting industry. Many new market entrants into the industry have been from the semiconductor and electronics industry. Some of the new businesses that are in California include:

- LEDtronics
- Feit Electric
- Greenshine
- Lunera

Many existing lighting manufacturers are adapting to this change in the market by discontinuing legacy products and switching to LED products (or increasing LED product production). National Electrical Manufacturers Association (NEMA) data illustrates the rapid growth of LED sales and stagnation and decline in legacy product sales and market penetration (Association 2017). The Statewide CASE Team spoke with five major manufacturers and collected the following information:

- Three of the manufacturers have discontinued some or most of their metal halide luminaires.
- Three of the manufacturers have discontinued some of their CFL luminaires.

3.4.3 Competitive Advantages or Disadvantages for Businesses in California

In 2014, California's electricity statewide costs were 1.7 percent of the state's gross domestic product (GPD) while electricity costs in the rest of the United States were 2.4 percent of GDP (Thornberg, Chong and Fowler 2016). As a result of spending a smaller portion of overall GDP on electricity relative to other states, Californians and California businesses save billions of dollars in energy costs per year relative to businesses located elsewhere. Money saved on energy costs can otherwise be invested, which provides California businesses with an advantage that will only be strengthened by the adoption of the proposed code changes that impact nonresidential buildings.

Reduced LPAs encourage the use of new innovative technologies. This is an advantage for nimble innovative companies that tend to congregate in California.

3.4.4 Increase or Decrease of Investments in the State of California

The proposed changes to the building code are not expected to impact investments in California on a macroeconomic scale, nor are they expected to affect investments by individual firms. The allocation of resources for the production of goods in California is not expected to change as a result of this proposal.

3.4.5 Effects on the State General Fund, State Special Funds, and Local Governments

The proposed code changes are not expected to have a significant impact on the California's General Fund, any state special funds, or local government funds. Revenue to these funds comes from taxes levied. The most relevant taxes to consider for this proposed code change are: personal income taxes,

corporation taxes, sales and use taxes, and property taxes. The proposed changes for the 2019 Title 24, Part 6 Standards are not expected to result in noteworthy changes to personal or corporate income, so the revenue from personal income taxes or corporate taxes is not expected to change. As discussed, reductions in energy expenditures are expected to increase discretionary income. State and local sales tax revenues may increase if building occupants spend additional discretionary income on taxable items. Although logic indicates there may be changes to sales tax revenue, the impacts that are directly related to revisions to Title 24, Part 6 have not been quantified. Finally, revenue generated from property taxes is directly linked to the value of the property, which is usually linked to the purchase price of the property. The proposed changes will increase construction costs. As discussed in Section 3.3.1, however, there is no statistical evidence that Title 24, Part 6 drives construction costs or that construction costs have a significant impact on building price. Since compliance with Title 24, Part 6 does not have a clear impact on purchase price, it can follow that Title 24, Part 6 cannot be shown to impact revenues from property taxes.

This proposal has the net effect of increasing the wealth of the State of California as the increased cost of construction is offset by reduced electricity consumption of lighting systems. Overall this proposal has a B/C ratio of 36.6:1. As a result, 37 times more energy cost savings are returned to California than would be expended, including the cost of capital. As a result, everything else being equal, companies are more profitable, which results in more taxes being paid to state and local government.

3.4.5.1 Cost of Enforcement

Cost to the State

State government already has budget for code development, education, and compliance enforcement. While state government will be allocating resources to update the Title 24, Part 6 Standards, including updating education and compliance materials and responding to questions about the revised requirements, these activities are already covered by existing state budgets. The costs to state government are small when compared to the overall costs savings and policy benefits associated with the code change proposals. The proposed code change will impact state buildings in terms of new construction and alterations/additions. However, the impacts will be minimal since the proposed code change only increases stringency of existing requirements, and has been found to be cost-effective.

This proposal relies on the same LPA structure that has been in Title 24, Part 6 for many code cycles; the same tables are used but with updated LPA values. As a result, no additional costs are expected to be incurred to the state government.

Cost to Local Governments

All revisions to Title 24, Part 6 will result in changes to compliance determinations. Local governments will need to train building department staff on the revised Title 2, Part 6 Standards. While this re-training is an expense to local governments, it is not a new cost associated with the 2019 code change cycle. The building code is updated on a triennial basis, and local governments plan and budget for retraining every time the code is updated. There are numerous resources available to local governments to support compliance training that can help mitigate the cost of retraining, including tools, training and resources provided by the IOU codes and standards program (such as Energy Code Ace). As noted in Section 2.5 and Appendix B, the Statewide CASE Team considered how the proposed code change might impact various market actors involved in the compliance and enforcement process and aimed to minimize negative impacts on local governments.

Since this proposal relies on the same LPA tables and structure that has been in Title 24, Part 6 for many code cycles, the Statewide CASE Team does not expect any additional costs to local government.

3.4.6 Impacts on Specific Persons

The proposed changes to Title 24, Part 6 are not expected to have a differential impact on any groups relative to the state population as a whole, including migrant workers, commuters or persons by age, race or religion. Tenants will typically benefit from lower energy bills if they pay energy bills directly. These savings should more than offset any capital costs passed-through from landlords. Renters who do not pay directly for energy costs may see some of the net savings depending on if and how landlords account for energy cost when determining rent prices.

The changes to the LPA requirements apply across all occupancies. There is no group that will be affected disproportionately.

4. ENERGY SAVINGS

4.1 Key Assumptions for Energy Savings Analysis

The Statewide CASE Team used a similar approach for performing the energy savings analysis that was used in the 2016 Title 24, Part 6 code cycle. The key assumptions and how they are used are described below.

The Statewide CASE Team calculated per-unit impacts and statewide impacts associated with both new construction and alterations by comparing energy use of outdoor lighting that is minimally compliant with the 2016 Title 24, Part 6 Standards to the proposed requirements for the 2019 Title 24, Part 6 Standards. Impacts for General Hardscapes and Specific Applications were considered.

The analysis for General Hardscapes defined effective wattage allowances (eWA) for the 2019 proposal using 3000K LED luminaires that are widely available today and commonly used. Wattage allowances were established for example sites that represent a reasonable cross-section of what is likely to be installed in the state during the 2019 code cycle. The effective wattage allowance values combine the Initial Wattage Allowance, the Area Wattage Allowance, and the Linear Wattage Allowance into a single value (Lighting Power Allowance also known as the effective Area Wattage Allowance) based on the size, shape, and type of the area in question. Table 4 presents the details of the prototype buildings used in the analysis for developing new LPAs for General Hardscape.

Table 4: Prototype Buildings Used for Energy, Demand, Cost, and Environmental Impacts Analysis for General Hardscape

Prototype ID	Occupancy Type (Residential, Retail, Office, etc.)	Hardscape Area (ft^2)	Hardscape Perimeter (ft)	Perimeter to Area (%)	Notes
Prototype A	Office/Retail	501,626	6,794	1.4%	Long skinny site, big building
Prototype B	Retail	471,726	5,131	1.1%	Square site, irregular building
Prototype C	Retail	42,828	3,052	7.1%	Irregular site, campus buildings
Prototype D	Retail	28,500	960	3.4%	Long skinny site, small building
Prototype E	Retail/Office/Industrial	21,000	760	3.6%	Square site, small square building
Prototype F	Retail/Office/Industrial	61,798	1,940	3.1%	Irregular site, long square building
Prototype G	Retail/Office/Industrial	21,797	1,408	6.5%	Long skinny site, irregular building
Prototype H	Retail/Office/Industrial	11,040	1,042	9.4%	Square site, large square building
Prototype J	Retail/Office/Industrial	34,735	2,593	7.5%	Irregular site, large irregular building
Prototype K	Parking	250,000	2,000	0.8%	Ideal square site

The analysis for the Specific Applications defined LPA in a similar way. That is, using readily available LED luminaires in example layouts that represent a reasonable cross-section of designs that are likely to be installed during the 2019 code cycle. The LPA values for Specific Applications characterize wattage allowance either in terms per square foot, per linear foot, or per area, depending on the application.

For Specific Applications, the 2016 standards allow the use of lower efficacy "legacy" technologies such as fluorescent, HID, and others. Savings were achieved by developing models with equivalent maintained luminaire lumens models for the proposed LPAs using higher efficacy 3000K LED luminaires.

A spreadsheet-based analysis was used to take into account a variety of variables including:

- Reductions in LPA values within Tables 140.7 A & B.
- Impacted area of LPA reduction (for situations where the area is not explicitly defined).
- Occupancy and use profiles for various outdoor applications.
- Prototype sites employed for effective wattage/square foot reduction calculations.

The analysis was completed using the outdoor lighting application types defined in the 2016 ACM Reference Manual. Duty cycles were based on energy use curves defined in the 2016 ACM Reference Manual and the Statewide CASE Team's industry knowledge of typical hours of operation for nonresidential buildings.

The General Hardscape LPA values derived from example site layouts were validated by applying the proposed LPA values to three real site designs. Using the new LPA values on real designs confirmed that it is technically feasible and cost effective to design to the new LPAs using technology that is readily available today. The Statewide CASE Team developed a basic lighting layout to use with the three real sites to conduct cost-effectiveness calculations. This is a more detailed calculation of the lighting design necessary to meet the design criteria, but this analysis allowed the CASE Team to develop more detailed cost estimates and design details for the CASE analysis.

Key considerations for the three real sites considered in the general hardscape maintained light level analyses are the expected lumen maintenance of the outdoor luminaires and the appropriate light loss factors. The rated lifetime of LED luminaires is typically defined as the time it takes the light output to drop to 70 percent of the initial output (referred to as L_{70}). The Statewide CASE Team applied the average L70 value at 60,000 hours of the area luminaires studied since this was the basis of the 2016 LPA CASE Report analysis. The 2016 LPA CASE Report analysis used a 70 percent lumen maintenance value at 60,000 hours. Since the 2016 analysis was completed, LED technology has advanced significantly. For the analysis of the proposed 2019 requirements, the Statewide CASE Team assumed a lumen maintenance of 90 percent at 60,000 hours for all general hardscape luminaires. This means that lower wattage luminaires could be modeled that would still meet design requirements with maintained lumens at 60,000 hours, resulting in more energy savings relative to the 2016 Standards. Appendix F provides data on the lumen maintenance values at 60,000 hours for the luminaires used in the General Hardscape savings models.

The 2016 LPA CASE Report assumed a dirt depreciation factor of 0.8. In the current analysis, the Statewide CASE Team assumed a luminaire dirt depreciation factor of 0.9. The Statewide CASE Team believes 0.9 to be industry standard practice based on current technology. Current fully shielded luminaire designs reduce the amount of rain or dust accumulation on the light emitting surfaces, improving luminaire dirt depreciation factors. This further increases maintained lumens and reduces initial lighting power. The total light loss factor of 0.81 combines both the lumen maintenance factor of 0.9 and luminaire dirt deprecation factor of 0.9.

Another consideration affecting the energy savings analysis is luminaire light distribution. Historically, larger parking lots were modeled using poles with four luminaire heads to meet IES RP-20-14 recommended light levels, but improved luminaire optical designs enabled the use of two luminaire heads per pole in some of the proposed site models. Distribution patterns have been improved by using LED luminaires with improved optics and a wider offering of lumen packages; these products are available from a variety of manufacturers including Acuity, Philips Lighting, Cree, and WE-EF. While no improvement to luminaire efficacy was assumed in the General Hardscape model, improved optical design and a greater offering of lumen packages enables a more effective use of light, less over-lighting, fewer heads, and lower wattage.

4.2 Energy Savings Methodology

To assess the energy, demand, and energy cost impacts, the Statewide CASE Team compared design practices associated with installations that are minimally compliant with the 2016 Standards to design practices that would comply with the proposed requirements. There is an existing Title 24, Part 6 standard that covers the building system in question, so the existing conditions assume a building complies with the 2016 Title 24, Part 6 Standards.

The proposed conditions are defined as the design conditions that will comply with the proposed code change. Specifically, the proposed code change will reduce the LPAs for nonresidential outdoor lighting based on meeting the same (or currently relevant) design criteria using currently available LED luminaires.

This measure only applies to outdoor lighting applications, so the Energy Commission building prototypes were not applicable. Instead, the Statewide CASE Team used the same outdoor lighting area prototypes used to evaluate LPA requirements that were updated for the 2016 code cycle: nine site plan prototypes to represent a variety of site configurations that account for both the building and hardscape footprint, which vary from an efficient (square) site with a simple building footprint and hardscape layout to a more complex site with less ideal conditions. These prototypes enabled the Statewide CASE Team to compare LPA values in practical lighting layout conditions that represent a reasonable spectrum of conditions that may be encountered in actual site designs.

The Statewide CASE Team used real designs to develop the new LPAs for General Hardscape. Specifically, small, medium, and large parking lot designs were used. The parking lot designs utilized a variety of pole heights and luminaire distributions that meet 2016 Title 24 requirements, CALGreen, and IES RP-20-14 lighting recommendations. The selected luminaires for the proposed 2019 Standards were all 3000K LED luminaires with better lumen maintenance and overall improved light loss factors, along with improved optical distributions and more lumen packages than the LED luminaires used for the 2016 Standards. Even though luminaires for the 2016 Standards had the same efficacy (lumen per watt or LPW) as those used in the analysis for the proposed 2019 Standards, the improved luminaire dirt depreciation factors, better lumen maintenance, improved optical distributions, and more available lumen packages, allowed less wattage to be used to achieve the recommended lighting levels. The standard design practice is to design lighting layouts based on the maintained light output of the luminaire, not initial lighting levels. Thus, energy savings are achieved due to lower initial wattage and lumen output, but systems will be designed to provide the same light levels at 60,000 hours. Overall, the proposed LPAs are approximately 30 percent lower than the 2016 LPAs while maintaining 60,000-hour design light levels. Please see Appendix F for additional details.

The Specific Applications legacy luminaires (i.e., luminaries used to establish the 2016 LPAs) maintained lumen outputs were compared to equivalent LED luminaire maintained lumen outputs to confirm that typical design practices will be unchanged with LED luminaires. The lumen output comparisons demonstrated that the proposed LPAs can be achieved independent of the site layout. These specific applications calculations reflect the efficacy improvements from legacy source types to current LED luminaires.

The Statewide CASE Team estimated the statewide energy impacts by first calculating the per-unit savings for each application (General Hardscape and Specific Applications), and then extrapolating the per-unit impacts to the entire state using estimates of statewide square footage of each type of outdoor hardscape area that will be impacted by the proposed requirements. The total statewide hardscape area was derived starting with the building construction forecasts that the Energy Commission provided, then applying assumptions about the type and size of hardscaped areas that are associated with typical nonresidential construction of different building types. See Appendix A, Appendix H, and Appendix I for more details.

The lighting measures evaluated in this CASE Report will have energy savings that are only secondarily impacted by climate. Installed wattage and hours of operation have significantly more impact on energy savings than climate. These light sources are outdoors, so there are no interaction effects with HVAC. As a result, the cost-effectiveness of this measure is deemed to be independent of climate zone.

Energy savings, energy cost savings, and peak demand reductions were calculated using a TDV (Time Dependent Valuation) methodology. Both General Hardscape and Specific Applications use operating hours that include the impact of outdoor lighting controls. See Appendix D for more details.

4.3 Per-Unit Energy Impacts Results

The per-unit first-year energy savings are presented in Table 5 through Table 9. See Section 6.1 of this report for estimated statewide savings from additions and alterations. The per unit energy savings estimates do not take naturally occurring market adoption or compliance rates into account. The Statewide CASE Team calculated per-unit savings for LZ 4 for both General Hardscape and Specific Applications (Table 5 and Table 9). However, California currently does not have any LZ 4 areas. First-year statewide savings (Section 5) do not include any savings from LZ 4 to reflect this.

Table 5: First-Year Energy Impacts Per-Unit for General Hardscape

General Hardscape	Per-Unit First-Year Savings[a]			
	Units	Electricity Savings[b] (kWh/yr)	Demand Savings (kW)	Natural Gas Savings (therms/yr)
Lighting Zone 1	Per Square Foot	0.03	0.00	N/A
Lighting Zone 2	Per Square Foot	0.10	0.00	N/A
Lighting Zone 3	Per Square Foot	0.11	0.00	N/A
Lighting Zone 4	Per Square Foot	0.15	0.00	N/A

a. Savings from one unit for the first year the site is in operation.

b. Site electricity savings, does not include TDV or electricity savings.

Table 6: First-Year Energy Impacts Per-Unit – Specific Applications Lighting Zone 1

Lighting Application	Per-Unit First-Year Savings[a]			
	Units	Electricity Savings[b] (kWh/yr)	Demand Savings (kW)	Natural Gas Savings (therms/yr)
Building Entrances	Each	28.17	0.00	N/A
Primary Entrances	Each	117.37	0.00	N/A
Drive Up Windows	Each	76.70	0.00	N/A
Vehicle Service Uncovered Fuel Dispenser	Each Pump Face	304.85	0.01	N/A
ATM Machine	Each	704.20	0.01	N/A
Outdoor Sales Frontage	Per Linear Foot	No Allowance	N/A	N/A
Hardscape Ornamental Lighting	Per Square Foot	No Allowance	N/A	N/A
Building Facades	Per Square Foot	No Allowance	N/A	N/A
Outdoor Sales Lots	Per Square Foot	0.45	0.00	N/A
Vehicle Service Station Hardscape	Per Square Foot	0.04	0.00	N/A
Vehicle Service Station Canopies	Per Square Foot	1.30	0.00	N/A
Sales Canopies	Per Square Foot	No Allowance	N/A	N/A
Non-sales Canopies	Per Square Foot	0.04	0.00	N/A
Guard Stations	Per Square Foot	0.34	0.00	N/A
Student Pick-up/Drop-off Zone	Per Square Foot	No Allowance	N/A	N/A
Outdoor Dining	Per Square Foot	0.02	0.00	N/A
Special Security Lighting for Retail	Per Square Foot	0.01	0.00	N/A

a. Savings from one unit for the first year the site is in operation.

b. Site electricity savings, does not include TDV or electricity savings.

Table 7: First-Year Energy Impacts Per-Unit – Specific Applications Lighting Zone 2

Lighting Application	Per-Unit First-Year Savings[a]			
	Units	Electricity Savings[b] (kWh/yr)	Demand Savings (kW)	Natural Gas Savings (therms/yr)
Building Entrances	Each	46.95	0.00	N/A
Primary Entrances	Each	187.79	0.00	N/A
Drive Up Windows	Each	143.81	0.00	N/A
Vehicle Service Uncovered Fuel Dispenser	Each Pump Face	459.62	0.01	N/A
ATM Machine	Each	704.20	0.01	N/A
Outdoor Sales Frontage	Per Linear Foot	22.22	0.00	N/A
Hardscape Ornamental Lighting	Per Square Foot	0.06	0.00	N/A
Building Facades	Per Square Foot	0.26	0.00	N/A
Outdoor Sales Lots	Per Square Foot	1.49	0.00	N/A
Vehicle Service Station Hardscape	Per Square Foot	0.39	0.00	N/A
Vehicle Service Station Canopies	Per Square Foot	2.55	0.00	N/A
Sales Canopies	Per Square Foot	0.59	0.00	N/A
Non-sales Canopies	Per Square Foot	0.11	0.00	N/A
Guard Stations	Per Square Foot	0.84	0.00	N/A
Student Pick-up/Drop-off Zone	Per Square Foot	0.10	0.00	N/A
Outdoor Dining	Per Square Foot	0.20	0.00	N/A
Special Security Lighting for Retail	Per Square Foot	0.02	0.00	N/A

a. Savings from one unit for the first year the site is in operation.

b. Site electricity savings, does not include TDV or electricity savings.

Table 8: First-Year Energy Impacts per Unit - Specific Applications Lighting Zone 3

Lighting Application	Per-Unit First-Year Savings[a]			
	Units	Electricity Savings[b] (kWh/yr)	Demand Savings (kW)	Natural Gas Savings (therms/yr)
Building Entrances	Each	75.12	0.00	N/A
Primary Entrances	Each	295.77	0.00	N/A
Drive Up Windows	Each	239.68	0.01	N/A
Vehicle Service Uncovered Fuel Dispenser	Each Pump Face	487.76	0.01	N/A
ATM Machine	Each	704.20	0.01	N/A
Outdoor Sales Frontage	Per Linear Foot	32.84	0.00	N/A
Hardscape Ornamental Lighting	Per Square Foot	0.13	0.00	N/A
Building Facades	Per Square Foot	0.58	0.00	N/A
Outdoor Sales Lots	Per Square Foot	2.09	0.00	N/A
Vehicle Service Station Hardscape	Per Square Foot	0.76	0.00	N/A
Vehicle Service Station Canopies	Per Square Foot	3.22	0.00	N/A
Sales Canopies	Per Square Foot	0.91	0.00	N/A
Non-sales Canopies	Per Square Foot	0.24	0.00	N/A
Guard Stations	Per Square Foot	1.80	0.00	N/A
Student Pick-up/Drop-off Zone	Per Square Foot	0.39	0.00	N/A
Outdoor Dining	Per Square Foot	0.37	0.00	N/A
Special Security Lighting for Retail	Per Square Foot	0.04	0.00	N/A

a. Savings from one unit for the first year the site is in operation.

b. Site electricity savings, does not include TDV or electricity savings.

Table 9: First-Year Energy Impacts per Unit - Specific Applications Lighting Zone 4

Lighting Application	Per-Unit First-Year Savings[a]			
	Units	Electricity Savings[b] (kWh/yr)	Demand Savings (kW)	Natural Gas Savings (therms/yr)
Building Entrances	Each	112.67	0.00	N/A
Primary Entrances	Each	328.63	0.01	N/A
Drive Up Windows	Each	399.46	0.01	N/A
Vehicle Service Uncovered Fuel Dispenser	Each Pump Face	914.55	0.02	N/A
ATM Machine	Each	704.20	0.01	N/A
Outdoor Sales Frontage	Per Linear Foot	38.64	0.00	N/A
Hardscape Ornamental Lighting	Per Square Foot	0.19	0.00	N/A
Building Facades	Per Square Foot	0.88	0.00	N/A
Outdoor Sales Lots	Per Square Foot	3.75	0.00	N/A
Vehicle Service Station Hardscape	Per Square Foot	1.34	0.00	N/A
Vehicle Service Station Canopies	Per Square Foot	5.59	0.00	N/A
Sales Canopies	Per Square Foot	1.26	0.00	N/A
Non-sales Canopies	Per Square Foot	0.45	0.00	N/A
Guard Stations	Per Square Foot	2.63	0.00	N/A
Student Pick-up/Drop-off Zone	Per Square Foot	No Allowance	N/A	N/A
Outdoor Dining	Per Square Foot	0.63	0.00	N/A
Special Security Lighting for Retail	Per Square Foot	No Allowance	N/A	N/A

a. Savings from one unit for the first year the site is in operation.

b. Site electricity savings, does not include TDV or electricity savings.

5. LIFECYCLE COST AND COST-EFFECTIVENESS

5.1 Energy Cost Savings Methodology

TDV energy is a normalized format for comparing electricity and natural gas cost savings that takes into account the cost of electricity and natural gas consumed during each hour of the year. The TDV values are based on long term discounted costs (30 years for all residential measures and nonresidential envelope measures and 15 years for all other nonresidential measures). In this case, the period of analysis used is 15 years. The TDV cost impacts are presented in 2020 present value (PV) dollars. The TDV energy estimates are based on present-valued cost savings but are normalized in terms of "TDV kBtu". Peak demand reductions are presented in peak power reductions (kW). The Energy Commission derived the 2020 TDV values that were used in the analyses for this report (Energy + Environmental Economics 2016). The Statewide CASE Team used a similar approach to calculating energy costs as was used in the 2016 code cycle. The previous methodology and how it was used for the 2019 cycle is described below.

The present value (PV) of the energy savings were calculated using hourly energy savings estimates for the first year of building operation and multiplying by the 2019 TDV cost values to arrive at the PV of the cost savings over the 15-year period of analysis. This measure is not climate sensitive, but the energy cost savings were calculated in each climate zone using TDV values for each unique climate zone. However, the energy cost savings calculated was then weighted by construction forecasts and averaged across all climate zones.

5.2 Energy Cost Savings Results

The per-unit energy cost savings for newly constructed buildings are averaged across all lighting zones. Table 10 presents the weighting used to average savings across all lighting zones. Note, LZ0 is specifically intended for undeveloped spaces in parks, and therefore has no substantial energy impact on the statewide values. As previously noted, LZ4 is also a lighting zone that local governments must request to use from the Energy Commission, and no municipality has chosen to do that yet.

Table 10: Lighting Zone Area Weighting Factors

Lighting Zone	Energy Impact Weight (%)
LZ0	0.0%
LZ1	0.1%
LZ2	9.9%
LZ3	90.0%
LZ4	0.0%

Per-unit energy cost savings for General Hardscape over the 15-year period of analysis in both new construction and alterations are presented in Table 11. Per-unit energy cost savings for Specific Applications over the 15-year period of analysis for new construction and alterations are presented in Table 12 and Table 13: Specific Applications TDV Energy Cost Savings Over a 15-Year Period of Analysis – Per-Unit – Alterations, respectively. The TDV methodology allows peak electricity savings to be valued more than electricity savings during non-peak periods.

Table 11: TDV Energy Cost Savings Over a 15-Year Period of Analysis, General Hardscape – Per-Unit

Measure	Unit	15-Year TDV Electricity Cost Savings (2020 PV$)	15-Year TDV Natural Gas Cost Savings (2020 PV$)	Total 15-Year TDV Energy Cost Savings (2020 PV$)
General Hardscape – New Construction	Per Square Foot	$0.10	N/A	$0.10
General Hardscape - Alterations	Per Square Foot	$0.10	N/A	$0.10

Table 12: Specific Applications TDV Energy Cost Savings Over a 15-Year Period of Analysis – Per-Unit – New Construction

Sub-measure	Units	15-Year TDV Electricity Cost Savings (2020 PV$)	15-Year TDV Natural Gas Cost Savings (2020 PV$)	Total 15-Year TDV Energy Cost Savings (2020 PV$)
Building Entrances	Each	$172.85	N/A	$172.85
Primary Entrances	Each	$672.33	N/A	$672.33
Drive Up Windows	Each	$550.41	N/A	$550.41
Vehicle Service Uncovered Fuel Dispenser	Each Pump Face	$1,138.02	N/A	$1,138.02
ATM Machine	Each	$1,086.38	N/A	$1,086.38
Outdoor Sales Frontage	Per Linear Foot	$82.01	N/A	$82.01
Hardscape Ornamental Lighting	Per Square Foot	$0.18	N/A	$0.18
Building Facades	Per Square Foot	$1.32	N/A	$1.32
Outdoor Sales Lots	Per Square Foot	$4.60	N/A	$4.60
Vehicle Service Station Hardscape	Per Square Foot	$1.63	N/A	$1.63
Vehicle Service Station Canopies	Per Square Foot	$7.13	N/A	$7.13
Sales Canopies	Per Square Foot	$2.26	N/A	$2.26
Non-sales Canopies	Per Square Foot	$0.68	N/A	$0.68
Guard Stations	Per Square Foot	$4.01	N/A	$4.01
Student Pick-up/Drop-off Zone	Per Square Foot	$0.95	N/A	$0.95
Outdoor Dining	Per Square Foot	$0.87	N/A	$0.87
Special Security Lighting for Retail	Per Square Foot	$0.10	N/A	$0.10

Table 13: Specific Applications TDV Energy Cost Savings Over a 15-Year Period of Analysis – Per-Unit – Alterations

Sub-measure	Units	15-Year TDV Electricity Cost Savings (2020 PV$)	15-Year TDV Natural Gas Cost Savings (2020 PV$)	Total 15-Year TDV Energy Cost Savings (2020 PV$)
Building Entrances	Each	$172.85	N/A	$172.85
Primary Entrances	Each	$672.33	N/A	$672.33
Drive Up Windows	Each	$550.41	N/A	$550.41
Vehicle Service Uncovered Fuel Dispenser	Each Pump Face	$1,138.02	N/A	$1,138.02
ATM Machine	Each	$1,086.38	N/A	$1,086.38
Outdoor Sales Frontage	Per Linear Foot	$82.01	N/A	$82.01
Hardscape Ornamental Lighting	Per Square Foot	$0.18	N/A	$0.18
Building Facades	Per Square Foot	$1.32	N/A	$1.32
Outdoor Sales Lots	Per Square Foot	$4.60	N/A	$4.60
Vehicle Service Station Hardscape	Per Square Foot	$1.63	N/A	$1.63
Vehicle Service Station Canopies	Per Square Foot	$7.13	N/A	$7.13
Sales Canopies	Per Square Foot	$2.26	N/A	$2.26
Non-sales Canopies	Per Square Foot	$0.68	N/A	$0.68
Guard Stations	Per Square Foot	$4.01	N/A	$4.01
Student Pick-up/Drop-off Zone	Per Square Foot	$0.95	N/A	$0.95
Outdoor Dining	Per Square Foot	$0.87	N/A	$0.87
Special Security Lighting for Retail	Per Square Foot	$0.10	N/A	$0.10

5.3 Incremental First Cost

The Statewide CASE Team reached out to 18 manufacturers and referenced distributor pricing to obtain data on cost, efficacy, maintenance, and pricing of legacy lighting products, which were compared to equivalent LED luminaire options. 82 different luminaire styles were used and matched as closely as possible for performance, function, and installation type.

For the Specific Applications allowance, the Statewide CASE Team used the same methodology used in the 2016 CASE Report.[6] This includes utilizing a luminaire lumen to lumen comparison using legacy light source technology (PSMH, CFL, incandescent, and T8s) compared to new proposed technology (3000K LED). Both legacy and LED systems consider the life of the technology along with maintenance access and maintenance cost to establish the cost-effectiveness of LED technology. If the existing legacy products have been discontinued by the manufacturer and no distributor pricing was provided, the product prices collected during the 2016 code cycle were applied.

[6] 2016 Nonresidential Outdoor Lighting Power Allowance CASE Study can be found online: http://www.energy.ca.gov/title24/2016standards/prerulemaking/documents/2014-06-24_workshop/final_case_reports/2016_T24_CASE_Report-Outdoor_LPA-Dec_2014-V3.pdf

For General Hardscape (Table 140.7-A), three different sites (large, medium, and small parking lot) were used to calculated realistic lighting layouts and determine an average watts per square foot that can be achieved per current design standards: IES RP-20-14 "Parking Lot", CALGreen, and Title 24 2016 Table 140.7-A. The proposed 2019 LPAs were the result of this analysis. The Statewide CASE Team then compared the 2016 4000K LED baseline effective area wattage allowance to the 3000K LEDs for the proposed measure.[7] The unit cost per watt is the same for 2016 base case and the proposed 2019 Standards case. As explained in Section 4.3 above, the savings were achieved as a result of improved light loss factors, allowing a lower initial wattage to maintain the same light levels over time. To calculate first cost implications, the unit cost per watt for the LED luminaires in each lighting zone was multiplied by the total LPA in the base condition (2016), and in the proposed standards case.[8] Since there is less wattage used in the 2019 LPA values, there is a lower cost of equipment. The difference in cost of equipment used between the 2016 and 2019 LPAs is the incremental cost of the proposed measure.

Per Energy Commission's guidance, design costs were not included in the incremental first cost.

5.4 Lifetime Incremental Maintenance Costs

Incremental maintenance cost is the incremental cost of replacing the equipment or parts of the equipment, as well as periodic maintenance required to keep the equipment operating relative to current practices over the period of analysis. The present value of equipment and maintenance costs (savings) was calculated using a three percent discount rate (d), which is consistent with the discount rate used when developing the 2019 TDV. The present value of maintenance costs that occurs in the nth year is calculated as follows (where d is the discount rate of three percent):

$$\text{Present Value of Maintenance Cost} = \text{Maintenance Cost} \times \left[\frac{1}{1+\text{d}}\right]^{\text{n}}$$

Maintenance costs associated with LED lighting products are generally less than legacy technology. The LCC analysis uses a 15-year lifecycle, during which no routine maintenance is expected for any of the LED lighting equipment because the products are still within their life expectancy at that time. As a result, the maintenance impacts result in savings related to the elimination of typical cyclic routine maintenance associated with the lighting equipment (primarily lamp/light source and ballast/driver replacement with failure). The routine maintenance costs consider typical light source and power supply replacement costs, labor costs, and duration of maintenance. This varies by lamp or light source type and wattage, so the Statewide CASE Team used a reasonable cross-section of technology to calculate routine maintenance costs for legacy and LED systems. The energy savings associated with a reduction in the LPA will persist the entire length of the installation of the lighting equipment. There is no field verification, maintenance, or commissioning required to ensure that the savings are maintained.

Table 14 and Table 15 show the summary results of the incremental cost analysis. Results in red denote a negative or zero cost. See Appendix E for more details on the incremental cost calculations.

[7] Effective area wattage allowance is calculated by multiplying the wattage per square foot of all prototypes (averaged) by the average square footage of all the prototypes. The wattage per square foot of each prototype is the total allowed wattage for the prototype: Area Wattage Allowance (W/ft^2) plus Linear Wattage Allowance (W/ft^2) multiplied by prototype area (ft^2) and added to Initial Wattage Allowance (W). This was done for the 2016 LPAs and the proposed 2019 LPAs.

[8] Total watts allowed per lighting zone based on prototypes is calculated by dividing the average watt per square foot of the lighting zone by the average square feet of all the prototypes. The average watt per square foot of each lighting zone is the average of each prototype's total allowed wattage divided by the prototype's square footage. Total allowed wattage for each prototype: Area Wattage Allowance (W/ft^2) plus Linear Wattage Allowance (W/ft^2) multiplied by prototype area (ft^2) and added to Initial Wattage Allowance (W).

Table 14: General Hardscape First Cost, Routine Maintenance Cost, and Total Incremental Cost

	First Cost (per square foot)	Routine Maintenance Cost (per square foot)	Total Cost (per square foot)
2016 LPAs (all LZs)	$1.54	$0.00	$1.54
2019 Proposed LPAs (all LZs)	$1.03	$0.00	$1.03
Total Incremental Cost per Square Foot (all LZs)[a]			**($0.52)**

a. A negative total incremental cost means a measure is instantly cost-effective.

Table 15: Specific Applications First-Cost, Routine Maintenance Cost, and Total Incremental Cost – Weighted of All Lighting Zones[a]

Specific Application	Unit		First Cost (per-unit)	Routine Maintenance Cost (per-unit)	Total Cost (per-unit)
Building Entrances	Each	2016 LPA	$697.89	$156.03	$853.92
		2019 LPA	$383.86	$0.00	$383.86
		Total Incremental Cost Per-Unit			($470.06)
Primary Entrances	Each	2016 LPA	$902.99	$216.82	$1,119.81
		2019 LPA	$936.68	$0.00	$936.68
		Total Incremental Cost Per-Unit			($183.13)
Drive Up Windows	Each	2016 LPA	$511.46	$256.06	$767.52
		2019 LPA	$670.97	$0.00	$670.97
		Total Incremental Cost Per-Unit			**($96.55)**
Vehicle Service Uncovered Fuel Dispenser	Each Pump Face	2016 LPA	$761.57	$234.43	$996.00
		2019 LPA	$1007.28	$0.00	$1,007.28
		Total Incremental Cost Per-Unit			**$11.28**
ATM Machine	Each	2016 LPA	$843.81	$382.09	$1,225.90
		2019 LPA	$1,296.76	$0.00	$1,296.76
		Total Incremental Cost Per-Unit			**$70.86**
Outdoor Sales Frontage	Per Linear Foot	2016 LPA	$99.22	$31.20	$130.42
		2019 LPA	$139.96	$0.00	$139.96
		Total Incremental Cost Per-Unit			**$9.54**
Hardscape Ornamental Lighting	Per Square Foot	2016 LPA	$0.89	$0.10	$0.99
		2019 LPA	$0.07	$0.00	$0.07
		Total Incremental Cost Per-Unit			**($0.92)**
Building Facades	Per Square Foot	2016 LPA	$1.67	$0.48	$2.15
		2019 LPA	$2.18	$0.00	$2.18
		Total Incremental Cost Per-Unit			**$0.03**
Outdoor Sales Lots	Per Square Foot	2016 LPA	$1.99	$1.05	$3.04
		2019 LPA	$2.96	$0.00	$2.96
		Total Incremental Cost Per-Unit			**($0.08)**
Vehicle Service Station Hardscape	Per Square Foot	2016 LPA	$1.57	$0.24	$1.81
		2019 LPA	$2.02	$0.00	$2.02
		Total Incremental Cost Per-Unit			**$0.21**
Vehicle Service Station Canopies	Per Square Foot	2016 LPA	$3.03	$1.69	$4.72
		2019 LPA	$2.77	$0.00	$2.77
		Total Incremental Cost Per-Unit			**($1.95)**
Sales Canopies	Per Square Foot	2016 LPA	$5.08	$1.54	$6.62
		2019 LPA	$5.11	$0.00	$5.11
		Total Incremental Cost Per-Unit			**($1.51)**
Non-sales Canopies	Per Square Foot	2016 LPA	$2.64	$1.79	$4.43
		2019 LPA	$2.65	$0.00	$2.65
		Total Incremental Cost Per-Unit			**($1.78)**

Specific Application	Unit		First Cost (per-unit)	Routine Maintenance Cost (per-unit)	Total Cost (per-unit)
Guard Stations	Per Square Foot	2016 LPA	$4.98	$1.68	$6.66
		2019 LPA	$4.12	$0.00	$4.12
		Total Incremental Cost Per-Unit			**($2.54)**
Student Pick-up/Drop-off Zone	Per Square Foot	2016 LPA	$3.06	$0.36	$3.42
		2019 LPA	$2.77	$0.00	$2.77
		Total Incremental Cost Per-Unit			**($0.65)**
Outdoor Dining	Per Square Foot	2016 LPA	$0.01	$7.09	$7.10
		2019 LPA	$0.06	$0.00	$0.06
		Total Incremental Cost Per-Unit			**($7.04)**
Special Security Lighting for Retail	Per Square Foot	2016 LPA	$0.27	$0.06	$0.33
		2019 LPA	$0.19	$0.00	$0.19
		Total Incremental Cost Per-Unit			**($0.14)**

a. A negative total incremental cost means a measure is instantly cost-effective

5.5 Lifecycle Cost-Effectiveness

This measure proposes a prescriptive requirement. As such, a lifecycle cost analysis is required to demonstrate that the measure is cost-effective over the 15-year period of analysis. The Energy Commission establishes the procedures for calculating lifecycle cost-effectiveness. The Statewide CASE Team collaborated with Energy Commission staff to confirm that the methodology in this report is consistent with their guidelines, including which costs were included in the analysis. In this case, incremental first cost and incremental routine maintenance costs within the 15-year period of analysis were included. The TDV energy cost savings from electricity savings were also included in the evaluation. Design costs and the incremental cost of code compliance verification were not included.

According to the Energy Commission's definitions, a measure is cost-effective if the benefit-to-cost (B/C) ratio is greater than 1.0. The B/C ratio is calculated by dividing the total present lifecycle cost benefits by the present value of the total incremental costs.

Results of the per-unit lifecycle cost-effectiveness analyses are presented in Table 16 and Table 17 for General Hardscape new construction and alterations, respectively. Table 18, and Table 19 present the results for Specific Applications new construction and alterations, respectively.

Table 16: General Hardscape Lifecycle Cost-Effectiveness Summary Per-Unit – New Construction

Sub-Measure	Units	Benefits TDV Energy Cost Savings + Other PV Savings[a] (2020 PV$)	Costs Total Incremental PV Costs[b] (2020 PV$)	Benefit-to-Cost Ratio
General Hardscape	Per Square Foot	$ 0.25	$0.00	Infinite

a. **Benefits: TDV Energy Cost Savings + Other PV Savings:** Benefits include TDV energy cost savings over the period of analysis (Energy + Environmental Economics 2016, 51-53). Other savings are discounted at a real (nominal – inflation) three percent rate. Other PV savings include incremental first-cost savings if proposed first cost is less than current first cost. Includes present value maintenance cost savings if PV of proposed maintenance costs is less than the PV of current maintenance costs.

b. **Costs: Total Incremental Present Valued Costs:** Costs include incremental equipment, replacement and routine maintenance costs over the period of analysis. Costs are discounted at a real (inflation adjusted) three percent rate. Includes incremental first cost if proposed first cost is greater than current first cost. Includes present value of routine maintenance incremental cost if PV of proposed routine maintenance costs is greater than the PV of current routine maintenance costs. If incremental routine maintenance cost is negative it is treated as a positive benefit. If there are no Total Incremental Present Valued Costs, the B/C ratio is infinite.

Table 17: General Hardscape Lifecycle Cost-Effectiveness Summary Per-Unit – Alterations

Sub-Measure	Units	Benefits TDV Energy Cost Savings + Other PV Savings[a] (2020 PV $)	Costs Total Incremental PV Costs[b] (2020 PV $)	Benefit-to-Cost Ratio
General Hardscape	Per Square Foot	$ 0.25	$0.00	Infinite

a. **Benefits: TDV Energy Cost Savings + Other PV Savings:** Benefits include TDV energy cost savings over the period of analysis (Energy + Environmental Economics 2016, 51-53). Other savings are discounted at a real (nominal – inflation) three percent rate. Other PV savings include incremental first-cost savings if proposed first cost is less than current first cost. Includes present value maintenance cost savings if PV of proposed maintenance costs is less than the PV of current maintenance costs.

b. **Costs: Total Incremental Present Valued Costs:** Costs include incremental equipment, replacement and routine maintenance costs over the period of analysis. Costs are discounted at a real (inflation adjusted) three percent rate. Includes incremental first cost if proposed first cost is greater than current first cost. Includes present value of routine maintenance incremental cost if PV of proposed routine maintenance costs is greater than the PV of current routine maintenance costs. If incremental routine maintenance cost is negative it is treated as a positive benefit. If there are no Total Incremental Present Valued Costs, the B/C ratio is infinite.

Table 18: Specific Applications Lifecycle Cost-effectiveness Summary Per-Unit – New Construction

Sub-Measure	Units	Benefits TDV Energy Cost Savings + Other PV Savings[a] (2020 PV$)	Costs Total Incremental PV Costs[b] (2020 PV$)	Benefit-to-Cost Ratio
Building Entrances	Each	$172.85	$0.00	Infinite
Primary Entrances	Each	$672.33	$0.00	Infinite
Drive Up Windows	Each	$550.41	$0.00	Infinite
Vehicle Service Uncovered Fuel Dispenser	Each Pump Face	$1,138.02	$11.66	97.6
ATM Machine	Each	$1,086.38	$90.89	12.0
Outdoor Sales Frontage	Per Linear Foot	$82.01	$11.17	7.35
Hardscape Ornamental Lighting	Per Square Foot	$0.18	$0.00	Infinite
Building Facades	Per Square Foot	$1.32	$0.02	51.4
Outdoor Sales Lots	Per Square Foot	$4.60	$0.00	Infinite
Vehicle Service Station Hardscape	Per Square Foot	$1.63	$0.21	7.9
Vehicle Service Station Canopies	Per Square Foot	$7.13	$0.00	Infinite
Sales Canopies	Per Square Foot	$2.26	$0.00	Infinite
Non-sales Canopies	Per Square Foot	$0.68	$0.00	Infinite
Guard Stations	Per Square Foot	$4.01	$0.00	Infinite
Student Pick-up/Drop-off Zone	Per Square Foot	$0.95	$0.00	Infinite
Outdoor Dining	Per Square Foot	$0.87	$0.00	Infinite
Special Security Lighting for Retail	Per Square Foot	$0.10	$0.00	Infinite

a. **Benefits: TDV Energy Cost Savings + Other PV Savings:** Benefits include TDV energy cost savings over the period of analysis (Energy + Environmental Economics 2016, 51-53). Other savings are discounted at a real (nominal – inflation) three percent rate. Other PV savings include incremental first cost savings if proposed first cost is less than current first cost. Includes present value maintenance cost savings if PV of proposed maintenance costs is less than the PV of current maintenance costs.

b. **Costs: Total Incremental Present Valued Costs:** Costs include incremental equipment, replacement and routine maintenance costs over the period of analysis. Costs are discounted at a real (inflation adjusted) three percent rate. Includes incremental first cost if proposed first cost is greater than current first cost. Includes present value of routine maintenance incremental cost if PV of proposed routine maintenance costs is greater than the PV of current routine maintenance costs. If incremental routine maintenance cost is negative it is treated as a positive benefit. If there are no Total Incremental Present Valued Costs, the B/C ratio is infinite.

Table 19: Specific Applications Lifecycle Cost-effectiveness Summary Per-Unit – Alterations

Sub-Measure	Units	Benefits TDV Energy Cost Savings + Other PV Savings[a] (2020 PV$)	Costs Total Incremental PV Costs[b] (2020 PV$)	Benefit-to-Cost Ratio
Building Entrances	Each	$172.85	$0.00	Infinite
Primary Entrances	Each	$672.33	$0.00	Infinite
Drive Up Windows	Each	$550.41	$0.00	Infinite
Vehicle Service Uncovered Fuel Dispenser	Each Pump Face	$1,138.02	$11.66	97.6
ATM Machine	Each	$1,086.38	$90.89	12.0
Outdoor Sales Frontage	Per Linear Foot	$82.01	$11.17	7.35
Hardscape Ornamental Lighting	Per Square Foot	$0.18	$0.00	Infinite
Building Facades	Per Square Foot	$1.32	$0.02	51.4
Outdoor Sales Lots	Per Square Foot	$4.60	$0.00	Infinite
Vehicle Service Station Hardscape	Per Square Foot	$1.63	$0.21	7.9
Vehicle Service Station Canopies	Per Square Foot	$7.13	$0.00	Infinite
Sales Canopies	Per Square Foot	$2.26	$0.00	Infinite
Non-sales Canopies	Per Square Foot	$0.68	$0.00	Infinite
Guard Stations	Per Square Foot	$4.01	$0.00	Infinite
Student Pick-up/Drop-off Zone	Per Square Foot	$0.95	$0.00	Infinite
Outdoor Dining	Per Square Foot	$0.87	$0.00	Infinite
Special Security Lighting for Retail	Per Square Foot	$0.10	$0.00	Infinite

a. **Benefits: TDV Energy Cost Savings + Other PV Savings:** Benefits include TDV energy cost savings over the period of analysis (Energy + Environmental Economics 2016, 51-53). Other savings are discounted at a real (nominal – inflation) three percent rate. Other PV savings include incremental first cost savings if proposed first cost is less than current first cost. Includes present value routine maintenance cost savings if PV of proposed routine maintenance costs is less than the PV of current routine maintenance costs.

b. **Costs: Total Incremental Present Valued Costs:** Costs include incremental equipment, replacement and routine maintenance costs over the period of analysis. Costs are discounted at a real (inflation adjusted) three percent rate. Includes incremental first cost if proposed first cost is greater than current first cost. Includes present value of routine maintenance incremental cost if PV of proposed routine maintenance costs is greater than the PV of current routine maintenance costs. If incremental routine maintenance cost is negative it is treated as a positive benefit. If there are no Total Incremental Present Valued Costs, the B/C ratio is infinite.

6. FIRST-YEAR STATEWIDE IMPACTS

6.1 Statewide Energy Savings and Lifecycle Energy Cost Savings

The Statewide CASE Team calculated the first-year statewide savings for new construction by multiplying the per-unit savings, which are presented in Section 4.3, by the statewide new construction forecast for 2020 or expected alterations in 2020, which is presented in more detail in Appendix A. The first-year energy impacts represent the annual savings from all buildings that were completed in 2020 for the first 12 months the buildings are operational. The lifecycle energy cost savings represent the energy cost savings over the entire 15-year analysis period. The statewide savings estimates do not take naturally occurring market adoption or compliance rates into account.

Results from new construction and alterations for General Hardscape and Specific Applications by climate zone are presented in Table 20 through Table 23.

Given data regarding the new construction forecast and expected additions and alterations in 2020, the Statewide CASE Team estimates that the proposed code change will reduce annual statewide electricity use by 118 GWh with an associated demand reduction of 2.4 MW. Natural gas use is expected to be reduced by zero therms. The energy savings for buildings constructed in 2020 are associated with a present valued energy cost savings of approximately $273.61 million in (discounted) energy costs over the 15-year period of analysis.

Table 20: General Hardscape Statewide Energy and Energy Cost Impacts – New Construction

Sub-measure	Units	Statewide Construction in 2020 (millions of units)	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction (MW)	First-Year Natural Gas Savings (million therms)	Lifecycle[2] Present Valued Energy Cost Savings (PV$ million)
General Hardscape	Per Square Foot	136.24	15.08	0.25	N/A	$34.10

Table 21: General Hardscape Statewide Energy and Energy Cost Impacts – Alterations

Sub-measure	Units	Statewide Construction in 2020 (millions of units)	First-Year Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction (MW)	First-Year Natural Gas Savings (million therms)	Lifecycle[2] Present Valued Energy Cost Savings (PV$ million)
General Hardscape	Per Square Foot	401.64	44.44	0.75	N/A	$100.50

Table 22: Specific Applications Statewide Energy and Energy Cost Impacts – New Construction

Sub-measure	Units	Statewide Construction in 2020 (millions of units)	First-Year[a] Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction (MW)	First-Year Natural Gas Savings (million therms)	Lifecycle[b] PV Energy Cost Savings (PV$ million)
Building Entrances	Each	0.03	2.54	0.04	N/A	$6.07
Primary Entrances	Each	0.00	0.02	0.00	N/A	$0.04
Drive Up Windows	Each	0.00	0.21	0.01	N/A	$0.51
Vehicle Service Uncovered Fuel Dispenser	Each Pump Face	0.00	0.02	0.00	N/A	$0.04
ATM Machine	Each	0.00	0.11	0.00	N/A	$0.14
Outdoor Sales Frontage	Per Linear Foot	0.01	3.80	0.15	N/A	$8.00
Hardscape Ornamental Lighting	Per Square Foot	5.10	0.61	0.01	N/A	$0.97
Building Facades	Per Square Foot	8.00	4.36	0.11	N/A	$2.83
Outdoor Sales Lots	Per Square Foot	2.40	3.55	0.09	N/A	$4.48
Vehicle Service Station Hardscape	Per Square Foot	4.40	2.74	0.06	N/A	$5.84
Vehicle Service Station Canopies	Per Square Foot	0.48	1.36	0.03	N/A	$2.78
Sales Canopies	Per Square Foot	0.20	0.18	0.00	N/A	$0.37
Non-sales Canopies	Per Square Foot	3.00	1.83	0.01	N/A	$2.01
Guard Stations	Per Square Foot	0.05	0.08	0.00	N/A	$0.18
Student Pick-up/Drop-off Zone	Per Square Foot	0.21	0.08	0.00	N/A	$0.20
Outdoor Dining	Per Square Foot	0.65	0.55	0.01	N/A	$0.58
Special Security Lighting for Retail	Per Square Foot	0.62	0.02	0.00	N/A	$0.06
TOTAL		**17.08**	**14.75**	**0.34**	**N/A**	**$35.10**

a. First-year savings from all buildings completed statewide in 2020.

b. Energy cost savings from all buildings completed statewide in 2020 accrued during 15-year period of analysis.

Table 23: Specific Applications Statewide Energy and Energy Cost Impacts – Alterations

Sub-measure	Units	Statewide Construction in 2020 (million units)	First-Year[a] Electricity Savings (GWh)	First-Year Peak Electrical Demand Reduction (MW)	First-Year Natural Gas Savings (million therms)	Lifecycle[b] PV Energy Cost Savings (PV$ million)
Building Entrances	Each	0.10	7.55	0.13	N/A	$18.06
Primary Entrances	Each	0.00	0.06	0.00	N/A	$0.13
Drive Up Windows	Each	0.00	0.60	0.01	N/A	$1.44
Vehicle Service Uncovered Fuel Dispenser	Each Pump Face	0.00	0.05	0.00	N/A	$0.11
ATM Machine	Each	0.00	0.27	0.00	N/A	$0.42
Outdoor Sales Frontage	Per Linear Foot	0.29	9.22	0.37	N/A	$23.78
Hardscape Ornamental Lighting	Per Square Foot	15.17	1.82	0.03	N/A	$2.79
Building Facades	Per Square Foot	6.29	3.35	0.08	N/A	$8.29
Outdoor Sales Lots	Per Square Foot	2.90	5.87	0.11	N/A	$13.34
Vehicle Service Station Hardscape	Per Square Foot	10.63	7.67	0.13	N/A	$17.37
Vehicle Service Station Canopies	Per Square Foot	1.16	3.65	0.06	N/A	$8.27
Sales Canopies	Per Square Foot	0.48	0.43	0.01	N/A	$1.09
Non-sales Canopies	Per Square Foot	8.54	1.93	0.03	N/A	$5.84
Guard Stations	Per Square Foot	0.14	0.23	0.00	N/A	$0.54
Student Pick-up/Drop-off Zone	Per Square Foot	0.70	0.25	0.01	N/A	$0.66
Outdoor Dining	Per Square Foot	1.89	0.66	0.03	N/A	$1.63
Special Security Lighting for Retail	Per Square Foot	1.67	0.07	0.00	N/A	$0.16
TOTAL		**49.95**	**43.68**	**1.02**	**N/A**	**$103.91**

a. First-year savings from all alterations completed statewide in 2020.

b. Energy cost savings from all alterations completed statewide in 2020 accrued during 15-year period of analysis.

6.2 Statewide Water Use Impacts

The proposed code change will not result in water savings.

6.3 Statewide Material Impacts

The Statewide CASE Team calculated material impacts based on life-cycle assessment of impacts of LED and legacy technology products.[9]

Table 24: Impacts of Material Use[c]

Element	Impact (I, D, or NC) [a]	Impact on Material Use (lbs/yr)	
		Per-Unit Impacts	First-Year[b] Statewide Impacts
Antimony	D	0.0	13
Arsenic	I	0.0	0.1
Barium	I	0.0	21
Chromium	I	0.0	17
Copper	D	0.0	372
Lead	D	0.0	47
Mercury	D	0.0	0.2
Nickel	D	0.0	11
Silver	I	0.0	3
Zinc	D	0.0	237

a. Material Increase (I), Decrease (D), or No Change (NC) compared to base case (lbs/yr).

b. First-year savings from all new construction completed statewide in 2020.

c. Materials with increased usage have been colored red.

6.4 Other Non-Energy Impacts

There are a number of non-energy impacts and benefits resulting from this code change. The new proposed LPAs are based on less efficacious, 3000K LED luminaires to ensure warmer CCTs are not precluded per code requirements. Additionally, an all LED baseline means that areas can be continuously and smoothly dimmed as necessary, versus large increments in dimming levels associated with legacy technology. LED luminaires can also operate at a much lower rated light source power level than legacy products. LEDs are typically able to operate at ten percent rated light source power while the lamp power of a PSMH luminaire cannot drop below 50 percent of its rated value. Additionally, LED technology has progressed so that local fauna and local active professional observatories' needs can be accommodated. This proposed measure includes an increases wattage allowance so that narrow band spectrum light sources can be used that will not disturb sensitive species or observatories.

7. PROPOSED REVISIONS TO CODE LANGUAGE

The proposed changes to the Standards, Reference Appendices, and the ACM Reference Manuals are provided below. Changes to the 2016 documents are marked with underlining (new language) and ~~strikethroughs~~ (deletions).

[9] https://energy.gov/sites/prod/files/2015/10/f27/2013_led_lca-pt3.pdf

7.1 Standards

SECTION 100.1 – DEFINITIONS AND RULES OF CONSTRUCTION

NARROW BAND SPECTRUM is a limited range of wavelengths (nm) concentric to a dominant peak wavelength in the visible spectrum. The limited range of wavelengths shall be within 20 nm on either side of the peak wavelength at 50 percent of the peak wavelength's relative spectral power, and within 75 nm on either side of the peak wavelength at 10 percent of the peak wavelength's relative spectral power.

SECTION 130.2(b) – OUTDOOR LIGHTING CONTROLS AND EQUIPMENT

(b) Luminaire ~~Cutoff~~ Shielding Requirements. All outdoor luminaires rated ~~for use with lamps~~ greater than 30 ~~150 lamp~~ watts, determined in accordance with Section 130.0(c), shall comply with Backlight, Uplight, and Glare (collectively referred to as "BUG" in accordance with IES TM-15-11, Addendum A) requirements as follows:

SECTION 140.7 – REQUIREMENTS FOR OUTDOOR LIGHTING

Two new lines were added to Table 140.7-A for concrete hardscape and asphalt hardscape and a third footnote for narrow band spectrum light sources was added. This table was also modified with edits to footnote two that incorporate revisions to RP-20. Table 25 and Table 26 below represent the current and proposed formats and LPAs, respectively:

Table 25: 2016 Table 140.7-A General Hardscape Format and LPAs

TABLE 140.7-A GENERAL HARDSCAPE LIGHTING POWER ALLOWANCE

Type of Power Allowance	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2[2]	Lighting Zone 3[2]	Lighting Zone 4
Area Wattage Allowance (AWA)	No Allowance [1]	0.020 W/ft^2	0.030 W/ft^2	0.040 W/ft^2	0.050 W/ft^2
Linear Wattage Allowance (LWA)		0.15 W/lf	0.25 W/lf	0.35 W/lf	0.45 W/lf
Initial Wattage Allowance (IWA)		340 W	450 W	520 W	640 W

[1] Continuous lighting is explicitly prohibited in Lighting Zone 0. A single luminaire of 15 Watts or less may be installed at an entrance to a parking area, trail head, fee payment kiosk, outhouse, or toilet facility, as required to provide safe navigation of the site infrastructure. Luminaires installed in Lighting Zone 0 shall meet the maximum zonal lumen limits for Uplight and Glare specified in Table 130.2-A and 130.2-B.

[2] For Lighting Zone 2 and 3, where greater than 50% of the paved surface of a parking lot is finished with concrete, the AWA for that area shall be 0.035 W/ft^2 for Lighting Zone 2 and 0.040 W/ft^2 for Lighting Zone 3, and the LWA for both lighting zones shall be 0.70 W/lf. This does not extend beyond the parking lot, and does not include any other General Hardscape areas.

Table 26: Proposed Format With New LPAs For Table 140.7-A General Hardscape

Type of Power Allowance	Lighting Zone 0[3]	Lighting Zone 1[3]	Lighting Zone 2[3]		Lighting Zone 3[3]		Lighting Zone 4[3]
	Asphalt/Concrete	Asphalt/Concrete	Asphalt	Concrete[2]	Asphalt	Concrete[2]	Asphalt/Concrete
Area Wattage Allowance (AWA)	No Allowance[1]	0.018	0.023	0.025	0.025	0.030	0.030
Linear Wattage Allowance (LWA)		0.15	0.17	0.40	0.25	0.40	0.35
Initial Wattage Allowance (IWA)		180	250	250	350	350	400

[1] Continuous lighting is explicitly prohibited in Lighting Zone 0. A single luminaire of 15 Watts or less may be installed at an entrance to a parking area, trail head, fee payment kiosk, outhouse, or toilet facility, as required to provide safe navigation of the site infrastructure. Luminaires installed in Lighting Zone 0 shall meet the maximum zonal lumen limits for Uplight and Glare specified in Table 130.2-A and 130.2-B.

[2] Where greater than 50% of the paved surface of a parking lot is finished with concrete. This does not extend beyond the parking lot, and does not include any other General hardscape areas.

[3] Light sources having a narrow band spectral output with a dominant peak wavelength greater than 580 nm - as mandated by local, state, or federal agencies to minimize the impact on local, active professional astronomy or nocturnal habitat of specific local fauna - shall be allowed a 2.0 lighting power allowance multiplier.

Table 27 below includes the new LPAs for Specific Applications.

Table 27: New LPAs For Table 140.7-B Specific Applications

Lighting Application	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
WATTAGE ALLOWANCE PER APPLICATION. Use all that apply as appropriate.					
Building Entrances or Exits. Allowance per door. Luminaires qualifying for this allowance shall be within 20 feet of the door.	Not Applicable	~~15~~ 9 watts	~~25~~ 15 watts	~~35~~ 19 watts	~~45~~ 21 watts
Primary Entrances to Senior Care Facilities, Police Stations, Hospitals, Fire Stations, and Emergency Vehicle Facilities. Allowance per primary entrance(s) only. Primary entrances shall provide access for the general public and shall not be used exclusively for staff or service personnel. This allowance shall be in addition to the building entrance or exit allowance above. Luminaires qualifying for this allowance shall be within 100 feet of the primary entrance.	Not Applicable	~~45~~ 20 watts	~~80~~ 40 watts	~~120~~ 57 watts	~~130~~ 60 watts
Drive Up Windows. Allowance per customer service location. Luminaires qualifying for this allowance shall be within 2 mounting heights of the sill of the window.	Not Applicable	~~40~~ 16 watts	~~75~~ 30 watts	~~125~~ 50 watts	~~200~~ 75 watts
Vehicle Service Station Uncovered Fuel Dispenser. Allowance per fueling dispenser. Luminaires qualifying for this allowance shall be within 2 mounting heights of the dispenser.	Not Applicable	~~120~~ 55 watts	~~175~~ 77 watts	~~185~~ 81 watts	~~330~~ 135 watts

Lighting Application	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
ATM Machine Lighting. Allowance per ATM machine. Luminaires qualifying for this allowance shall be within 50 feet of the dispenser.	Not Applicable	~~250~~ 100 watts for first ATM machine, ~~70~~ 35 watts for each additional ATM machine			
WATTAGE ALLOWANCE PER UNIT LENGTH (w/linear ft). May be used for one or two frontage side(s) per site.					
Outdoor Sales Frontage. Allowance for frontage immediately adjacent to the principal viewing location(s) and unobstructed for its viewing length. A corner sales lot may include two adjacent sides to a public right of way provided that a different principal viewing location exists for each side. Luminaires qualifying for this allowance shall be located between the principal viewing location and the frontage outdoor sales area.	Not Applicable	No Allowance	~~22.5~~ 11 W/linear ft	~~36~~ 19 W/linear ft	~~45~~ 25 W/linear ft
WATTAGE ALLOWANCE PER HARDSCAPE AREA (W/ft²). May be used for any illuminated hardscape area on the site.					
Hardscape Ornamental Lighting. Allowance for the total site illuminated hardscape area. Luminaires qualifying for this allowance shall be rated for 100 watts or less as determined in accordance with Section 130.0(d), and shall be post- top luminaires, lanterns, pendant luminaires, or chandeliers.	Not Applicable	No Allowance	~~0.02~~ 0.007 W/ft²	~~0.04~~ 0.013 W/ft²	~~0.06~~ 0.019 W/ft²
WATTAGE ALLOWANCE PER SPECIFIC AREA (W/ft²). Use as appropriate provided that none of the following specific applications shall be used for the same area.					
Building Facades. Only areas of building façade that are illuminated shall qualify for this allowance. Luminaires qualifying for this allowance shall be aimed at the façade and shall be capable of illuminating it without obstruction or interference by permanent building features or other objects.	Not Applicable	No Allowance	~~0.18~~ 0.100 W/ft²	~~0.35~~ 0.170 W/ft²	~~0.50~~ 0.225 W/ft²
Outdoor Sales Lots. Allowance for uncovered sales lots used exclusively for the display of vehicles or other merchandise for sale. Driveways, parking lots or other non-sales areas shall be considered hardscape areas even if these areas are completely surrounded by sales lot on all sides. Luminaires qualifying for this allowance shall be within 5 mounting heights of the sales lot area.	Not Applicable	~~0.164~~ 0.060 W/ft²	~~0.555~~ 0.210 W/ft²	~~0.758~~ 0.280 W/ft²	~~1.285~~ 0.485 W/ft²
Vehicle Service Station Hardscape. Allowance for the total illuminated hardscape area less area of buildings, under canopies, off property, or obstructed by signs or structures. Luminaires qualifying for this allowance shall be illuminating the hardscape area and shall not be within a building, below a canopy, beyond property lines, or obstructed by a sign or other structure.	Not Applicable	~~0.014~~ 0.006 W/ft²	~~0.155~~ 0.068 W/ft²	~~0.308~~ 0.138 W/ft²	~~0.485~~ 0.200 W/ft²
Vehicle Service Station Canopies. Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	Not Applicable	~~0.514~~ 0.220 W/ft²	~~1.005~~ 0.430 W/ft²	~~1.300~~ 0.580 W/ft²	~~2.200~~ 1.010 W/ft²
Sales Canopies. Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	Not Applicable	No Allowance	~~0.655~~ 0.470 W/ft²	~~0.908~~ 0.622 W/ft²	~~1.135~~ 0.740 W/ft²
Non-sales Canopies and Tunnels. Allowance for the total area within the drip line of the canopy or inside the tunnel. Luminaires qualifying for this allowance shall be located under the canopy or tunnel.	Not Applicable	~~0.084~~ 0.057 W/ft²	~~0.205~~ 0.137 W/ft²	~~0.408~~ 0.270 W/ft²	~~0.585~~ 0.370 W/ft²
Guard Stations. Allowance up to 1,000 square feet per vehicle lane. Guard stations provide access to secure areas controlled by security personnel who stop and may inspect vehicles and vehicle occupants, including identification, documentation, vehicle license plates, and vehicle contents. Qualifying luminaires shall be within 2 mounting heights of a vehicle lane or the guardhouse.	Not Applicable	~~0.154~~ 0.081 W/ft²	~~0.355~~ 0.176 W/ft²	~~0.708~~ 0.325 W/ft²	~~0.985~~ 0.425 W/ft²

Lighting Application	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Student Pick-up/Drop-off zone. Allowance for the area of the student pick-up/drop-off zone, with or without canopy, for preschool through 12th grade school campuses. A student pick-up/drop off zone is a curbside, controlled traffic area on a school campus where students are picked-up and dropped off from vehicles. The allowed area shall be the smaller of the actual width or 25 feet, times the smaller of the actual length or 250 feet. Qualifying luminaires shall be within 2 mounting heights of the student pick-up/drop-off zone.	Not Applicable	No Allowance	~~0.12~~ 0.056 W/ft²	~~0.45~~ 0.200 W/ft²	No Allowance
Outdoor Dining. Allowance for the total illuminated hardscape of outdoor dining. Outdoor dining areas are hardscape areas used to serve and consume food and beverages. Qualifying luminaires shall be within 2 mounting heights of the hardscape area of outdoor dining.	Not Applicable	~~0.014~~ 0.004 W/ft²	~~0.135~~ 0.030 W/ft²	~~0.240~~ 0.050 W/ft²	~~0.400~~ 0.075 W/ft²
Special Security Lighting for Retail Parking and Pedestrian Hardscape. This additional allowance is for illuminated retail parking and pedestrian hardscape identified as having special security needs. This allowance shall be in addition to the building entrance or exit allowance.	Not Applicable	~~0.007~~ 0.004 W/ft²	~~0.009~~ 0.005 W/ft²	~~0.019~~ 0.010 W/ft²	No Allowance

7.2 Reference Appendices

There are no proposed changes to the Reference Appendices.

7.3 ACM Reference Manual

There are no proposed changes to the ACM Reference Manual.

7.4 Compliance Manuals

Chapter 6 of the Nonresidential Compliance Manual will need to be revised to account for updated LPAs. No other changes are expected in the manual.

7.5 Compliance Documents

Compliance document NRCC-LTO-03-E will need to be revised to account for different LPAs between asphalt and concrete for Table 140.7-A General Hardscape.

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Appendix A: STATEWIDE SAVINGS METHODOLOGY

The projected nonresidential new construction forecast that will be impacted by the proposed code change in 2020 is presented in Table 28. The projected nonresidential existing statewide building stock that will be impacted by the propose code change as a result of additions and alterations in 2020 is presented in Table 29.

To calculate first-year statewide savings, the Statewide CASE Team multiplied the per-unit savings by statewide new construction estimates for the first year the standards will be in effect (2020). The Energy Commission Demand Analysis Office provided the Statewide CASE Team with the nonresidential new construction forecast. The raw data presented annual total building stock and new construction estimates for twelve building types by forecast climate zones (FCZ). The Statewide CASE Team completed the following steps to refine the data and develop estimates of statewide floorspace that will be impacted by the proposed code changes:

The Statewide CASE Team completed the following steps to refine the data and develop estimates of statewide floorspace that will be impacted by the proposed code changes:

1. Translated data from FCZ data into building climate zones (BCZ). This was completed using the FCZ to BCZ conversion factors provided by the Energy Commission (see Table 30). Translated data from FCZ data into building standards climate zones (BSCZ). Since Title 24, Part 6 uses BSCZ, the Statewide CASE Team converted the construction forecast from FCZ to BSCZ using conversion factors supplied by the Energy Commission. The conversion factors, which are presented in Table 30 represent the percentage of building square footage in FCZ that is also in BSCZ. For example, looking at the first column of conversion factors in Table 30, 22.5 percent of the building square footage in FCZ 1 is also in BSCZ 1 and 0.1 percent of building square footage in FCZ 4 is in BSCZ 1. To convert from FCZ to BSCZ, the total forecasted construction for a specific building type in each FCZ was multiplied by the conversion factors for BSCZ 1, then all square footage from all FCZs that are found to be in BSCZ 1 are summed to arrive at the total construction for that building type in BSCZ 1. This process was repeated for every climate zone and every building type. See Table 32 for an example calculation to convert from FCZ to BSCZ. In this example, construction BSCZ 1 is made up of building floorspace from FCZs 1, 4, and 14.
2. Made assumptions about the percentage of nonresidential new construction in 2020 that will be impacted by proposed code change by building type and climate zone. The Statewide CASE Team's assumptions are presented in Table 31 and Table 32 and discussed further below.
3. Made assumptions about the percentage of the total nonresidential building stock in 2020 that will be impacted by the proposed code change (additions and alterations) by building type and climate zone. The Statewide CASE Team's assumptions are presented in Table 31 and Table 32 and discussed further below.
4. Calculated nonresidential floorspace that will be impacted by the proposed code change in 2020 by building type and climate zone for both new construction and alterations. Results are presented in Table 28 and Table 29.

This measure applies to all nonresidential spaces, which is why 100 percent of new construction is assumed to be affected. The Statewide CASE Team used a seven percent assumption for existing floorspace as an industry standard percentage of turnover for lighting.

There are several aspects of the statewide estimates that add complexity to the calculation. These are:

1. Construction estimates of the square footage of outdoor hardscape are not included in statewide construction forecasts, and therefore must be estimated by the use of a proxy.
2. The construction forecasts do not predict construction activity based on the Lighting Zones, as defined in Title 24, and therefore another translation must be performed to predict the statewide impacts based on the area of each individual Lighting Zone, and modified by anticipated construction activity weighted for each Lighting Zone.
3. The actual amount of lighting employed on the hardscape is not clearly known. There is evidence that it may be somewhat less than a fully lighted condition in some cases. The Statewide CASE Team analysis will adjust the full allowance downward to accommodate sites that are not fully lighted.

Table 28: Estimated New Nonresidential Construction Impacted by Proposed Code Change in 2020, by Climate Zone and Building Type (Million Square Feet)

Climate Zone	New Construction in 2020 (Million Square Feet)												
	Small Office	Restaurant	Retail	Food	Non-Refrigerated Warehouse	Refrigerated Warehouse	School	College	Hospital	Hotel	Miscellaneous	Large Office	TOTAL
1	0.0494	0.0163	0.0853	0.0287	0.0368	0.0024	0.0656	0.0280	0.0307	0.0252	0.1115	0.0546	0.5344
2	0.2094	0.0921	0.7071	0.1856	0.4734	0.0379	0.3277	0.1629	0.2106	0.2354	0.8961	0.8296	4.3678
3	0.6925	0.3910	3.1839	0.7394	2.8795	0.1861	1.2192	0.7361	0.8441	1.3410	4.2876	5.5830	22.0835
4	0.4642	0.2089	1.6923	0.4394	1.0709	0.0942	0.7371	0.3647	0.5034	0.5232	2.0944	1.8543	10.0470
5	0.0901	0.0406	0.3286	0.0853	0.2079	0.0183	0.1431	0.0708	0.0977	0.1016	0.4066	0.3600	1.9508
6	0.6562	0.4806	2.7570	0.6896	2.2619	0.0986	0.8324	0.4764	0.5260	0.6422	2.6255	3.6351	15.6814
7	0.8790	0.2643	1.7010	0.5230	0.9519	0.0093	0.8959	0.3922	0.5561	0.5616	1.7181	1.8328	10.2854
8	0.9103	0.6887	3.9674	0.9869	3.2044	0.1363	1.2113	0.6661	0.7993	0.9200	3.8447	5.3065	22.6420
9	0.8937	0.7622	4.1915	1.0172	3.4313	0.1143	1.2286	0.7831	1.1364	1.0587	4.4500	7.1600	26.2269
10	0.9833	0.6400	3.0564	0.8578	2.6193	0.0595	1.6484	0.5499	0.6499	0.5891	3.3939	1.7311	16.7786
11	0.2830	0.0875	0.6543	0.2231	0.6491	0.0768	0.4366	0.1406	0.2110	0.1448	0.7554	0.3341	3.9962
12	1.5316	0.4403	3.5976	0.9482	3.0782	0.2282	1.7985	0.6916	1.0131	0.9038	3.9658	3.6878	21.8846
13	0.6028	0.1986	1.4244	0.4797	1.2207	0.1958	0.9484	0.2751	0.4488	0.3201	1.7269	0.6287	8.4700
14	0.1598	0.1219	0.6017	0.1621	0.5098	0.0187	0.2989	0.0969	0.1279	0.1102	0.6806	0.4322	3.3207
15	0.2172	0.0853	0.5340	0.1817	0.5765	0.0167	0.3049	0.0737	0.0905	0.1339	0.5966	0.2185	3.0295
16	0.2220	0.1358	0.7642	0.2060	0.5350	0.0332	0.3240	0.1666	0.1893	0.1510	0.9377	0.9963	4.6611
TOTAL	**8.8443**	**4.6542**	**29.2467**	**7.7536**	**23.7066**	**1.3263**	**12.4207**	**5.6748**	**7.4348**	**7.7617**	**32.4914**	**34.6448**	**175.9598**

Table 29: Estimated Existing Nonresidential Floorspace Impacted by Proposed Code Change in 2020 (Alterations), by Climate Zone and Building Type (Million Square Feet)

Climate Zone	Alterations in 2020 (Million Square Feet)												
	Small Office	Restaurant	Retail	Food	Non-Refrigerated Warehouse	Refrigerated Warehouse	School	College	Hospital	Hotel	Miscellaneous	Large Office	TOTAL
1	0.1471	0.0475	0.2577	0.0874	0.1283	0.0073	0.1902	0.0981	0.1119	0.0902	0.3107	0.1532	1.6296
2	0.6551	0.2442	1.9541	0.5166	1.3669	0.1081	1.0646	0.5800	0.7262	0.6878	2.4262	2.2715	12.6014
3	2.0934	0.9847	8.1846	1.9039	7.1501	0.4943	4.1610	2.4477	2.8807	3.2837	10.8984	13.7501	58.2327
4	1.4864	0.5487	4.7111	1.2252	3.2142	0.2729	2.4328	1.3312	1.7208	1.5808	5.7553	5.2988	29.5781
5	0.2886	0.1065	0.9147	0.2379	0.6241	0.0530	0.4724	0.2585	0.3341	0.3069	1.1175	1.0288	5.7430
6	2.0920	1.3923	8.2196	2.0578	7.6495	0.3102	3.6382	2.0389	2.1685	2.2835	9.5940	10.0748	51.5193
7	2.5404	0.7374	5.1268	1.5550	3.4287	0.0315	2.4626	1.3414	1.8381	2.1824	5.1626	5.6371	32.0440
8	2.8855	1.9848	11.7115	2.9199	10.7365	0.4281	5.1045	2.7994	3.1900	3.2311	13.8259	14.5972	73.4144
9	2.6479	2.1239	11.4846	2.8097	10.3170	0.3507	4.6013	3.0294	3.9106	3.2276	13.2542	17.8912	75.6480
10	3.0563	1.9712	9.6954	2.6919	10.3684	0.1987	4.6292	1.9062	2.2675	2.2077	10.9100	5.2016	55.1041
11	0.8060	0.2335	1.7677	0.6039	1.9178	0.2230	1.1901	0.4882	0.7102	0.3968	1.9943	0.8518	11.1833
12	4.1402	1.1836	9.8761	2.6078	8.8320	0.6819	5.1107	2.3287	3.4676	2.5740	10.4168	9.7204	60.9400
13	1.7153	0.5161	3.7249	1.2534	3.1859	0.5435	2.6320	0.9747	1.4680	0.8125	4.4551	1.4942	22.7757
14	0.4987	0.3691	1.8405	0.4943	1.9145	0.0580	0.8624	0.3375	0.4464	0.3832	2.1845	1.1972	10.5861
15	0.6470	0.2521	1.5392	0.5116	1.8970	0.0495	0.7499	0.2204	0.3057	0.3856	1.6352	0.5870	8.7804
16	0.6559	0.3819	2.2184	0.5964	1.7429	0.0967	0.9457	0.5797	0.6577	0.4706	2.7056	2.4926	13.5441
TOTAL	**26.3558**	**13.0776**	**83.2270**	**22.0728**	**74.4740**	**3.9074**	**40.2476**	**20.7599**	**26.2039**	**24.1045**	**96.6463**	**92.2475**	**523.3243**

Table 30: Translation from Forecast Climate Zone (FCZ) to Building Standards Climate Zone (BSCZ)

		Building Climate Zone (BSCZ)																
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**Total**
Forecast Climate Zone (FCZ)	**1**	22.5%	20.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	9.8%	33.1%	0.2%	0.0%	0.0%	13.8%	100%
	2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	22.0%	75.7%	0.0%	0.0%	0.0%	2.3%	100%
	3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	20.9%	22.8%	54.5%	0.0%	0.0%	1.8%	100%
	4	0.1%	13.7%	8.4%	46.0%	8.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	22.8%	0.0%	0.0%	0.0%	0.0%	100%
	5	0.0%	4.2%	89.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.6%	0.0%	0.0%	0.0%	0.0%	100%
	6	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	100%
	7	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	75.8%	7.1%	0.0%	17.1%	100%
	8	0.0%	0.0%	0.0%	0.0%	0.0%	40.1%	0.0%	50.8%	8.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	100%
	9	0.0%	0.0%	0.0%	0.0%	0.0%	6.4%	0.0%	26.9%	54.8%	0.0%	0.0%	0.0%	0.0%	6.1%	0.0%	5.8%	100%
	10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	74.9%	0.0%	0.0%	0.0%	12.3%	7.9%	4.9%	100%
	11	0.0%	0.0%	0.0%	0.0%	0.0%	27.0%	0.0%	30.6%	42.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100%
	12	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	4.2%	95.6%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	100%
	13	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	69.6%	0.0%	0.0%	28.8%	0.0%	0.0%	0.0%	1.6%	0.1%	0.0%	100%
	14	2.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	97.1%	100%
	15	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	99.9%	0.0%	100%
	16	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100%

Table 31: Description of Building Types and Sub-types (Prototypes) in Statewide Construction Forecast

Energy Commission Building Type ID	Energy Commission Description	Prototype Description			
		Prototype ID	Floor Area (ft^2)	Stories	Notes
OFF-SMALL	Offices less than 30,000 square feet	Small Office	5,502	1	Five zone office model with unconditioned attic and pitched roof.
REST	Any facility that serves food	Small Restaurant	2,501	1	Similar to a fast food joint with a small kitchen and dining areas.
RETAIL	Retail stores and shopping centers	Stand-Alone Retail	24,563	1	Stand Alone store similar to Walgreens or Banana Republic.
		Large Retail	240,000	1	Big box retail building, similar to a Target or Best Buy store.
		Strip Mall	9,375	1	Four-unit strip mall retail building. West end unit is twice as large as other three.
		Mixed-Use Retail	9,375	1	Four-unit retail representing the ground floor units in a mixed-use building. Same as the strip mall with adiabatic ceilings.
FOOD	Any service facility that sells food and or liquor	N/A	N/A	N/A	N/A
NWHSE	Non-refrigerated warehouses	Warehouse	49,495	1	High ceiling warehouse space with small office area.
RWHSE	Refrigerated Warehouses	N/A	N/A	N/A	N/A
SCHOOL	Schools K-12, not including colleges	Small School	24,413	1	Similar to an elementary school with classrooms, support spaces and small dining area.
		Large School	210,886	2	Similar to high school with classrooms, commercial kitchen, auditorium, gymnasium and support spaces.
COLLEGE	Colleges, universities, community colleges	Small Office	5,502	1	Five zone office model with unconditioned attic and pitched roof.
		Medium Office	53,628	3	Five zones per floor office building with plenums on each floor.
		Medium Office/Lab		3	Five zones per floor building with a combination of office and lab spaces.
		Public Assembly		2	TBD
		Large School	210,886	2	Similar to high school with classrooms, commercial kitchen, auditorium, gymnasium and support spaces.
		High Rise Apartment	93,632	10	75 residential units along with common spaces and a penthouse. Multipliers are used to represent typical floors.
HOSP	Hospitals and other health-related facilities	N/A	N/A	N/A	N/A
HOTEL	Hotels and motels	Hotel	42,554	4	Hotel building with common spaces and 77 guest rooms.
MISC	All other space types that do not fit another category	N/A	N/A	N/A	N/A
OFF-LRG	Offices larger than 30,000 square feet	Medium Office	53,628	3	Five zones per floor office building with plenums on each floor.
		Large Office	498,589	12	Five zones per floor office building with plenums on each floor. Middle floors represented using multipliers.

Table 32: Converting from Forecast Climate Zone (FCZ) to Building Standards Climate Zone (BSCZ) – Example Calculation

Climate Zone	**Total Statewide Small Office Square Footage in 2020 by FCZ** (Million Square Feet) **[A]**	**Conversion Factor FCZ to BSCZ 1 [B]**	**Small Office Square Footage in BSCZ 1** (Million Square Feet) **[C] = A x B**
1	0.204	22.5%	0.046
2	0.379	0.0%	0.000
3	0.857	0.0%	0.000
4	1.009	0.1%	0.001
5	0.682	0.0%	0.000
6	0.707	0.0%	0.000
7	0.179	0.0%	0.000
8	1.276	0.0%	0.000
9	0.421	0.0%	0.000
10	0.827	0.0%	0.000
11	0.437	0.0%	0.000
12	0.347	0.0%	0.000
13	1.264	0.0%	0.000
14	0.070	2.9%	0.002
15	0.151	0.0%	0.000
16	0.035	0.0%	0.000
Total	**8.844**		**0.049**

Table 33: Percent of Floorspace Impacted by Proposed Measure, by Building Type

Building Type *Building sub-type*	Composition of Building Type by Sub-types[a]	Percent of Square Footage Impacted[b]	
		New Construction	Existing Building Stock (Alterations)[c]
Small Office		100%	7%
Restaurant		100%	7%
Retail		100%	7%
Stand-Alone Retail	*10%*	*100%*	*7%*
Large Retail	*75%*	*100%*	*7%*
Strip Mall	*5%*	*100%*	*7%*
Mixed-Use Retail	*10%*	*100%*	*7%*
Food		100%	7%
Non-Refrigerated Warehouse		100%	7%
Refrigerated Warehouse		100%	7%
Schools		100%	7%
Small School	*60%*	*100%*	*7%*
Large School	*40%*	*100%*	*7%*
College		100%	7%
Small Office	*5%*	*100%*	*7%*
Medium Office	*15%*	*100%*	*7%*
Medium Office/Lab	*20%*	*100%*	*7%*
Public Assembly	*5%*	*100%*	*7%*
Large School	*30%*	*100%*	*7%*
High Rise Apartment	*25%*	*100%*	*7%*
Hospital		100%	7%
Hotel/Motel		100%	7%
Large Offices		100%	7%
Medium Office	*50%*	*100%*	*7%*
Large Office	*50%*	*100%*	*7%*
Miscellaneous		100%	7%

a. Presents the assumed composition of the main building type category by the building sub-types. All 2019 CASE Reports assumed the same percentages of building sub-types.

b. When the building type is comprised of multiple sub-types, the overall percentage for the main building category was calculated by weighing the contribution of each sub-type.

c. Percent of existing floorspace that will be altered during the first year the 2019 Standards are in effect.

Table 34: Percent of Floorspace Impacted by Proposed Measure, by Climate Zone

Climate Zone	Percent of Square Footage Impacted	
	New Construction	Existing Building Stock (Alterations)[a]
1	100%	7%
2	100%	7%
3	100%	7%
4	100%	7%
5	100%	7%
6	100%	7%
7	100%	7%
8	100%	7%
9	100%	7%
10	100%	7%
11	100%	7%
12	100%	7%
13	100%	7%
14	100%	7%
15	100%	7%
16	100%	7%

a. Percent of existing floorspace that will be altered during the first year the 2019 Standards are in effect.

Outdoor nonresidential construction is not included in the Energy Commission's construction forecasts, so the impact of the various lighting measures must be predicted based on other metrics that rely on indoor construction square footage as the basis of measurement. The Statewide CASE Team estimated the total square footage of statewide hardscaped area that will be impacted by the proposed measure by relying on estimates of hardscaped lighting area per Lighting Zone (LZ). This approach was also used for the 2016 CASE analysis. The definition of the Lighting Zones is tied to the U.S. Census (2010), and is related to the classification of land mass designated as urban or rural, which is the demarcation line between LZ2 (rural) and LZ3 (urban). Table 35 presents the percent of U.S. land mass and California construction activity in each Lighting Zone. Note that the U.S. Census data only provides information on land mass in LZ0, LZ1, and LZ2 as a single group, and similarly, LZ3 and LZ4 as another group.

Table 35: Percent Construction by Lighting Zone

Lighting Zone	Percent of Land Mass (Source: 2010 US Census)	Percent of Construction Activity (Estimate)
LZ0	9%	0%
LZ1	1%	0.1%
LZ2	85%	9.9%
LZ3	5%	90%
LZ4	0%	0%

Table 36 presents assumptions used to translate the California construction forecast into useful information about new and altered Specific Applications area. Table 38 provides the assumed ratio of building square footage per parking space and the resulting ratio of General Hardscape area to new building area in the statewide construction forecasts. The assumptions for Specific Applications are the same used in the 2016 CASE Report with some minor refinements. Appendix I details the changes to the assumptions. Table 36 illustrates the assumptions from the 2016 CASE Report and Table 37 details

the updated assumptions. The assumptions for General Hardscape are also the same used in the 2016 CASE Report. See Appendix H for details on the development of these assumptions.

Table 36: Assumptions for Converting Indoor New Construction Forecasts to Outdoor Spaces for Specific Applications – Table 140.7-B

Assumptions for Statewide Estimates - Specific Applications										
		Applied to % of Building S.F. in Category								
Lighting Allowance	**Assumptions**	Office, LG & SM	Retail	Restaurant	Food (Grocery)	Warehouse, Ref & NR	Hotel	School	College	Other
Building Entrances or Exits	**1 per 5000 sf of building interior** (20 occupants per door, 250 occ/sf)	100%	100%	100%	100%	100%	100%	100%	100%	99%
Primary Entrances to Senior Care Facilities, Police Stations, Hospitals, Fire Stations, and Emergency Vehicle Facilities	**1 per 5000 SF of gross building area** (1 primary entrance per building)									1%
Drive Up Windows	**1 per 1500 SF of gross building area** (2 locations per building; 1000 sf building)			30%						
Vehicle Service Station Uncovered Fuel Dispenser	**1 per 100 sf of gross building area** (1 fuel dispenser face per 25 sf of station building interior)									0.01%
Automated Teller Machines	**400W MH luminaire as typical standard practice, switch to 250W limit for first location,** 2500 sf per ATM installation.									1%
Outdoor Sales Frontage	**0.2 LF per sf of gross building area** (1 display parking space per 50 sf of building interior)									1.5%
Hardscape Ornamental Lighting	**0.1 SF per SF of gross building area**	50%	50%	50%	25%		50%	25%	25%	5%
Building Facades	**30' building height, 2 floors per building** (20% of applicable facades are lit)	25%	50%	50%	25%		50%	25%	25%	5%
Outdoor Sales Lots	**4 SF of sales lot per sf of gross building area** (1 display parking space per 50 sf of building interior)									1.5%
Vehicle Service Station Hardscape	**11 SF per SF of gross building area**									1%
Vehicle Service Station Canopies	**1.2 SF of canopy per SF of gross building area**									1%
Sales Canopies	**0.1 SF of canopy per SF of gross building area**									5%
Non-sales Canopies	**0.1 SF of canopy per SF of gross building area**	25%	25%	25%	25%		25%	25%	25%	5%
Guard Stations	**0.00043 sf per SF of gross building area** (1 12x18 guard station per 500,000 sf of total construction)	100%				100%			100%	100%
Student Pick-up/Drop-off zone	**0.0173 sf per SF of gross building area** (1 12x72 drop off per 50,000 sf of total construction)							100%		
Outdoor Dining	**1 sf per 5 sf of gross building area** (20% of typical building sf)		2.5%	50%	2.5%					
Special Security Lighting for Retail Parking and Pedestrian Hardscape	**1 SF per 100 SF gross building SF** (1% of hardscape)		100%	100%	100%					50%

Table 37: Changes to Assumptions for Converting Indoor New Construction Forecasts to Outdoor Spaces for Specific Applications – Table 140.7-B

Lighting Allowance	Assumptions
Building Facades	5.15% used instead of 20% from original assumptions.
Outdoor Sales Lots	2 ft^2 used instead of 4 ft^2 from original assumptions.

Table 38: Assumptions for Converting Indoor New Construction Forecasts to Outdoor Spaces for General Hardscape – Table 140.7-A

Assumptions for Statewide Estimates - General Hardscape		
General Hardscape	**Assumptions**	**Area Multipliers for Construction S.F.**
for Large Office, Small Office, Food, Restaurant, College	1 parking space per 250 sf of gross building area	1
for Hotel, Retail, School, Other	1 parking space per 360 sf of gross building area	0.7
for NR Warehouse, Ref. Warehouse	1 parking space per 830 sf of gross building area	0.3

Appendix B: DISCUSSION OF IMPACTS OF COMPLIANCE PROCESS ON MARKET ACTORS

This section discusses how the recommended compliance process, which is described in Section 2.5, could impact various market actors. The Statewide CASE Team asked stakeholders for feedback on how the measure will impact various market actors during public stakeholder meetings that were held on September 8, 2016, and March 30, 2017 (Team 2016). The Statewide CASE Team also held several meetings with NEMA and conducted an online survey. The key results from feedback received during stakeholder meetings and other target outreach efforts are detailed below.

Table 39 identifies the market actors who will play a role in complying with the proposed change, the tasks for which they will be responsible, their objectives in completing the tasks, how the proposed code change could impact their existing work flow, and ways negative impacts could be mitigated.

The proposed code change increases current code stringency. The Statewide CASE Team expects little to no compliance issues since no new requirements are being introduced. Market actors will continue to use the same compliance processes as before. Market actors will need to understand the new requirements and develop designs to meet the lower LPAs, but otherwise little is expected to change.

Table 39: Roles of Market Actors in The Proposed Compliance Process

Market Actor	Task(s) In Compliance Process	Objective(s) in Completing Compliance Tasks	How Proposed Code Change Could Impact Work Flow	Opportunities to Minimize Negative Impacts of Compliance Requirement
Lighting designer	• Identify relevant requirements and/ or compliance path and ensure their design complies and meets building owner's needs. • Perform required calculations by space to confirm compliance. • Coordinate design with other team members (HVAC & modeler). • Complete compliance document for permit application. • Review submittals during construction. • Coordinate with commissioning agent/ATT as necessary.	• Quickly and easily determine requirements based on scope. • Demonstrate compliance with calculations required for other design tasks. • Streamlined coordination with other team members. • Clearly communicate system requirements to constructors. • Quickly complete compliance documents. • Easily identify non-compliant substitutions. • Coordinate with manufacturers/dealers to know what products are available and meet compliance. • Coordinate with building owner to determine what their needs/wants are early in design phase. • Interaction with contractors is around submittal reviews, so not much coordination (RFI or submittal reviews). Subcontractors sends specs through submittal process to designer to make sure compliant with codes. Lighting designer is supposed to catch if lights do not meet code. • Coordinate with the building department for a plan check.	• Will need to learn new, more stringent LPAs. • Will need to apply new cutoff wattage for BUG rating. • Aside from more stringent LPAs and new cutoff wattage for BUG rating, compliance does not change.	• Revise compliance document to automate compliance calculations • Existing conditions could be documented via as-builts or photographs. Some market actors supportive of ATT verification. • Modeling software will need to be updated to include proposed values. Software training updates. • Clear code requirements that apply to the project. • Designation on products about whether or not they meet code requirements. How to/direction on how to specify the products that meet the code (lighting designer is not purchasing the lighting fixtures, the contractor purchases). • Examples showing systems that are Title 24 compliant. • Examples showing systems that are not Title 24 compliant with explanations of why they are not. • Documents showing exactly what their role in Title 24 compliance is/how to complete compliance tasks. • Documents explaining who they can speak with for help on code compliance.

Market Actor	Task(s) In Compliance Process	Objective(s) in Completing Compliance Tasks	How Proposed Code Change Could Impact Work Flow	Opportunities to Minimize Negative Impacts of Compliance Requirement
Contractor /Builder	• Follow the lighting design and specifications provided by the lighting designer. • They should only need to follow the design, but it is helpful for them to understand the code in case they need to make substitutions in products.	• They are responsible for following what is in the design – if they do not, the system can end up not being in compliance. They complete installation compliance documents. • Coordinate with lighting designer in case issues with installation arise. • They purchase/install products specified by design. It is helpful for them to know what products meet compliance in case they need to substitute products.	• Will need to know BUG rating of lower wattage products due to lowered threshold of BUG rating for fixtures.	• Clear documentation of Title 24, Part 6 compliant products. • Clear documentation illustrating difference between old standards and new one. • Clear documentation explaining who they can speak with for help on code compliance. • Examples showing systems that are Title 24 compliant. • Examples showing systems that are not Title 24 compliant with explanations of why they are not.
Electrician	• Need to understand the code as they might be responsible for designing lighting systems. • They might play a similar role to contractor/builder and follow lighting design/install lighting equipment.	• If designing the system, they are responsible for ensuring it follows the code. They would also be responsible for filling out design compliance documents. • If building the system, they are responsible for following what is in the design – if they do not, the system can end up out of compliance. They would complete installation compliance documents. • Coordinate with lighting designer in case issues with installation arise. • Purchase/install products specified by design that are compliant.	• If designing a system, will need to learn new, more stringent LPAs. • Will need to apply new cutoff wattage for BUG rating.	• Clear documentation of Title 24, Part 6 compliant products. • Clear documentation illustrating difference between old standards and new one. • Clear documentation explaining who they can speak with for help on code compliance. • Examples showing systems that are Title 24 compliant. • Examples showing systems that are not Title 24 compliant with explanations of why they are not.

Market Actor	Task(s) In Compliance Process	Objective(s) in Completing Compliance Tasks	How Proposed Code Change Could Impact Work Flow	Opportunities to Minimize Negative Impacts of Compliance Requirement
Title 24 Consultant	• Experts on Title 24, Part 6 and compliance/compliance documents/compliance steps. • They are hired by designers/building owners to help interpret the code/ensure compliance/fill out paperwork.	• Coordinate with designers, installers, building owners, and compliance agencies. • They generate compliance documentation as well as provide assistance in code interpretation.	• Will need to know the new, more stringent standards.	• Document explaining Title 24 process and where documents go/who needs to sign what. • Modeling software will need to be updated to include proposed values. Software training updates. • Clear code requirements that apply to the project. • Designation on products about whether or not they meet code requirements. How to/direction on how to specify the products that meet the code (lighting designer is not purchasing the lighting fixtures, the contractor purchases). • Examples showing systems that are Title 24 compliant. • Examples showing systems that are not Title 24 compliant with explanations of why they are not. • Documents explaining who they can speak with for help on code compliance.
Building Owner	• Coordinate with designers/contractors and fill out appropriate paperwork. They must also ensure proper compliance paperwork is filled out/signed/submitted to appropriate entities.	• Need to ensure paperwork is sent to proper places and their system is up to code. • Coordinate with contractors, designers, and compliance enforcement agencies.	• Will need to know the standards have changed and what the changes are.	• Clear documentation of code requirements. • Clear documentation of everything that needs to be completed for code requirements. • Clear documentation of what compliance paperwork goes where, and the steps of the process. • Documents explaining who they can speak with for help on code compliance.

Market Actor	Task(s) In Compliance Process	Objective(s) in Completing Compliance Tasks	How Proposed Code Change Could Impact Work Flow	Opportunities to Minimize Negative Impacts of Compliance Requirement
Plan Checker	• Identify relevant requirements. • Confirm data on documents is compliant. • Confirm plans/ specifications match data on documents. • Provide correction comments if necessary.	• Quickly and easily determine requirements based on scope. • Quickly and easily determine if data in documents meets requirements. • Quickly and easily determine if plans/ specs match documents. • Quickly and easily provide correction comments that will resolve issue. • Coordinate with building owners/designers/inspectors.	• Will need to verify calculations are compliant with new standards. • Will need to verify existing conditions baseline.	• Clear code language that is easily understandable. Clear instructions on where to find everything in the plans. • Clear documentation of what paperwork they need to receive and/or other tasks they need to perform. • Clear documentation of how the new code differs from the old. • Compliance document could auto-verify data is compliant with Standards. • Existing conditions documented via as-builts or photos or ATT. Do not require additional field visit by Authority Having Jurisdiction. • Document compliance on documents in a way easily compared to plans. • Examples of plans that are in compliance. • Examples of plans that are not in compliance and reasons why they are not.

Market Actor	Task(s) In Compliance Process	Objective(s) in Completing Compliance Tasks	How Proposed Code Change Could Impact Work Flow	Opportunities to Minimize Negative Impacts of Compliance Requirement
Building Inspector	• Identify relevant requirements. • Confirm installed equipment matches documents/plans. • Provide correction comments if necessary.	• Quickly and easily determine requirements based on scope. • Quickly and easily determine if installation meets requirements and matches documents/plans. • Quickly and easily provide correction comments that will resolve issue. • Coordinate with building owners/designers/plan checkers.	• Will need to verify installations are compliant with new standards.	• Clear documentation of code requirements, although they probably rely more on the plan checker to make sure everything in the plan is up to code. • Clear documentation of how the new code differs from the old. • Clear documentation of the different types of technologies that might be used/installed and equivalences – if something installed is different from the plans, then the inspector needs to know whether or not it is still in code compliance. • Clear documentation of what paperwork they need to receive and/or other tasks they need to perform.

Appendix C: TARGET ILLUMINANCE LEVELS

Hardscape Target Illuminance

Parking lot lighting levels are taken from IES RP-20-14, until this recommended practice is revised with new research by Virginia Tech Transportation Institute or lighting zone multipliers are included. The recommended lighting levels in RP-20-14 can be found in Table 40.

Table 40: IES RP-20-2014 Recommended Maintained Illuminance Values for Parking Lots

	Minimum Horizontal Footcandles (FC)	Minimum Vertical Footcandles (FC)	Maximum Average: Minimum Uniformity Ratio
Asphalt Surfaces: Pre-curfew	0.5	0.25	4:1
Asphalt Surfaces: Post-curfew	0.2	0.10	4:1
Concrete Surfaces: Pre-curfew	1.0	0.50	4:1
Concrete Surfaces: Post-curfew	0.2	0.10	4:1

The lighting industry has raised concerns that the recommended parking lot lighting levels result in over lighting. Virginia Tech Transportation Institute (VTTI) is researching the lighting levels to avoid hazards in a parking lot. These findings will be used to revise RP-20, and provide lighting recommendations that are appropriate for each lighting zone. This research is expected to be completed by the third quarter of 2017. IES adoption of the revised RP-20 could occur during the fourth quarter of 2017.

In the meantime, the parking lot lighting calculations are based on the current RP-20-14 pre-curfew lighting level recommendations. Due to the increases in LED efficiencies over the last three years, it is expected that the proposed LPA for general hardscape applications can be reduced. Further reductions will be able to be made to the general hardscape LPAs if VTTI's findings are approved by IES and incorporated into the new RP-20 in the third quarter of 2017.

Specific Applications Target Illuminances

The target illuminance values proposed for the 2019 code cycle are found in Table 41: 2019 Target Illuminance Criteria. These proposed lighting levels are taken from current IES recommendations and the California Financial Code ATM lighting requirements.

Table 41: 2019 Target Illuminance Criteria

	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Area Wattage Allowance (AWA) Linear Wattage Allowance (LWA) Initial Wattage Allowance (IWA)	Not Applicable	RP-20-14 "Parking Lot - Pre-curfew" Asphalt 0.5 Horizontal FC Min, 4:1 Avg:Min Asphalt 0.25 Vertical FC Min, 4:1 Avg:Min Concrete 1.0 Horizontal FC Min, 4:1 Avg:Min Concrete 0.5 Vertical HF Min, 4:1 Avg:Min	RP-20-14 "Parking Lot - Pre-curfew" Asphalt 0.5 Horizontal FC Min, 4:1 Avg:Min Asphalt 0.25 Vertical FC Min, 4:1 Avg:Min Concrete 1.0 Horizontal FC Min, 4:1 Avg:Min Concrete 0.5 Vertical HF Min, 4:1 Avg:Min	RP-20-14 "Parking Lot - Pre-curfew" Asphalt 0.5 Horizontal FC Min, 4:1 Avg:Min Asphalt 0.25 Vertical FC Min, 4:1 Avg:Min Concrete 1.0 Horizontal FC Min, 4:1 Avg:Min Concrete 0.5 Vertical HF Min, 4:1 Avg:Min	RP-20-14 "Parking Lot - Pre-curfew" Asphalt 0.5 Horizontal FC Min, 4:1 Avg:Min Asphalt 0.25 Vertical FC Min, 4:1 Avg:Min Concrete 1.0 Horizontal FC Min, 4:1 Avg:Min Concrete 0.5 Vertical HF Min, 4:1 Avg:Min
Building Entrances or Exits. Allowance per door. Luminaires qualifying for this allowance shall be within 20 feet of the door.	Not Applicable	HB10 T22.2 "Non-Covered Entries/Exits - Medium Activity LZ1" 1.0 Horizontal FC Avg, 2:1 Avg:Min 0.4 Vertical FC Avg, 4:1 Avg:Min	HB10 T22.2 "Non-Covered Entries/Exits - Medium Activity LZ2" 1.0 Horizontal FC Avg, 2:1 Avg:Min 0.6 Vertical FC Avg, 4:1 Avg:Min	HB10 T22.2 "Non-Covered Entries/Exits - Medium Activity LZ3" 1.0 Horizontal FC Avg, 2:1 Avg:Min 0.8 Vertical FC Avg, 4:1 Avg:Min	HB10 T22.2 "Non-Covered Entries/Exits - Medium Activity LZ4" 1.0 Horizontal FC Avg, 2:1 Avg:Min 1.0 Vertical FC Avg, 2:1 Avg:Min
Primary Entrances to Senior Care Facilities, Police Stations, Hospitals, Fire Stations, and Emergency Vehicle Facilities. Allowance per primary entrance(s) only. Primary entrances shall provide access for the general public and shall not be used exclusively for staff or service personnel. This allowance shall be in addition to the building entrance or exit allowance above. Luminaires qualifying for this allowance shall be within 100 feet of the primary entrance.	Not Applicable	HB10 T22.2 "Building Entries, Porte Cocheres - High Activity for Elderly LZ1" 2.0 Horizontal FC Avg, 2:1 Avg:Min 1.5 Vertical FC Avg, 4:1 Avg:Min	HB10 T22.2 "Building Entries, Porte Cocheres - High Activity for Elderly LZ2" 4.0 Horizontal FC Avg, 2:1 Avg:Min 2.0 Vertical FC Avg, 4:1 Avg:Min	HB10 T22.2 "Building Entries, Porte Cocheres - High Activity for Elderly LZ3" 5.0 Horizontal FC Avg, 2:1 Avg:Min 3.0 Vertical FC Avg, 4:1 Avg:Min	HB10 T22.2 "Building Entries, Porte Cocheres - High Activity for Elderly LZ4" 7.5 Horizontal FC Avg, 2:1 Avg:Min 4.0 Vertical FC Avg, 2:1 Avg:Min

	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Drive Up Windows. Allowance per customer service location. Luminaires qualifying for this allowance shall be within 2 mounting heights of the sill of the window.	Not Applicable	HB10 T31.2 "Drive-Up Financial Services - Covered LZ1" 2.0 Horizontal FC Avg, 3:1 Avg:Min 0.8 Vertical FC Avg, 6:1 Avg:Min	HB10 T31.2 "Drive-Up Financial Services - Covered LZ2" 3.0 Horizontal FC Avg, 3:1 Avg:Min 1.0 Vertical FC Avg, 6:1 Avg:Min	HB10 T31.2 "Drive-Up Financial Services - Covered LZ3" 4.0 Horizontal FC Avg, 3:1 Avg:Min 1.5 Vertical FC Avg, 6:1 Avg:Min	HB10 T31.2 "Drive-Up Financial Services - Covered LZ4" 5.0 Horizontal FC Avg, 3:1 Avg:Min 2.0 Vertical FC Avg, 3:1 Avg:Min
Vehicle Service Station Uncovered Fuel Dispenser. Allowance per fueling dispenser. Luminaires qualifying for this allowance shall be within 2 mounting heights of the dispenser.	Not Applicable	HB10 T34.2 "Service Stations Dispensing Islands - Medium Activity LZ1" 5.0 Horizontal FC Avg, 4:1 Avg:Min 5.0 Vertical FC Avg, 8:1 Avg:Min	HB10 T34.2 "Service Stations Dispensing Islands - Medium Activity LZ2" 7.5 Horizontal FC Avg, 4:1 Avg:Min 7.5 Vertical FC Avg, 8:1 Avg:Min	HB10 T34.2 "Service Stations Dispensing Islands - Medium Activity LZ3" 10.0 Horizontal FC Avg, 4:1 Avg:Min 10.0 Vertical FC Avg, 8:1 Avg:Min	HB10 T34.2 "Service Stations Dispensing Islands - Medium Activity LZ4" 15.0 Horizontal FC Avg, 4:1 Avg:Min 15.0 Vertical FC Avg, 4:1 Avg:Min
ATM Machine Lighting. Allowance per ATM machine. Luminaires qualifying for this allowance shall be within 50 feet of the dispenser.	Not Applicable	California Financial Code 13041 10.0 Horizontal FC Min within 5ft 2.0 Horizontal FC Min within 60ft 10.0 Vertical FC Min on machine face	California Financial Code 13041 10.0 Horizontal FC Min within 5ft 2.0 Horizontal FC Min within 60ft 10.0 Vertical FC Min on machine face	California Financial Code 13041 10.0 Horizontal FC Min within 5ft 2.0 Horizontal FC Min within 60ft 10.0 Vertical FC Min on machine face	California Financial Code 13041 10.0 Horizontal FC Min within 5ft 2.0 Horizontal FC Min within 60ft 10.0 Vertical FC Min on machine face
Outdoor Sales Frontage. Allowance for frontage immediately adjacent to the principal viewing location(s) and unobstructed for its viewing length. A corner sales lot may include two adjacent sides provided that a different principal viewing location exists for each side. Luminaires qualifying for this allowance shall be located between the principal viewing location and the frontage outdoor sales area.	Not Applicable	NO ALLOWANCE HB10 T34.2 "Automotive Sales Front Row - Medium Activity LZ1" 7.5 Horizontal FC Avg, 3:1 Avg:Min 7.5 Vertical FC Avg, 6:1 Avg:Min	HB10 T34.2 "Automotive Sales Front Row - Medium Activity LZ2" 10.0 Horizontal FC Avg, 3:1 Avg:Min 10.0 Vertical FC Avg, 6:1 Avg:Min	HB10 T34.2 "Automotive Sales Front Row - Medium Activity LZ3" 15.0 Horizontal FC Avg, 3:1 Avg:Min 15.0 Vertical FC Avg, 6:1 Avg:Min	HB10 T34.2 "Automotive Sales Front Row - Medium Activity LZ4" 20.0 Horizontal FC Avg, 3:1 Avg:Min 20.0 Vertical FC Avg, 3:1 Avg:Min

	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Hardscape Ornamental Lighting. Allowance for the total site illuminated hardscape area. Luminaires qualifying for this allowance shall be rated for 100 watts or less as determined in accordance with Section 130(d), and shall be post-top luminaires, lanterns, pendant luminaires, or chandeliers.	Not Applicable	NO ALLOWANCE HB10 T34.2 "Centers, Outdoor, Plazas and Town Squares - Medium Activity LZ1" 0.1 Horizontal FC Avg, 5:1 Avg:Min 0 Vertical FC Avg	HB10 T34.2 "Centers, Outdoor, Plazas and Town Squares - Medium Activity LZ2" 0.2 Horizontal FC Avg, 5:1 Avg:Min 0.1 Vertical FC Avg, 10:1 Avg:Min	HB10 T34.2 "Centers, Outdoor, Plazas and Town Squares - Medium Activity LZ3" 0.4 Horizontal FC Avg, 5:1 Avg:Min 0.2 Vertical FC Avg, 10:1 Avg:Min	HB10 T34.2 "Centers, Outdoor, Plazas and Town Squares - Medium Activity LZ4" 0.6 Horizontal FC Avg, 5:1 Avg:Min 0.2 Vertical FC Avg, 5:1 Avg:Min
Building Facades. Only areas of building façade that are illuminated shall qualify for this allowance. Luminaires qualifying for this allowance shall be aimed at the façade and shall be capable of illuminating it without obstruction or interference by permanent building features or other objects.	Not Applicable	NO ALLOWANCE HB10 T26.2 "Façade Fields - Medium Activity LZ1 Reflectance ≥ 50%" 1.5 FC AVG	HB10 T26.2 "Façade Fields - Medium Activity LZ2 Reflectance ≥ 50%" 2 FC AVG	HB10 T26.2 "Façade Fields - Medium Activity LZ3 Reflectance ≥ 50%" 3 FC AVG	HB10 T26.2 "Façade Fields - Medium Activity LZ4 Reflectance ≥ 50%" 4 FC AVG
Outdoor Sales Lots. Allowance for uncovered sales lots used exclusively for the display of vehicles or other merchandise for sale. Driveways, parking lots or other non-sales areas shall be considered hardscape areas even if these areas are completely surrounded by sales lot on all sides. Luminaires qualifying for this allowance shall be within 5 mounting heights of the sales lot area.	Not Applicable	HB10 T34.2 "Automotive Sales, Sales - Medium Activity LZ1" 4.0 Horizontal FC Avg, 3:1 Avg:Min 2.0 Vertical FC Avg, 6:1 Avg:Min	HB10 T34.2 "Automotive Sales, Sales - Medium Activity LZ2" 5.0 Horizontal FC Avg, 3:1 Avg:Min 3.0 Vertical FC Avg, 6:1 Avg:Min	HB10 T34.2 "Automotive Sales, Sales - Medium Activity LZ3" 7.5 Horizontal FC Avg, 3:1 Avg:Min 4.0 Vertical FC Avg, 6:1 Avg:Min	HB10 T34.2 "Automotive Sales, Sales - Medium Activity LZ4" 10.0 Horizontal FC Avg, 3:1 Avg:Min 5.0 Vertical FC Avg, 3:1 Avg:Min

	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Vehicle Service Station Hardscape. Allowance for the total illuminated hardscape area less area of buildings, under canopies, off property, or obstructed by signs or structures. Luminaires qualifying for this allowance shall be illuminating the hardscape area and shall not be within a building, below a canopy, beyond property lines, or obstructed by a sign or other structure.	Not Applicable	HB10 T34.2 "Service Stations Outdoor Service - Medium Activity LZ1" 1.5 Horizontal FC Avg, 2:1 Avg:Min 1.5 Vertical FC Avg, 4:1 Avg:Min	HB10 T34.2 "Service Stations Outdoor Service - Medium Activity LZ2" 2.0 Horizontal FC Avg, 2:1 Avg:Min 2.0 Vertical FC Avg, 4:1 Avg:Min	HB10 T34.2 "Service Stations Outdoor Service - Medium Activity LZ3" 3.0 Horizontal FC Avg, 2:1 Avg:Min 3.0 Vertical FC Avg, 4:1 Avg:Min	HB10 T34.2 "Service Stations Outdoor Service - Medium Activity LZ4" 4.0 Horizontal FC Avg, 2:1 Avg:Min 4.0 Vertical FC Avg, 2:1 Avg:Min
Vehicle Service Station Canopies. Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	Not Applicable	HB10 T34.2 "Service Stations Dispensing Islands - Medium Activity LZ1" 5.0 Horizontal FC Avg, 4:1 Avg:Min 5.0 Vertical FC Avg, 8:1 Avg:Min	HB10 T34.2 "Service Stations Dispensing Islands - Medium Activity LZ2" 7.5 Horizontal FC Avg, 4:1 Avg:Min 7.5 Vertical FC Avg, 8:1 Avg:Min	HB10 T34.2 "Service Stations Dispensing Islands - Medium Activity LZ3" 10.0 Horizontal FC Avg, 4:1 Avg:Min 10.0 Vertical FC Avg, 8:1 Avg:Min	HB10 T34.2 "Service Stations Dispensing Islands - Medium Activity LZ4" 15.0 Horizontal FC Avg, 4:1 Avg:Min 15.0 Vertical FC Avg, 4:1 Avg:Min
Sales Canopies. Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	Not Applicable	HB10 T34.2 "Seasonal Open-Air Merchandise - LZ1" 1.5 Horizontal FC Avg, 2:1 Avg:Min 1.5 Vertical FC Avg, 4:1 Avg:Min	HB10 T34.2 "Seasonal Open-Air Merchandise - LZ2" 2.0 Horizontal FC Avg, 2:1 Avg:Min 2.0 Vertical FC Avg, 4:1 Avg:Min	HB10 T34.2 "Seasonal Open-Air Merchandise - LZ3" 3.0 Horizontal FC Avg, 2:1 Avg:Min 3.0 Vertical FC Avg, 4:1 Avg:Min	HB10 T34.2 "Seasonal Open-Air Merchandise - LZ4" 4.0 Horizontal FC Avg, 2:1 Avg:Min 4.0 Vertical FC Avg, 4:1 Avg:Min
Non-sales Canopies and Tunnels. Allowance for the total area within the drip line of the canopy or inside the tunnel. Luminaires qualifying for this allowance shall be located under the canopy or tunnel.	Not Applicable	HB10 T22.2 "Canopied Entries - Medium Activity LZ1" 0.8 Horizontal FC Avg, 2:1 Avg:Min 0.4 Vertical FC Avg, 4:1 Avg:Min	HB10 T22.2 "Canopied Entries - Medium Activity LZ2" 1.0 Horizontal FC Avg, 2:1 Avg:Min 0.6 Vertical FC Avg, 4:1 Avg:Min	HB10 T22.2 "Canopied Entries - Medium Activity LZ3" 1.5 Horizontal FC Avg, 2:1 Avg:Min 0.8 Vertical FC Avg, 4:1 Avg:Min	HB10 T22.2 "Canopied Entries - Medium Activity LZ1" 2.0 Horizontal FC Avg, 2:1 Avg:Min 1.0 Vertical FC Avg, 2:1 Avg:Min

	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Guard Stations. Allowance up to 1,000 square feet per vehicle lane. Guard stations provide access to secure areas controlled by security personnel who stop and may inspect vehicles and vehicle occupants, including identification, documentation, vehicle license plates, and vehicle contents. Qualifying luminaires shall be within 2 mounting heights of a vehicle lane or the guardhouse.	Not Applicable	HB10 T22.2 "Remote Monitored Site Gated Entries - Vehicles LZ1" 1.0 Horizontal FC Avg, 2:1 Avg:Min 0.8 Vertical FC Avg, 4:1 Avg:Min	HB10 T22.2 "Remote Monitored Site Gated Entries - Vehicles LZ2" 1.5 Horizontal FC Avg, 2:1 Avg:Min 1.0 Vertical FC Avg, 4:1 Avg:Min	HB10 T22.2 "Remote Monitored Site Gated Entries - Vehicles LZ3" 2.0 Horizontal FC Avg, 2:1 Avg:Min 1.5 Vertical FC Avg, 4:1 Avg:Min	HB10 T22.2 "Remote Monitored Site Gated Entries - Vehicles LZ4" 3.0 Horizontal FC Avg, 2:1 Avg:Min 2.0 Vertical FC Avg, 2:1 Avg:Min
Student Pick-up/Drop-off zone. Allowance for the area of the student pick-up/drop-off zone, with or without canopy, for preschool through 12th grade school campuses. A student pick-up/drop off zone is a curbside, controlled traffic area on a school campus where students are picked-up and dropped off from vehicles. The allowed area shall be the smaller of the actual width or 25 feet, times the smaller of the actual length or 250 feet. Qualifying luminaires shall be within 2 mounting heights of the student pick-up/drop-off zone.	Not Applicable	NO ALLOWANCE HB10 T36.2 "Aviation Terminals Covered Bus and Shuttle Pick-Up/Drop-Off - Medium Activity LZ1" 0.8 Horizontal FC Avg, 2:1 Avg:Min 0.4 Vertical FC Avg, 4:1 Avg:Min	HB10 T36.2 "Aviation Terminals Covered Bus and Shuttle Pick-Up/Drop-Off - Medium Activity LZ2" 1.0 Horizontal FC Avg, 2:1 Avg:Min 0.6 Vertical FC Avg, 4:1 Avg:Min	HB10 T36.2 "Aviation Terminals Covered Bus and Shuttle Pick-Up/Drop-Off - Medium Activity LZ3" 1.5 Horizontal FC Avg, 2:1 Avg:Min 0.8 Vertical FC Avg, 4:1 Avg:Min	NO ALLOWANCE HB10 T36.2 "Aviation Terminals Covered Bus and Shuttle Pick-Up/Drop-Off - Medium Activity LZ4" 2.0 Horizontal FC Avg, 2:1 Avg:Min 1.0 Vertical FC Avg, 2:1 Avg:Min
Outdoor Dining. Allowance for the total illuminated hardscape of outdoor dining. Outdoor dining areas are hardscape areas used to serve and consume food and beverages. Qualifying luminaires shall be within 2 mounting heights of the hardscape area of outdoor dining.	Not Applicable	HB10 T22.2 "Food Service, Restaurants - Fine Dining" 3.0 Horizontal FC Avg, 3:1 Avg:Min1.0 Vertical FC Avg, 3:1 Avg:Min	HB10 T22.2 "Food Service, Restaurants - Fine Dining" 3.0 Horizontal FC Avg, 3:1 Avg:Min1.0 Vertical FC Avg, 3:1 Avg:Min	HB10 T22.2 "Food Service, Restaurants - Fine Dining" 3.0 Horizontal FC Avg, 3:1 Avg:Min1.0 Vertical FC Avg, 3:1 Avg:Min	HB10 T22.2 "Food Service, Restaurants - Fine Dining" 3.0 Horizontal FC Avg, 3:1 Avg:Min1.0 Vertical FC Avg, 3:1 Avg:Min

	Lighting Zone 0	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
Special Security Lighting for Retail Parking and Pedestrian Hardscape. This additional allowance is for illuminated retail parking and pedestrian hardscape identified as having special security needs. This allowance shall be in addition to the building entrance or exit allowance.	Not Applicable	G-1-03 T1 "Supermarket, Major Retail Parking - Parking Lot" 3.0 Horizontal FC Avg; 4:1 Avg:Min	G-1-03 T1 "Supermarket, Major Retail Parking - Parking Lot" 3.0 Horizontal FC Avg; 4:1 Avg:Min	G-1-03 T1 "Supermarket, Major Retail Parking - Parking Lot" 3.0 Horizontal FC Avg; 4:1 Avg:Min	NO ALLOWANCE G-1-03 T1 "Supermarket, Major Retail Parking - Parking Lot" 3.0 Horizontal FC Avg; 4:1 Avg:Min

Appendix D: NONRESIDENTIAL USE SCHEDULES

The energy savings per application were based on the following nonresidential electric use schedules. While LED luminaires can often be dimmed to twenty percent or lower, legacy products such as Pulse Start Metal Halide (PSMH) luminaire have bi-level motion controls that dim the lights to fifty percent. The partial-off and bi-level control requirements from the 2016 Title 24, Part 6 code cycle were considered for the schedules listed below. The Statewide CASE Team assumed spaces with pole mounted lighting would have a mix of controls depending on the height of the poles. These spaces were assumed to have different lighting schedules, based on mounting-height dependent control requirements: one schedule for luminaires mounted more than 24 feet from the ground, which are controlled primarily by scheduling and photocontrols; and one schedule for luminaires mounted less than 24 feet above the ground, which require additional motion-based controls. The Statewide CASE Team assumed that roughly 78 percent of pole mounted light fixtures were above 24 feet and 22 percent were mounted below 24 feet. The following schedules are based on industry observations.

The schedules shown in Table 39 document the schedule applied to the general hardscape and specific applications, which were used to determine energy savings. The separate schedule dimming profiles for both winter and summer months are shown in Figure 1 to Figure 10.

Table 42: Application Use Schedules

Application	Schedule	Type	Annual Full Load Hours
General Hardscape	General Hardscape, A	Dusk-30min to Dawn+30min, Bi-level motion sensor	4263
Building Entrances and Exits	A	with Bi-level motion sensor	4690
Primary Entrances	A	Dusk-30min to Dawn+30min	4690
Drive-Up Windows	Retail	Dusk-30min to Dawn+30min	3193
Uncovered Fuel Dispenser	A	Dusk-30min to Dawn+30min	4690
ATM	ATM	with Partial Off	4690
Outdoor Sales Frontage	C	Dusk-30min to Dawn+30min	1932
Hardscape Ornamental Lighting	A	Dusk-30min to Dawn+30min	4690
Building Facades	D	Dusk-30min to Dawn+30min	3193
Outdoor Sales Lots	Outdoor Sales Lots, A	Dusk-30min to Dawn+30min, Bi-level motion sensor	4357
Vehicle Service Station Hardscape	Service Station Hardscape, A	Dusk-30min to Dawn+30min, Bi-level motion sensor	4459
Vehicle Service Station Canopies	Service Station Canopies, A	with Partial Off, Bi-level motion sensor	4459
Sales Canopies	Retail	Dusk-30min to Dawn+30min	3193
Non-sales Canopies and Pedestrian Tunnels	A	with Partial Off	4690
Guard Stations	A	Dusk-30min to Dawn+30min	4690
Student Pick-up/Drop-off Zones	B	Dusk-30min to Dawn+30min	1567
Outdoor Dining	Outdoor Dining	Dusk-30min to Dawn+30min	1932
Special Security Lighting for Retail Parking and Pedestrian Hardscape	A	with Partial Off	4690

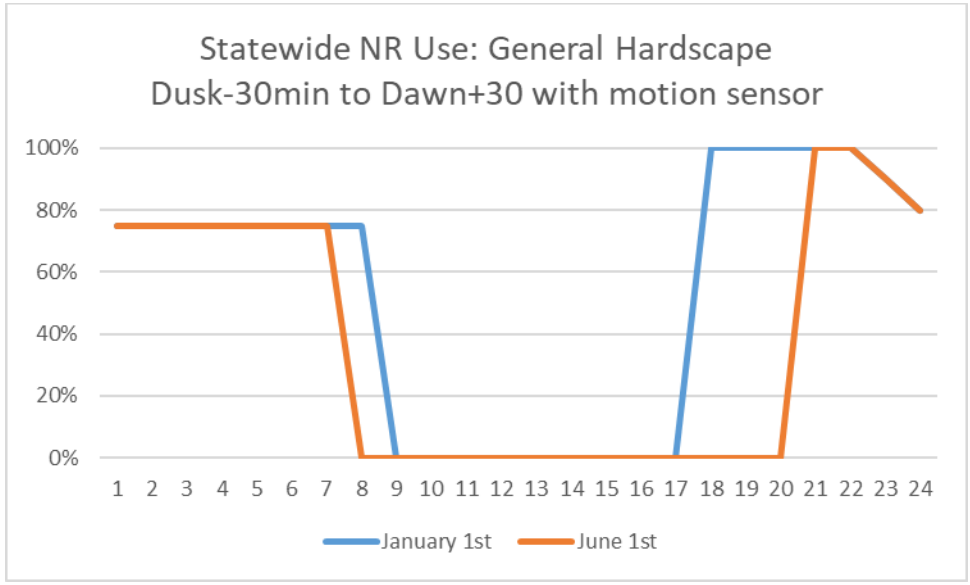

Figure 1: General Hardscape schedule showing percentage of rated power (y-axis) and hours in a day (x-axis).

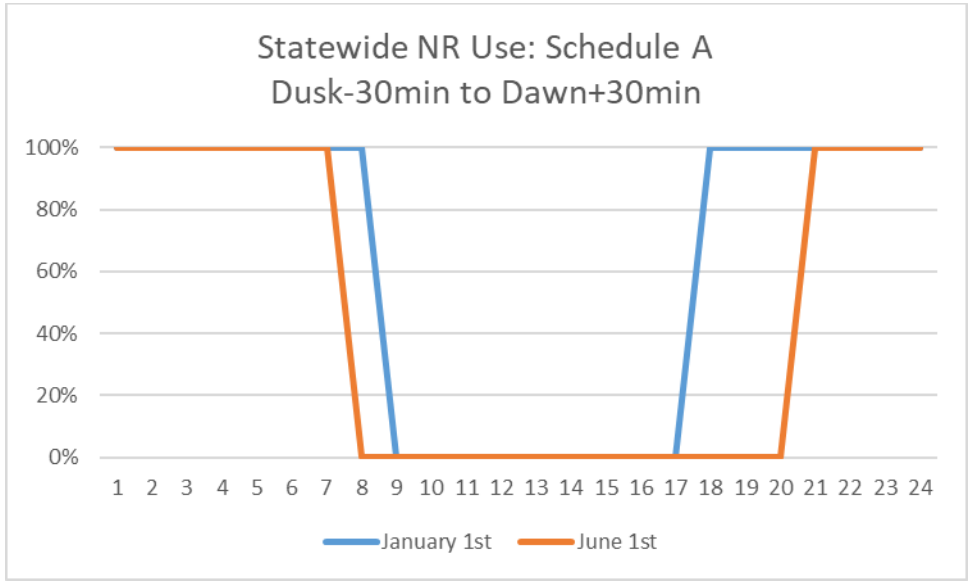

Figure 2: Schedule A showing percentage of rated power (y-axis) and hours in a day (x-axis).

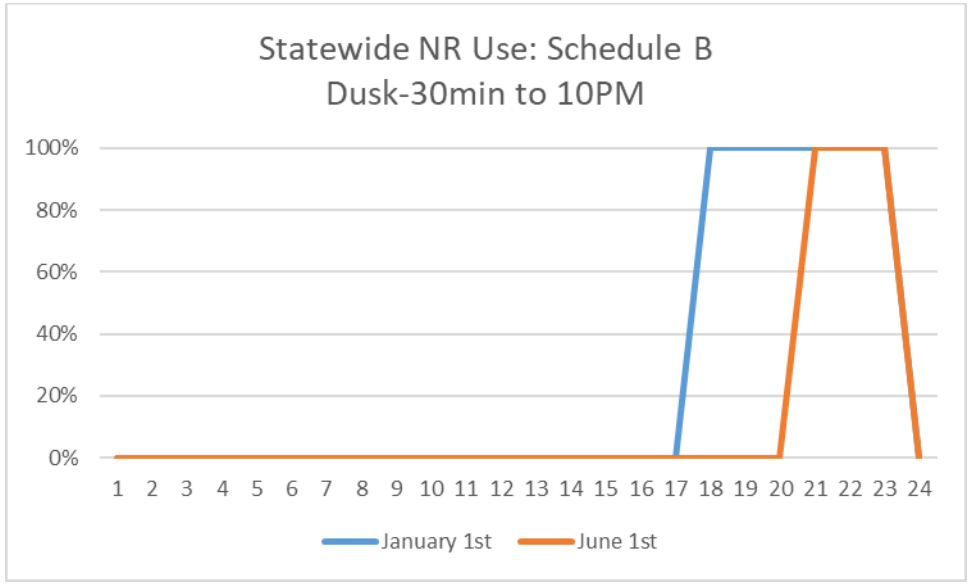

Figure 3: Schedule B showing percentage of rated power (y-axis) and hours in a day (x-axis).

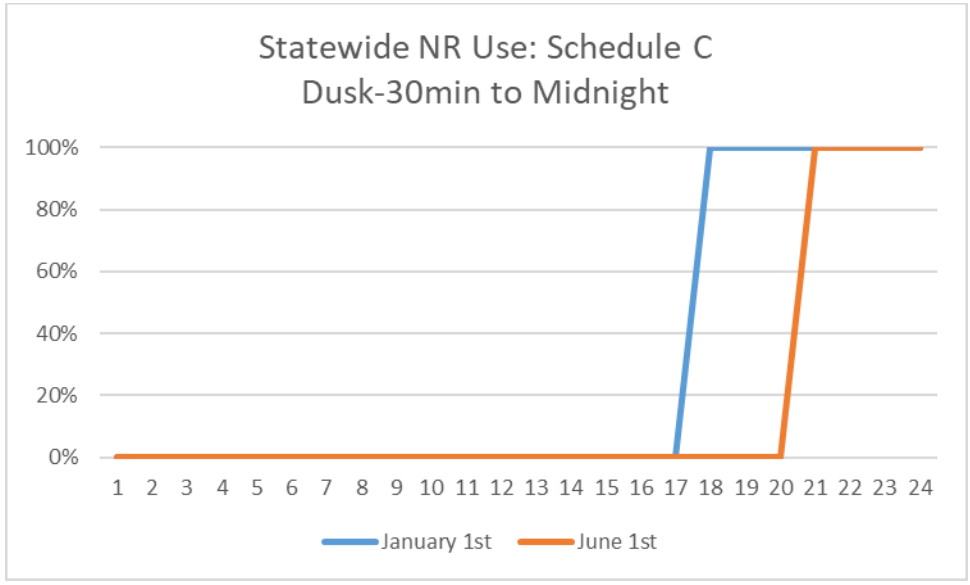

Figure 4: Schedule C showing percentage of rated power (y-axis) and hours in a day (x-axis).

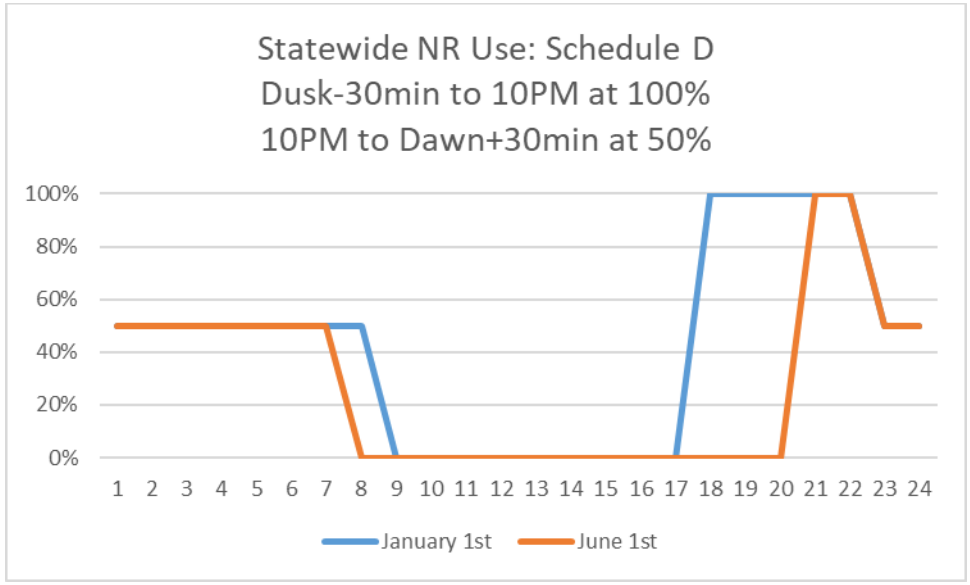

Figure 5: Schedule D showing percentage of rated power (y-axis) and hours in a day (x-axis).

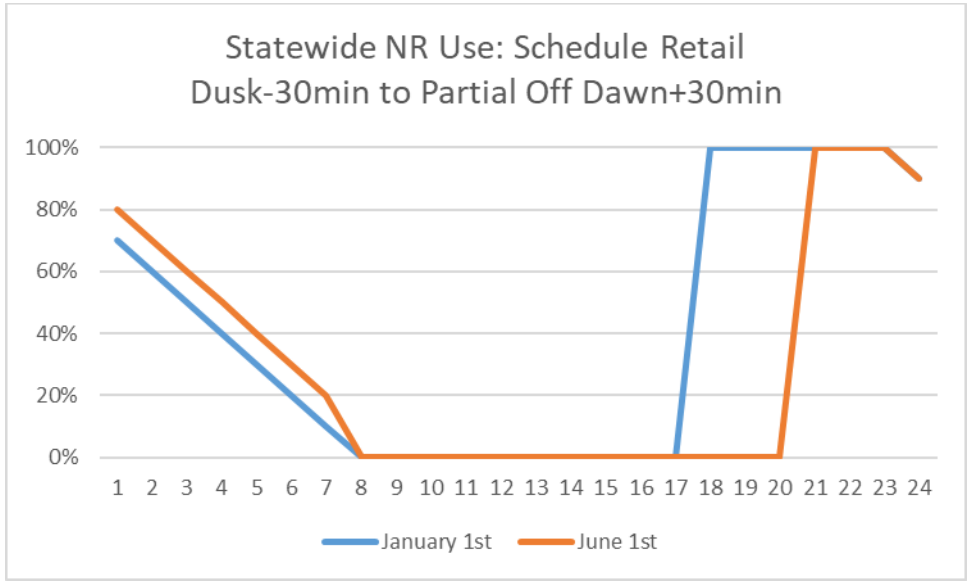

Figure 6: Retail schedule showing percentage of rated power (y-axis) and hours in a day (x-axis).

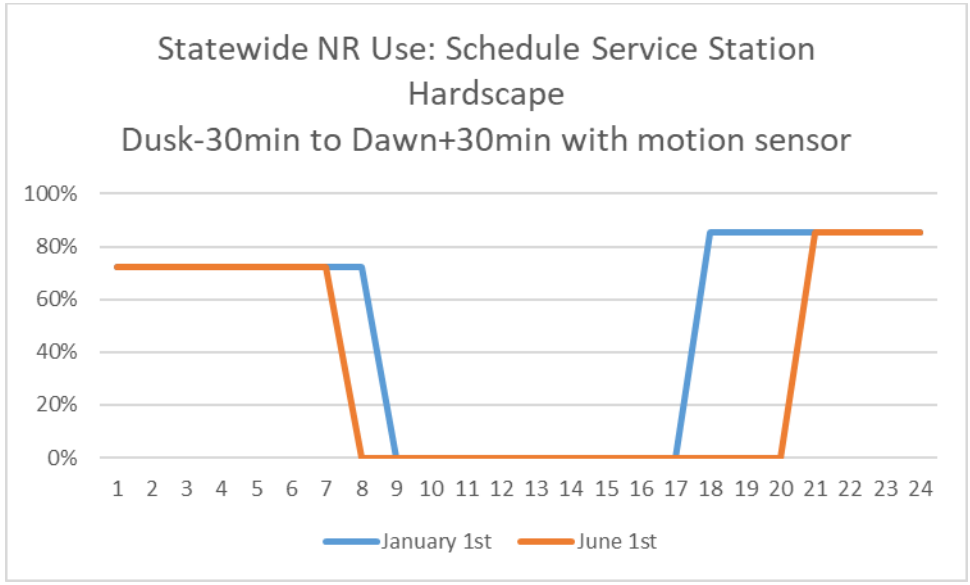

Figure 7: Service station hardscape schedule showing percentage of rated power (y-axis) and hours in a day (x-axis).

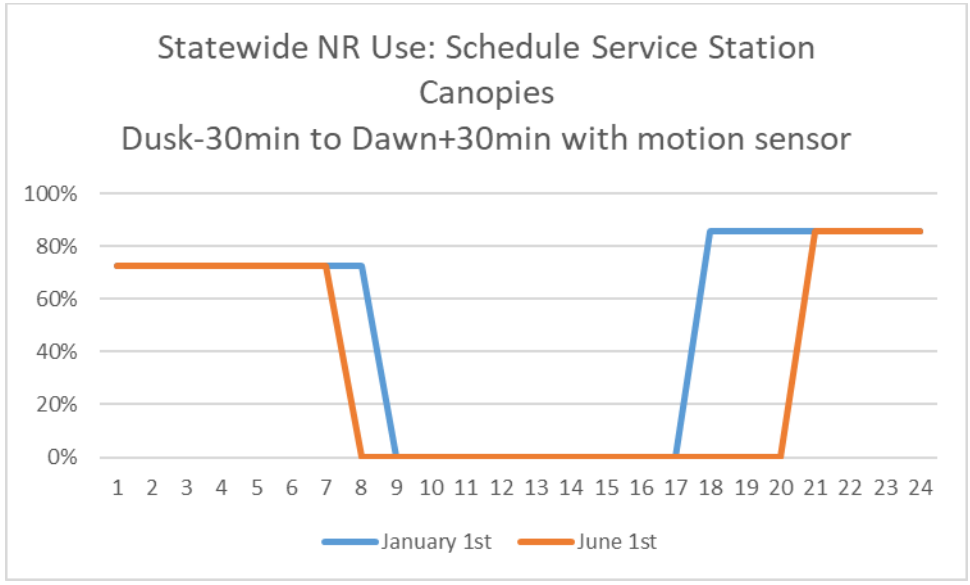

Figure 8: Service station canopies schedule showing percentage of rated power (y-axis) and hours in a day (x-axis).

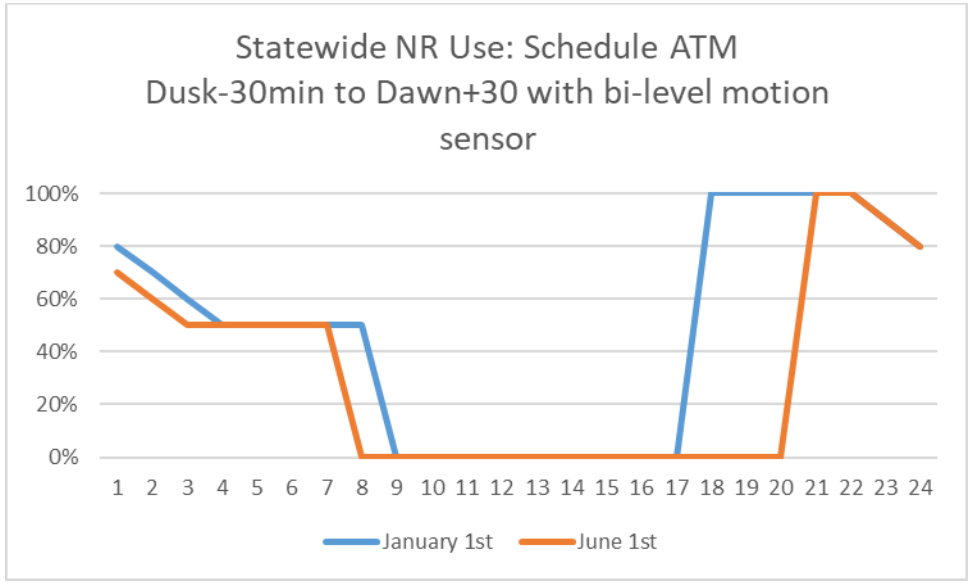

Figure 9: ATM schedule showing percentage of rated power (y-axis) and hours in a day (x-axis).

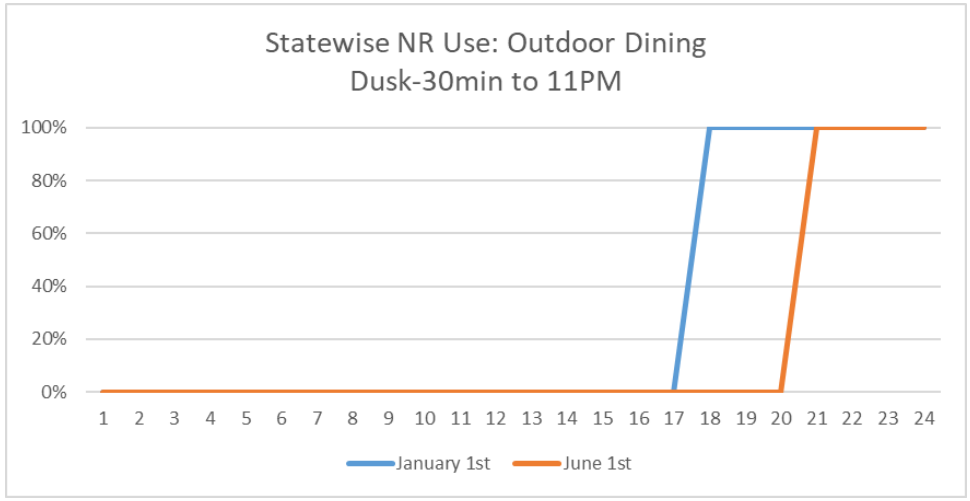

Figure 10: Outdoor dining schedule showing percentage of rated power (y-axis) and hours in a day (x-axis).

Appendix E: LIGHTING MODELS

The General Hardscape proposed effective area wattage allowances (eAWA) are based on three real design site models, used to determine cost impacts, and nine prototype sites used to provide a reasonable understanding of the eAWA for multiple site conditions.

The three real designs calculations are a valid approach applied in the 2016 code cycle that demonstrate advantages to improvements in LED technology that affect luminaire quantity, pole height, and pole spacing. LED technology has made significant advancements in the last three years and more products are available on the market with higher efficacy 3000K LEDs. Figure 11 provides the site geometry of the three models selected from an evaluation of actual parking lots in California represent the General Hardscape designs. These designs were used to determine a sampling of LED luminaires that were used in the unit cost calculations.

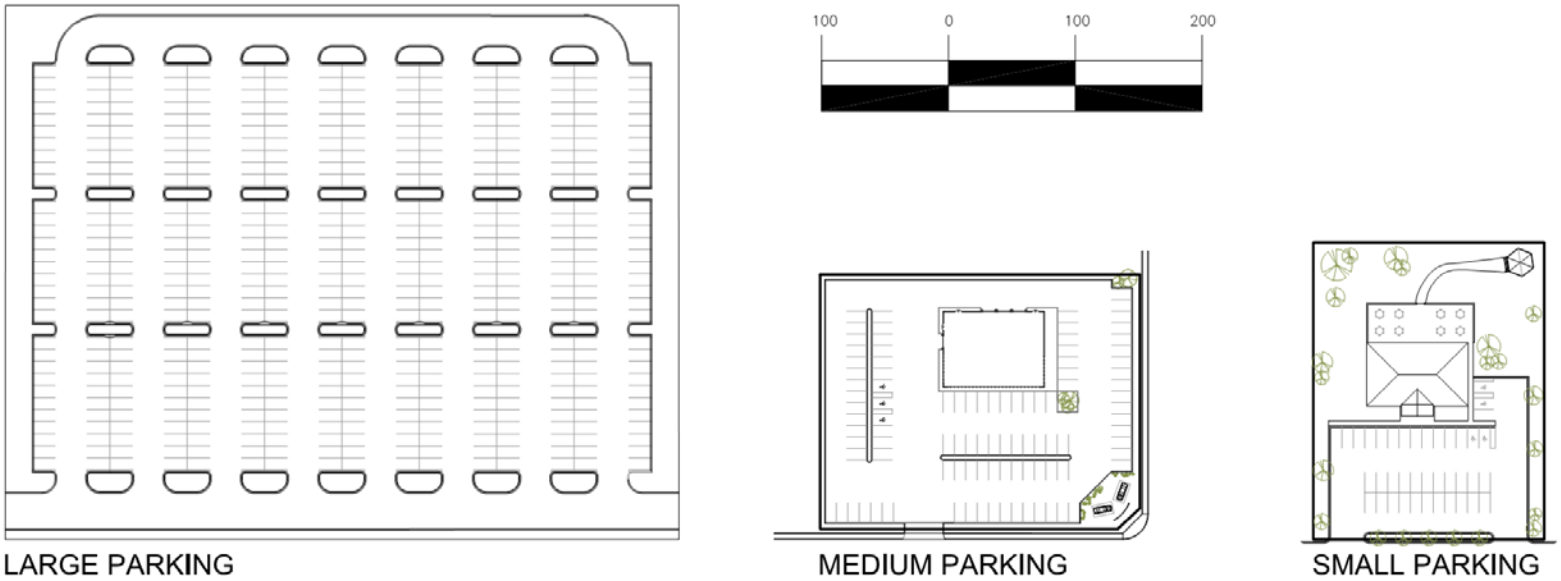

Figure 11: Three site models used for real design calculations.

Table 43: General Hardscape 2016 LED Cost Impact

Weighting							Luminaire ID	Reported Life	Lx at 60,000hr	Luminaire Wattage	2017 Luminaire Cost	2017 $/W	2016 Weighted Cost					
LZ1-A	LZ2-A	LZ2-C	LZ3-A	LZ3-C	LZ4-A	LZ4-C							LZ1-A	LZ2-A	LZ2-C	LZ3-A	LZ3-C	LZ4-A
0.00	0.00	0.00	0.09	0.00	0.00	0.00	PL01	100,000	0.990	45	$ 630	$ 14.00	$ -	$ -	$ -	$ 12,441	$ -	$ -
0.00	0.00	0.00	0.02	0.00	0.00	0.00	PL03	100,000	0.990	52	$ 830	$ 15.96	$ -	$ -	$ -	$ 3,546	$ -	$ -
0.00	0.00	0.00	0.00	0.00	0.00	0.22	PL05	100,000	0.990	68	$ 831	$ 12.22	$ -	$ -	$ -	$ -	$ -	$ -
0.06	0.00	0.00	0.00	0.03	0.00	0.00	PL06	60,000	0.930	75	$ 867	$ 11.56	$ 3,399	$ -	$ -	$ -	$ 3,886	$ -
0.00	0.00	0.00	0.04	0.00	0.00	0.00	PL07	60,000	0.930	75	$ 905	$ 12.07	$ -	$ -	$ -	$ 5,362	$ -	$ -
0.00	0.00	0.00	0.00	0.05	0.00	0.00	PL08	60,000	0.700	133	$ 1,685	$ 12.67	$ -	$ -	$ -	$ -	$ 8,518	$ -
0.00	0.00	0.00	0.02	0.00	0.00	0.00	PL09	60,000	0.700	72	$ 1,497	$ 20.79	$ -	$ -	$ -	$ 4,619	$ -	$ -
0.00	0.00	0.00	0.02	0.00	0.00	0.00	PL11	100,000	0.840	45	$ 742	$ 16.49	$ -	$ -	$ -	$ 3,663	$ -	$ -
0.00	0.00	0.00	0.26	0.00	0.00	0.00	PL12	100,000	0.840	47	$ 742	$ 15.79	$ -	$ -	$ -	$ 42,088	$ -	$ -
0.00	0.00	0.00	0.02	0.00	0.00	0.00	PL13	154,000	0.910	54	$ 1,220	$ 22.59	$ -	$ -	$ -	$ 5,019	$ -	$ -
0.00	0.00	0.03	0.00	0.00	0.00	0.00	PL14	100,000	0.887	107	$ 1,344	$ 12.56	$ -	$ -	$ 3,983	$ -	$ -	$ -
0.00	0.00	0.00	0.04	0.00	0.00	0.00	PL15	100,000	0.887	86	$ 1,407	$ 16.36	$ -	$ -	$ -	$ 7,269	$ -	$ -
0.11	0.00	0.00	0.00	0.00	0.00	0.00	PL16	100,000	0.887	20	$ 1,218	$ 60.90	$ 35,817	$ -	$ -	$ -	$ -	$ -
0.22	0.00	0.00	0.00	0.00	0.00	0.00	PL17	100,000	0.887	29	$ 1,218	$ 42.00	$ 49,402	$ -	$ -	$ -	$ -	$ -
0.14	0.03	0.03	0.02	0.03	0.00	0.00	PL18	100,000	0.887	37	$ 1,282	$ 34.65	$ 25,472	$ 7,547	$ 10,988	$ 7,698	$ 11,647	$ -
0.00	0.00	0.00	0.02	0.00	0.00	0.00	PL19	90,000	0.864	47	$ 1,218	$ 25.91	$ -	$ -	$ -	$ 5,757	$ -	$ -
0.00	0.11	0.00	0.07	0.00	0.00	0.00	PL20	100,000	0.887	55	$ 1,282	$ 23.31	$ -	$ 20,309	$ -	$ 15,535	$ -	$ -
0.03	0.08	0.28	0.00	0.14	0.00	0.00	PL21	100,000	0.887	55	$ 1,344	$ 24.44	$ 3,593	$ 15,969	$ 77,492	$ -	$ 41,072	$ -
0.00	0.11	0.00	0.00	0.00	0.00	0.00	PL22	100,000	0.887	73	$ 1,407	$ 19.27	$ -	$ 16,794	$ -	$ -	$ -	$ -
0.00	0.00	0.00	0.02	0.00	0.00	0.00	PL23	100,000	0.887	73	$ 1,282	$ 17.56	$ -	$ -	$ -	$ 3,902	$ -	$ -
0.00	0.00	0.00	0.00	0.05	0.00	0.00	PL24	100,000	0.887	78	$ 1,344	$ 17.23	$ -	$ -	$ -	$ -	$ 11,584	$ -
0.00	0.00	0.00	0.00	0.05	0.33	0.33	PL25	100,000	0.887	86	$ 1,470	$ 17.09	$ -	$ -	$ -	$ -	$ 11,492	$ 72,993
0.00	0.00	0.00	0.07	0.00	0.00	0.00	PL26	154,000	0.910	69	$ 1,283	$ 18.59	$ -	$ -	$ -	$ 12,393	$ -	$ -
0.00	0.00	0.00	0.00	0.00	0.00	0.00	PL27	154,000	0.910	87	$ 1,344	$ 15.45	$ -	$ -	$ -	$ -	$ -	$ -
0.19	0.00	0.00	0.00	0.00	0.00	0.00	PL29	150,000	0.950	14	$ 1,030	$ 73.57	$ 75,720	$ -	$ -	$ -	$ -	$ -
0.03	0.00	0.00	0.04	0.00	0.00	0.00	PL30	150,000	0.950	27	$ 1,118	$ 41.41	$ 6,088	$ -	$ -	$ 18,399	$ -	$ -
0.08	0.00	0.00	0.00	0.00	0.00	0.00	PL31	150,000	0.950	27	$ 1,030	$ 38.15	$ 16,827	$ -	$ -	$ -	$ -	$ -
0.00	0.33	0.33	0.07	0.32	0.33	0.22	PL32	150,000	0.950	55	$ 1,118	$ 20.33	$ -	$ 53,134	$ 77,354	$ 13,548	$ 81,998	$ 86,804
0.03	0.00	0.00	0.00	0.00	0.00	0.00	PL33	150,000	0.950	55	$ 1,118	$ 20.33	$ 2,989	$ -	$ -	$ -	$ -	$ -
0.08	0.33	0.33	0.17	0.32	0.33	0.22	PL34	150,000	0.950	55	$ 1,118	$ 20.33	$ 8,966	$ 53,134	$ 77,354	$ 36,128	$ 81,998	$ 86,804
0.03	0.00	0.00	0.00	0.00	0.00	0.00	PL35	150,000	0.950	27	$ 1,118	$ 41.41	$ 6,088	$ -	$ -	$ -	$ -	$ -
1.00	1.00	1.00	1.00	1.00	1.00	1.00							$ 234,361	$ 166,887	$ 247,171	$ 197,368	$ 252,195	$ 246,602

Table 44: General Hardscape 2019 LED Cost Impact

Weighting							Luminaire ID	Reported Life	Lx at 60,000hr	Luminaire Wattage	2017 Luminaire Cost	2017 $/W	2019 Weighted Cost					
LZ1-A	LZ2-A	LZ2-C	LZ3-A	LZ3-C	LZ4-A	LZ4-C							LZ1-A	LZ2-A	LZ2-C	LZ3-A	LZ3-C	LZ4-A
0.00	0.00	0.00	0.09	0.00	0.00	0.00	PL01	100,000	0.990	45	$ 630	$ 14.00	$ -	$ -	$ -	$ 8,147	$ -	$ -
0.00	0.00	0.00	0.02	0.00	0.00	0.00	PL03	100,000	0.990	52	$ 830	$ 15.96	$ -	$ -	$ -	$ 2,322	$ -	$ -
0.00	0.00	0.00	0.00	0.00	0.00	0.22	PL05	100,000	0.990	68	$ 831	$ 12.22	$ -	$ -	$ -	$ -	$ -	$ -
0.06	0.00	0.00	0.00	0.03	0.00	0.00	PL06	60,000	0.930	75	$ 867	$ 11.56	$ 2,775	$ -	$ -	$ -	$ 2,614	$ -
0.00	0.00	0.00	0.04	0.00	0.00	0.00	PL07	60,000	0.930	75	$ 905	$ 12.07	$ -	$ -	$ -	$ 3,511	$ -	$ -
0.00	0.00	0.00	0.00	0.05	0.00	0.00	PL08	60,000	0.700	133	$ 1,685	$ 12.67	$ -	$ -	$ -	$ -	$ 5,729	$ -
0.00	0.00	0.00	0.02	0.00	0.00	0.00	PL09	60,000	0.700	72	$ 1,497	$ 20.79	$ -	$ -	$ -	$ 3,025	$ -	$ -
0.00	0.00	0.00	0.02	0.00	0.00	0.00	PL11	100,000	0.840	45	$ 742	$ 16.49	$ -	$ -	$ -	$ 2,399	$ -	$ -
0.00	0.00	0.00	0.26	0.00	0.00	0.00	PL12	100,000	0.840	47	$ 742	$ 15.79	$ -	$ -	$ -	$ 27,561	$ -	$ -
0.00	0.00	0.00	0.02	0.00	0.00	0.00	PL13	154,000	0.910	54	$ 1,220	$ 22.59	$ -	$ -	$ -	$ 3,287	$ -	$ -
0.00	0.00	0.03	0.00	0.00	0.00	0.00	PL14	100,000	0.887	107	$ 1,344	$ 12.56	$ -	$ -	$ 2,518	$ -	$ -	$ -
0.00	0.00	0.00	0.04	0.00	0.00	0.00	PL15	100,000	0.887	86	$ 1,407	$ 16.36	$ -	$ -	$ -	$ 4,760	$ -	$ -
0.11	0.00	0.00	0.00	0.00	0.00	0.00	PL16	100,000	0.887	20	$ 1,218	$ 60.90	$ 29,236	$ -	$ -	$ -	$ -	$ -
0.22	0.00	0.00	0.00	0.00	0.00	0.00	PL17	100,000	0.887	29	$ 1,218	$ 42.00	$ 40,326	$ -	$ -	$ -	$ -	$ -
0.14	0.03	0.03	0.02	0.03	0.00	0.00	PL18	100,000	0.887	37	$ 1,282	$ 34.65	$ 20,792	$ 5,264	$ 6,945	$ 5,041	$ 7,834	$ -
0.00	0.00	0.00	0.02	0.00	0.00	0.00	PL19	90,000	0.864	47	$ 1,218	$ 25.91	$ -	$ -	$ -	$ 3,770	$ -	$ -
0.00	0.11	0.00	0.07	0.00	0.00	0.00	PL20	100,000	0.887	55	$ 1,282	$ 23.31	$ -	$ 14,164	$ -	$ 10,173	$ -	$ -
0.03	0.08	0.28	0.00	0.14	0.00	0.00	PL21	100,000	0.887	55	$ 1,344	$ 24.44	$ 2,933	$ 11,137	$ 48,979	$ -	$ 27,624	$ -
0.00	0.11	0.00	0.00	0.00	0.00	0.00	PL22	100,000	0.887	73	$ 1,407	$ 19.27	$ -	$ 11,712	$ -	$ -	$ -	$ -
0.00	0.00	0.00	0.02	0.00	0.00	0.00	PL23	100,000	0.887	73	$ 1,282	$ 17.56	$ -	$ -	$ -	$ 2,555	$ -	$ -
0.00	0.00	0.00	0.00	0.05	0.00	0.00	PL24	100,000	0.887	78	$ 1,344	$ 17.23	$ -	$ -	$ -	$ -	$ 7,791	$ -
0.00	0.00	0.00	0.00	0.05	0.33	0.33	PL25	100,000	0.887	86	$ 1,470	$ 17.09	$ -	$ -	$ -	$ -	$ 7,729	$ 47,074
0.00	0.00	0.00	0.07	0.00	0.00	0.00	PL26	154,000	0.910	69	$ 1,283	$ 18.59	$ -	$ -	$ -	$ 8,115	$ -	$ -
0.00	0.00	0.00	0.00	0.00	0.00	0.00	PL27	154,000	0.910	87	$ 1,344	$ 15.45	$ -	$ -	$ -	$ -	$ -	$ -
0.19	0.00	0.00	0.00	0.00	0.00	0.00	PL29	150,000	0.950	14	$ 1,030	$ 73.57	$ 61,809	$ -	$ -	$ -	$ -	$ -
0.03	0.00	0.00	0.04	0.00	0.00	0.00	PL30	150,000	0.950	27	$ 1,118	$ 41.41	$ 4,970	$ -	$ -	$ 12,048	$ -	$ -
0.08	0.00	0.00	0.00	0.00	0.00	0.00	PL31	150,000	0.950	27	$ 1,030	$ 38.15	$ 13,735	$ -	$ -	$ -	$ -	$ -
0.00	0.33	0.33	0.07	0.32	0.33	0.22	PL32	150,000	0.950	55	$ 1,118	$ 20.33	$ -	$ 37,056	$ 48,891	$ 8,872	$ 55,149	$ 55,981
0.03	0.00	0.00	0.00	0.00	0.00	0.00	PL33	150,000	0.950	55	$ 1,118	$ 20.33	$ 2,440	$ -	$ -	$ -	$ -	$ -
0.08	0.33	0.33	0.17	0.32	0.33	0.22	PL34	150,000	0.950	55	$ 1,118	$ 20.33	$ 7,319	$ 37,056	$ 48,891	$ 23,658	$ 55,149	$ 55,981
0.03	0.00	0.00	0.00	0.00	0.00	0.00	PL35	150,000	0.950	27	$ 1,118	$ 41.41	$ 4,970	$ -	$ -	$ -	$ -	$ -
1.00	1.00	1.00	1.00	1.00	1.00	1.00							$ 191,304	$ 116,388	$ 156,223	$ 129,243	$ 169,619	$ 159,036

The nine site prototype models used for the hardscape allowance calculations were selected to determine the reasonable range of ratios in the hardscape area and perimeter. Below in Figure 12, the general layout of the sites is shown to provide an understanding of the conditions that are anticipated in the calculations. These sites vary in overall hardscape size, as can be seen in the varying amount of gray shading, which impacts

the influence of the initial wattage allowance. The sites vary in both hardscape perimeter and building complexity, which impacts the perimeter to hardscape area ratio. The square footage of these nine prototype sites are used to determine a typical effective area wattage allowance that can be met with current technology used in the real design scenarios. The annual energy use was determined by applying the General Hardscape nonresidential statewide schedule profile shown in Figure 1.

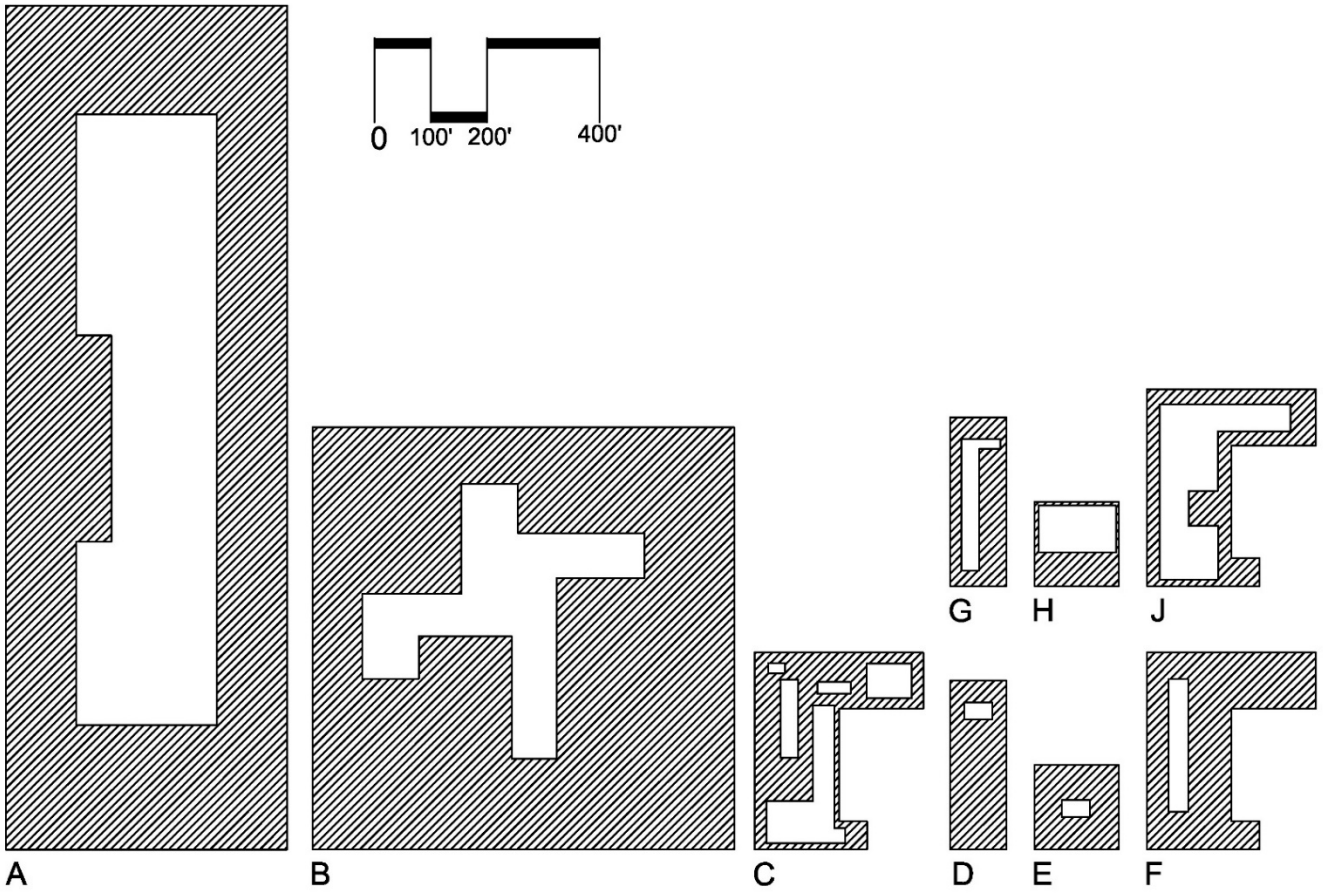

Figure 12: Nine site prototypes used to determine reasonable site calculations.

Table 45: General Hardscape Calculation Results and LPA Recommendations in Red

		LZ1	LZ2 Asphalt	LZ2 Concrete	LZ3 Asphalt	LZ3 Concrete	LZ4	
2016	Area Wattage Allowance	0.020	0.030	0.035	0.040	0.040	0.050	Watts per Square Foot
	Linear Wattage Allowance	0.150	0.250	0.700	0.350	0.700	0.450	Watts per Linear Foot
	Initial Wattage Allowance	340	450	450	520	520	640	Watts
	effective Area Wattage Allowance	0.037	0.054	0.079	0.071	0.086	0.089	Watts per Square Foot
2019	effective Area Wattage Allowance	0.030	0.038	0.050	0.046	0.058	0.057	Watts per Square Foot
	Limit of Reduction	0.019	0.023	0.035	0.027	0.037	0.030	Limit of Reduction
	Area Wattage Allowance	**0.018**	**0.023**	**0.025**	**0.025**	**0.030**	**0.030**	**Watts per Square Foot**
	Linear Wattage Allowance	**0.150**	**0.170**	**0.400**	**0.250**	**0.400**	**0.350**	**Watts per Linear Foot**
	Initial Wattage Allowance	**180**	**250**	**250**	**350**	**350**	**400**	**Watts**

Table 46: 2016 LED Prototype Site Calculations

Site Description			A- Long Skinny, Big Building	B-Square, Odd Building	C- Odd, Campus Buildings	D- Long Skinny, Small Square Building	E- Square, Small Building	F- Odd, Long Square Building	G- Long Skinny, Odd Building	H- Square, Large Square Building	J- Odd, Large Odd Building	K- Perfect Square Site, No Building	
Area, [sf]			501,626	471,726	42,828	28,500	21,000	61,798	21,797	11,040	34,735	250,000	
Perimeter, [sf]			6,794	5,131	3,052	960	760	1,940	1,408	1,042	2,593	2,000	
Perimeter to Area Ratio			1.4%	1.1%	7.1%	3.4%	3.6%	3.1%	6.5%	9.4%	7.5%	0.8%	
Title 24 - 2016: With IWA													
LZ1	AWA	W/sf	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	
		W	10,033	9,435	857	570	420	1,236	436	221	695	5,000	
	LWA	W/lf	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	
		W	1,019	770	458	144	114	291	211	156	389	300	
	IWA	W	340	340	340	340	340	340	340	340	340	340	
	TOTAL	W	11,392	10,544	1,654	1,054	874	1,867	987	717	1,424	5,640	Mean
	LPD	W/sf	0.023	0.022	0.039	0.037	0.042	0.030	0.045	0.065	0.041	0.023	0.037
	%W from AWA		88.1%	89.5%	51.8%	54.1%	48.1%	66.2%	44.2%	30.8%	48.8%	88.7%	61.0%
	%W from LWA		8.9%	7.3%	27.7%	13.7%	13.0%	15.6%	21.4%	21.8%	27.3%	5.3%	16.2%
	%W from IWA		3.0%	3.2%	20.6%	32.3%	38.9%	18.2%	34.4%	47.4%	23.9%	6.0%	22.8%
LZ2 Asphalt	AWA	W/sf	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	
		W	15,049	14,152	1,285	855	630	1,854	654	331	1,042	7,500	
	LWA	W/lf	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
		W	1,699	1,283	763	240	190	485	352	261	648	500	
	IWA	W	450	450	450	450	450	450	450	450	450	450	
	TOTAL	W	17,197	15,885	2,498	1,545	1,270	2,789	1,456	1,042	2,140	8,450	Mean
	LPD	W/sf	0.034	0.034	0.058	0.054	0.060	0.045	0.067	0.094	0.062	0.034	0.054
	%W from AWA		87.5%	89.1%	51.4%	55.3%	49.6%	66.5%	44.9%	31.8%	48.7%	88.8%	61.4%
	%W from LWA		9.9%	8.1%	30.5%	15.5%	15.0%	17.4%	24.2%	25.0%	30.3%	5.9%	18.2%
	%W from IWA		2.6%	2.8%	18.0%	29.1%	35.4%	16.1%	30.9%	43.2%	21.0%	5.3%	20.5%
LZ2 Concrete	AWA	W/sf	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	
		W	17,557	16,510	1,499	998	735	2,163	763	386	1,216	8,750	
	LWA	W/lf	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	
		W	4,756	3,592	2,136	672	532	1,358	986	729	1,815	1,400	
	IWA	W	450	450	450	450	450	450	450	450	450	450	
	TOTAL	W	22,763	20,552	4,085	2,120	1,717	3,971	2,198	1,566	3,481	10,600	Mean
	LPD	W/sf	0.045	0.044	0.095	0.074	0.082	0.064	0.101	0.142	0.100	0.042	0.079
	%W from AWA		77.1%	80.3%	36.7%	47.1%	42.8%	54.5%	34.7%	24.7%	34.9%	82.5%	51.5%
	%W from LWA		20.9%	17.5%	52.3%	31.7%	31.0%	34.2%	44.8%	46.6%	52.1%	13.2%	34.4%
	%W from IWA		2.0%	2.2%	11.0%	21.2%	26.2%	11.3%	20.5%	28.7%	12.9%	4.2%	14.0%

Table 47: 2016 LED Prototype Site Calculations

Site Description			A- Long Skinny, Big Building	B-Square, Odd Building	C- Odd, Campus Buildings	D- Long Skinny, Small Square Building	E- Square, Small Building	F- Odd, Long Square Building	G- Long Skinny, Odd Building	H- Square, Large Square Building	J- Odd, Large Odd Building	K- Perfect Square Site, No Building	
Area, [sf]			501,626	471,726	42,828	28,500	21,000	61,798	21,797	11,040	34,735	250,000	
Perimeter, [sf]			6,794	5,131	3,052	960	760	1,940	1,408	1,042	2,593	2,000	
Perimeter to Area Ratio			1.4%	1.1%	7.1%	3.4%	3.6%	3.1%	6.5%	9.4%	7.5%	0.8%	
Title 24 - 2016: With IWA													
LZ3 Asphalt	AWA	W/sf	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	
		W	20,065	18,869	1,713	1,140	840	2,472	872	442	1,389	10,000	
	LWA	W/lf	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	
		W	2,378	1,796	1,068	336	266	679	493	365	908	700	
	IWA	W	520	520	520	520	520	520	520	520	520	520	
	TOTAL	W	22,963	21,185	3,301	1,996	1,626	3,671	1,885	1,326	2,817	11,220	Mean
	LPD	W/sf	0.046	0.045	0.077	0.070	0.077	0.059	0.086	0.120	0.081	0.045	0.071
	%W from AWA		87.4%	89.1%	51.9%	57.1%	51.7%	67.3%	46.3%	33.3%	49.3%	89.1%	62.2%
	%W from LWA		10.4%	8.5%	32.4%	16.8%	16.4%	18.5%	26.1%	27.5%	32.2%	6.2%	19.5%
	%W from IWA		2.3%	2.5%	15.8%	26.1%	32.0%	14.2%	27.6%	39.2%	18.5%	4.6%	18.3%
LZ3 Concrete	AWA	W/sf	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040	
		W	20,065	18,869	1,713	1,140	840	2,472	872	442	1,389	10,000	
	LWA	W/lf	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	
		W	4,756	3,592	2,136	672	532	1,358	986	729	1,815	1,400	
	IWA	W	520	520	520	520	520	520	520	520	520	520	
	TOTAL	W	25,341	22,981	4,370	2,332	1,892	4,350	2,377	1,691	3,725	11,920	Mean
	LPD	W/sf	0.051	0.049	0.102	0.082	0.090	0.070	0.109	0.153	0.107	0.048	0.086
	%W from AWA		79.2%	82.1%	39.2%	48.9%	44.4%	56.8%	36.7%	26.1%	37.3%	83.9%	53.5%
	%W from LWA		18.8%	15.6%	48.9%	28.8%	28.1%	31.2%	41.5%	43.1%	48.7%	11.7%	31.7%
	%W from IWA		2.1%	2.3%	11.9%	22.3%	27.5%	12.0%	21.9%	30.8%	14.0%	4.4%	14.9%
LZ4	AWA	W/sf	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	
		W	25,081	23,586	2,141	1,425	1,050	3,090	1,090	552	1,737	12,500	
	LWA	W/lf	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	
		W	3,057	2,309	1,373	432	342	873	634	469	1,167	900	
	IWA	W	640	640	640	640	640	640	640	640	640	640	
	TOTAL	W	28,779	26,535	4,155	2,497	2,032	4,603	2,363	1,661	3,544	14,040	Mean
	LPD	W/sf	0.057	0.056	0.097	0.088	0.097	0.074	0.108	0.150	0.102	0.056	0.089
	%W from AWA		87.2%	88.9%	51.5%	57.1%	51.7%	67.1%	46.1%	33.2%	49.0%	89.0%	62.1%
	%W from LWA		10.6%	8.7%	33.1%	17.3%	16.8%	19.0%	26.8%	28.2%	32.9%	6.4%	20.0%
	%W from IWA		2.2%	2.4%	15.4%	25.6%	31.5%	13.9%	27.1%	38.5%	18.1%	4.6%	17.9%

Table 48: Proposed 2019 LED Prototype Site Calculations

Site Description			A- Long Skinny, Big Building	B-Square, Odd Building	C- Odd, Campus Buildings	D- Long Skinny, Small Square Building	E- Square, Small Building	F- Odd, Long Square Building	G- Long Skinny, Odd Building	H- Square, Large Square Building	J- Odd, Large Odd Building	K- Perfect Square Site, No Building	
Area, [sf]			501,626	471,726	42,828	28,500	21,000	61,798	21,797	11,040	34,735	250,000	
Perimeter, [sf]			6,794	5,131	3,052	960	760	1,940	1,408	1,042	2,593	2,000	
Perimeter to Area Ratio			1.4%	1.1%	7.1%	3.4%	3.6%	3.1%	6.5%	9.4%	7.5%	0.8%	
Title 24 - 2019: With IWA													
LZ1	AWA	W/sf	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	
		W	9,029	8,491	771	513	378	1,112	392	199	625	4,500	
	LWA	W/lf	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	
		W	1,019	770	458	144	114	291	211	156	389	300	
	IWA	W	180	180	180	180	180	180	180	180	180	180	
	TOTAL	W	10,228	9,441	1,409	837	672	1,583	784	535	1,194	4,980	Mean
	LPD	W/sf	0.020	0.020	0.033	0.029	0.032	0.026	0.036	0.048	0.034	0.020	0.030
	%W from AWA		88.3%	89.9%	54.7%	61.3%	56.3%	70.3%	50.1%	37.1%	52.4%	90.4%	65.1%
	%W from LWA		10.0%	8.2%	32.5%	17.2%	17.0%	18.4%	27.0%	29.2%	32.6%	6.0%	19.8%
	%W from IWA		1.8%	1.9%	12.8%	21.5%	26.8%	11.4%	23.0%	33.6%	15.1%	3.6%	15.1%
LZ2 Asphalt	AWA	W/sf	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	
		W	11,537	10,850	985	656	483	1,421	501	254	799	5,750	
	LWA	W/lf	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	
		W	1,155	872	519	163	129	330	239	177	441	340	
	IWA	W	250	250	250	250	250	250	250	250	250	250	
	TOTAL	W	12,942	11,972	1,754	1,069	862	2,001	991	681	1,490	6,340	Mean
	LPD	W/sf	0.026	0.025	0.041	0.037	0.041	0.032	0.045	0.062	0.043	0.025	0.038
	%W from AWA		89.1%	90.6%	56.2%	61.3%	56.0%	71.0%	50.6%	37.3%	53.6%	90.7%	65.7%
	%W from LWA		8.9%	7.3%	29.6%	15.3%	15.0%	16.5%	24.2%	26.0%	29.6%	5.4%	17.8%
	%W from IWA		1.9%	2.1%	14.3%	23.4%	29.0%	12.5%	25.2%	36.7%	16.8%	3.9%	16.6%
LZ2 Concrete	AWA	W/sf	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	
		W	12,541	11,793	1,071	713	525	1,545	545	276	868	6,250	
	LWA	W/lf	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	
		W	2,718	2,052	1,221	384	304	776	563	417	1,037	800	
	IWA	W	250	250	250	250	250	250	250	250	250	250	
	TOTAL	W	15,508	14,096	2,542	1,347	1,079	2,571	1,358	943	2,156	7,300	Mean
	LPD	W/sf	0.031	0.030	0.059	0.047	0.051	0.042	0.062	0.085	0.062	0.029	0.050
	%W from AWA		80.9%	83.7%	42.1%	52.9%	48.7%	60.1%	40.1%	29.3%	40.3%	85.6%	56.4%
	%W from LWA		17.5%	14.6%	48.0%	28.5%	28.2%	30.2%	41.5%	44.2%	48.1%	11.0%	31.2%
	%W from IWA		1.6%	1.8%	9.8%	18.6%	23.2%	9.7%	18.4%	26.5%	11.6%	3.4%	12.5%

Table 49: Proposed 2019 LED Prototype Site Calculations

Site Description			A- Long Skinny, Big Building	B-Square, Odd Building	C- Odd, Campus Buildings	D- Long Skinny, Small Square Building	E- Square, Small Building	F- Odd, Long Square Building	G- Long Skinny, Odd Building	H- Square, Large Square Building	J- Odd, Large Odd Building	K- Perfect Square Site, No Building	
Area, [sf]			501,626	471,726	42,828	28,500	21,000	61,798	21,797	11,040	34,735	250,000	
Perimeter, [sf]			6,794	5,131	3,052	960	760	1,940	1,408	1,042	2,593	2,000	
Perimeter to Area Ratio			1.4%	1.1%	7.1%	3.4%	3.6%	3.1%	6.5%	9.4%	7.5%	0.8%	
Title 24 - 2019: With IWA													
LZ3 Asphalt	AWA	W/sf	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	
		W	12,541	11,793	1,071	713	525	1,545	545	276	868	6,250	
	LWA	W/lf	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
		W	1,699	1,283	763	240	190	485	352	261	648	500	
	IWA	W	350	350	350	350	350	350	350	350	350	350	
	TOTAL	W	14,589	13,426	2,184	1,303	1,065	2,380	1,247	887	1,867	7,100	Mean
	LPD	W/sf	0.029	0.028	0.051	0.046	0.051	0.039	0.057	0.080	0.054	0.028	0.046
	%W from AWA		86.0%	87.8%	49.0%	54.7%	49.3%	64.9%	43.7%	31.1%	46.5%	88.0%	60.1%
	%W from LWA		11.6%	9.6%	34.9%	18.4%	17.8%	20.4%	28.2%	29.4%	34.7%	7.0%	21.2%
	%W from IWA		2.4%	2.6%	16.0%	26.9%	32.9%	14.7%	28.1%	39.5%	18.8%	4.9%	18.7%
LZ3 Concrete	AWA	W/sf	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	
		W	15,049	14,152	1,285	855	630	1,854	654	331	1,042	7,500	
	LWA	W/lf	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	
		W	2,718	2,052	1,221	384	304	776	563	417	1,037	800	
	IWA	W	350	350	350	350	350	350	350	350	350	350	
	TOTAL	W	18,116	16,554	2,856	1,589	1,284	2,980	1,567	1,098	2,429	8,650	Mean
	LPD	W/sf	0.036	0.035	0.067	0.056	0.061	0.048	0.072	0.099	0.070	0.035	0.058
	%W from AWA		83.1%	85.5%	45.0%	53.8%	49.1%	62.2%	41.7%	30.2%	42.9%	86.7%	58.0%
	%W from LWA		15.0%	12.4%	42.8%	24.2%	23.7%	26.0%	35.9%	38.0%	42.7%	9.2%	27.0%
	%W from IWA		1.9%	2.1%	12.3%	22.0%	27.3%	11.7%	22.3%	31.9%	14.4%	4.0%	15.0%
LZ4	AWA	W/sf	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	0.030	
		W	15,049	14,152	1,285	855	630	1,854	654	331	1,042	7,500	
	LWA	W/lf	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	
		W	2,378	1,796	1,068	336	266	679	493	365	908	700	
	IWA	W	400	400	400	400	400	400	400	400	400	400	
	TOTAL	W	17,827	16,348	2,753	1,591	1,296	2,933	1,547	1,096	2,350	8,600	Mean
	LPD	W/sf	0.036	0.035	0.064	0.056	0.062	0.047	0.071	0.099	0.068	0.034	0.057
	%W from AWA		84.4%	86.6%	46.7%	53.7%	48.6%	63.2%	42.3%	30.2%	44.4%	87.2%	58.7%
	%W from LWA		13.3%	11.0%	38.8%	21.1%	20.5%	23.2%	31.9%	33.3%	38.6%	8.1%	24.0%
	%W from IWA		2.2%	2.4%	14.5%	25.1%	30.9%	13.6%	25.9%	36.5%	17.0%	4.7%	17.3%

The cost-effectiveness of using LED luminaires as a baseline for all the specific applications was based on a one-for-one comparison of lighting equipment. Most of these applications are unlikely to reduce the equipment quantity substantially from using LED products, allowing for a one-on-one comparison. The 3000K LED luminaires studied were based on equivalent lumen output and luminaire type as the legacy product baseline. A breakdown of the recommended LPAs along with legacy product and equivalent 3000K LEDs are provided in Table 50 to Table 100.

Table 50: Building Entrances and Exits Calculation Results and LPA Recommendations in Red

		LZ1	LZ2	LZ3	LZ4	
2016	Allowance	15	25	35	45	Watts
	LPW	32	32	32	32	lm/W
2019	LPW	63	66	70	77	lm/W
	Limit of Reduction	7.6	12.1	15.9	19.0	Limit of Reduction
	Proposed LPA	**9**	**15**	**19**	**21**	**Watts**

Table 51: Building Entrances and Exits Legacy Product Calculation

Area Light

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.20	0.10	0.05	0.00	18	CFL	E104	$ 3,719	20	0.856	746	37	7.5	3.7	1.9	0.0	4	2	1	0	$ 744	$ 372	$ 186	$ -
0.25	0.15	0.05	0.05	26	CFL	E105	$ 3,719	28	0.858	1,077	38	9.6	5.8	1.9	1.9	7	4	1	1	$ 930	$ 558	$ 186	$ 186
0.25	0.20	0.15	0.10	32	CFL	E106	$ 3,719	35	0.860	1,440	41	10.3	8.2	6.2	4.1	9	7	5	4	$ 930	$ 744	$ 558	$ 372
0.15	0.25	0.25	0.10	42	CFL	E107	$ 3,719	46	0.860	1,920	42	6.3	10.4	10.4	4.2	7	12	12	5	$ 558	$ 930	$ 930	$ 372
0.10	0.15	0.15	0.05	50	PSMH	E045	$ 686	67	0.670	2,257	34	3.4	5.1	5.1	1.7	7	10	10	3	$ 69	$ 103	$ 103	$ 34
0.05	0.10	0.20	0.10	70	PSMH	E046	$ 686	92	0.740	3,675	40	2.0	4.0	8.0	4.0	5	9	18	9	$ 34	$ 69	$ 137	$ 69
0.00	0.05	0.10	0.30	100	PSMH	E047	$ 696	129	0.750	5,431	42	0.0	2.1	4.2	12.6	0	6	13	39	$ -	$ 35	$ 70	$ 209
0.00	0.00	0.05	0.30	150	PSMH	E048	$ 774	190	0.740	8,037	42	0.0	0.0	2.1	12.7	0	0	10	57	$ -	$ -	$ 39	$ 232
1	1	1	1									39	39	40	41	38	50	70	118	$ 3,264	$ 2,810	$ 2,208	$ 1,474

Wall Mounted Luminaire

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.20	0.10	0.05	0.00	26	CFL	e020	$ 467	28	0.858	709	25	5.1	2.5	1.3	0.0	6	3	1	0	$ 93	$ 47	$ 23	$ -
0.25	0.15	0.05	0.05	26	CFL	E020	$ 467	28	0.858	709	25	6.3	3.8	1.3	1.3	7	4	1	1	$ 117	$ 70	$ 23	$ 23
0.25	0.20	0.15	0.10	32	CFL	E021	$ 470	35	0.860	947	27	6.8	5.4	4.1	2.7	9	7	5	4	$ 117	$ 94	$ 70	$ 47
0.15	0.25	0.25	0.10	42	CFL	E022	$ 470	46	0.860	1,262	27	4.1	6.9	6.9	2.7	7	12	12	5	$ 70	$ 117	$ 117	$ 47
0.10	0.15	0.15	0.05	50	PSMH	E023	$ 600	67	0.670	1,225	18	1.8	2.7	2.7	0.9	7	10	10	3	$ 60	$ 90	$ 90	$ 30
0.05	0.10	0.20	0.10	70	PSMH	E024	$ 600	92	0.740	1,996	22	1.1	2.2	4.3	2.2	5	9	18	9	$ 30	$ 60	$ 120	$ 60
0.00	0.05	0.10	0.30	100	PSMH	E025	$ 606	129	0.750	2,949	23	0.0	1.1	2.3	6.9	0	6	13	39	$ -	$ 30	$ 61	$ 182
0.00	0.00	0.05	0.30	150	PSMH	E026	$ 548	190	0.740	4,364	23	0.0	0.0	1.1	6.9	0	0	10	57	$ -	$ -	$ 27	$ 164
1	1	1	1									25	25	24	24	40	51	70	118	$ 488	$ 508	$ 533	$ 554
											Average:	32	32	32	32	39	51	70	118	$ 1,876	$ 1,659	$ 1,370	$ 1,014

Table 52: Building Entrances and Exits Equivalent LED Calculation

Area Light

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.20	0.10	0.05	0.00	L104	$ 1,197	14	0.700	1130	81	3	1	1	0	$ 239	$ 120	$ 60	$ -	16	8	4	0
0.25	0.15	0.05	0.05	L105	$ 1,197	14	0.700	1130	81	4	2	1	1	$ 299	$ 179	$ 60	$ 60	20	12	4	4
0.25	0.20	0.15	0.10	L106	$ 1,197	14	0.700	1130	81	4	3	2	1	$ 299	$ 239	$ 179	$ 120	20	16	12	8
0.15	0.25	0.25	0.10	L107	$ 1,124	21	0.700	1695	81	3	5	5	2	$ 169	$ 281	$ 281	$ 112	12	20	20	8
0.10	0.15	0.15	0.05	L045	$ 1,242	50	0.887	4703	94	5	8	8	3	$ 124	$ 186	$ 186	$ 62	9	14	14	5
0.05	0.10	0.20	0.10	L046	$ 1,242	50	0.887	4703	94	3	5	10	5	$ 62	$ 124	$ 248	$ 124	5	9	19	9
0.00	0.05	0.10	0.30	L047	$ 1,275	80	0.887	6781	85	0	4	8	24	$ -	$ 64	$ 128	$ 383	0	4	8	25
0.00	0.00	0.05	0.30	L048	$ 1,309	105	0.887	8601	82	0	0	5	32	$ -	$ -	$ 65	$ 393	0	0	4	25
1	1	1	1							20	28	40	67	$ 1,193	$ 1,194	$ 1,208	$ 1,254	83	84	86	84

Wall Mounted Luminaire

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.20	0.10	0.05	0.00	L020	$ 136	16	0.781	625	39	3	2	1	0	$ 27	$ 14	$ 7	$ -	8	4	2	0
0.25	0.15	0.05	0.05	L020	$ 136	16	0.781	625	39	4	2	1	1	$ 34	$ 20	$ 7	$ 7	10	6	2	2
0.25	0.20	0.15	0.10	L021	$ 136	16	0.781	625	39	4	3	2	2	$ 34	$ 27	$ 20	$ 14	10	8	6	4
0.15	0.25	0.25	0.10	L022	$ 225	27	0.700	1222	45	4	7	7	3	$ 34	$ 56	$ 56	$ 23	7	11	11	5
0.10	0.15	0.15	0.05	L023	$ 406	18	0.700	1202	67	2	3	3	1	$ 41	$ 61	$ 61	$ 20	7	10	10	3
0.05	0.10	0.20	0.10	L024	$ 533	28	0.700	1693	60	1	3	6	3	$ 27	$ 53	$ 107	$ 53	3	6	12	6
0.00	0.05	0.10	0.30	L025	$ 608	55	0.700	2904	53	0	3	6	17	$ -	$ 30	$ 61	$ 182	0	3	5	16
0.00	0.00	0.05	0.30	L026	$ 608	37	0.700	4164	113	0	0	2	11	$ -	$ -	$ 30	$ 182	0	0	6	34
1	1	1	1							18	22	26	36	$ 196	$ 262	$ 349	$ 481	44	48	54	69
									Average:	19	25	33	52	$ 694	$ 728	$ 779	$ 867	63	66	70	77

Table 53: Primary Entrances Calculation Results and LPA Recommendations in Red

		LZ1	LZ2	LZ3	LZ4	
2016	Allowance	45	80	120	130	Watts
	LPW	27	26	25	25	lm/W
2019	LPW	62	66	69	79	lm/W
	Limit of Reduction	19.7	31.8	44.4	40.5	Limit of Reduction
	Proposed LPA	**20**	**40**	**57**	**60**	**Watts**

Table 54: Primary Entrances Legacy Product Calculation

Downlight

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.50	0.35	0.10	0.05	32	CFL	E140	$ 315	35	0.860	685	20	9.8	6.8	2.0	1.0	18	12	4	2	$ 157	$ 110	$ 31	$ 16
0.30	0.30	0.20	0.15	42	CFL	E141	$ 281	46	0.860	913	20	6.0	6.0	4.0	3.0	14	14	9	7	$ 84	$ 84	$ 56	$ 42
0.15	0.20	0.25	0.25	70	PSMH	E097	$ 292	92	0.740	1,895	21	3.1	4.1	5.2	5.2	14	18	23	23	$ 44	$ 58	$ 73	$ 73
0.05	0.10	0.30	0.30	100	PSMH	E098	$ 299	129	0.750	2,801	22	1.1	2.2	6.5	6.5	6	13	39	39	$ 15	$ 30	$ 90	$ 90
1	1	1	1									20	19	18	16	52	57	74	70	$ 300	$ 283	$ 251	$ 221

Wall Pack

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.40	0.20	0.10	0.00	26	CFL	E020	$ 467	28	0.858	709	25	10.1	5.1	2.5	0.0	11	6	3	0	$ 187	$ 93	$ 47	$ -
0.25	0.25	0.15	0.05	32	CFL	E021	$ 470	35	0.860	947	27	6.8	6.8	4.1	1.4	9	9	5	2	$ 117	$ 117	$ 70	$ 23
0.20	0.20	0.15	0.10	42	CFL	E022	$ 470	46	0.860	1,262	27	5.5	5.5	4.1	2.7	9	9	7	5	$ 94	$ 94	$ 70	$ 47
0.10	0.15	0.20	0.10	70	PSMH	E024	$ 600	92	0.740	1,996	22	2.2	3.3	4.3	2.2	9	14	18	9	$ 60	$ 90	$ 120	$ 60
0.05	0.10	0.20	0.15	100	PSMH	E025	$ 606	129	0.750	2,949	23	1.1	2.3	4.6	3.4	6	13	26	19	$ 30	$ 61	$ 121	$ 91
0.00	0.05	0.05	0.25	150	PSMH	E026	$ 548	190	0.740	4,364	23	0.0	1.1	1.1	5.7	0	10	10	48	$ -	$ 27	$ 27	$ 137
0.00	0.05	0.10	0.25	175	PSMH	E042	$ 328	198	0.700	4,721	24	0.0	1.2	2.4	6.0	0	10	20	50	$ -	$ 16	$ 33	$ 82
0.00	0.00	0.05	0.10	250	PSMH	E043	$ 535	291	0.700	6,787	23	0.0	0.0	1.2	2.3	0	0	15	29	$ -	$ -	$ 27	$ 54
1.00	1.00	1.00	1.00									26	25	24	24	45	70	103	161	$ 488	$ 499	$ 516	$ 494

Area

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.00	0.00	18	CFL	E104	$ 3,719	20	0.856	746	37	1.9	1.9	0.0	0.0	1	1	0	0	$ 186	$ 186	$ -	$ -
0.10	0.05	0.00	0.00	26	CFL	E105	$ 3,719	28	0.858	1,077	38	3.8	1.9	0.0	0.0	3	1	0	0	$ 372	$ 186	$ -	$ -
0.20	0.10	0.10	0.00	32	CFL	E106	$ 3,719	35	0.860	1,440	41	8.2	4.1	4.1	0.0	7	4	4	0	$ 744	$ 372	$ 372	$ -
0.20	0.15	0.10	0.10	42	CFL	E107	$ 3,719	46	0.860	1,920	42	8.3	6.3	4.2	4.2	9	7	5	5	$ 744	$ 558	$ 372	$ 372
0.20	0.20	0.15	0.10	50	PSMH	E136	$ 686	67	0.670	1,558	23	4.7	4.7	3.5	2.3	13	13	10	7	$ 137	$ 137	$ 103	$ 69
0.15	0.25	0.25	0.20	70	PSMH	E137	$ 686	92	0.740	3,098	34	5.1	8.4	8.4	6.7	14	23	23	18	$ 103	$ 172	$ 172	$ 137
0.10	0.15	0.25	0.30	100	PSMH	E138	$ 696	129	0.750	4,736	37	3.7	5.5	9.2	11.0	13	19	32	39	$ 70	$ 104	$ 174	$ 209
0.00	0.05	0.15	0.30	150	PSMH	E139	$ 774	190	0.705	6,372	34	0.0	1.7	5.0	10.1	0	10	29	57	$ -	$ 39	$ 116	$ 232
1.00	1.00	1.00	1.00									36	34	34	34	60	78	102	125	$ 2,355	$ 1,754	$ 1,308	$ 1,019
											Average:	27	26	25	25	52	68	93	119	$ 1,048	$ 845	$ 692	$ 578

Table 55: Primary Entrances LED Calculation

Downlight

Weighting				2016 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.50	0.35	0.10	0.05	L140	$ 141	12.8	0.700	732	57	6	4	1	1	$ 70	$ 49	$ 14	$ 7	29	20	6	3
0.30	0.30	0.20	0.15	L141	$ 154	20.5	0.700	1086	53	6	6	4	3	$ 46	$ 46	$ 31	$ 23	16	16	11	8
0.15	0.20	0.25	0.25	L097	$ 243	31.6	0.700	1603	51	5	6	8	8	$ 36	$ 49	$ 61	$ 61	8	10	13	13
0.05	0.10	0.30	0.30	L098	$ 1,128	67	0.940	3677	55	3	7	20	20	$ 56	$ 113	$ 338	$ 338	3	5	16	16
1	1	1	1							21	24	33	32	$ 209	$ 257	$ 444	$ 429	55	52	45	40

Wall Pack

Weighting				2016 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.40	0.20	0.10	0.00	L020	$ 136	16	0.781	625	39	6	3	2	0	$ 54	$ 27	$ 14	$ -	16	8	4	0
0.25	0.25	0.15	0.05	L021	$ 136	16	0.781	625	39	4	4	2	1	$ 34	$ 34	$ 20	$ 7	10	10	6	2
0.20	0.20	0.15	0.10	L022	$ 225	27	0.700	1222	45	5	5	4	3	$ 45	$ 45	$ 34	$ 23	9	9	7	5
0.10	0.15	0.20	0.10	L024	$ 533	28	0.880	2129	76	3	4	6	3	$ 53	$ 80	$ 107	$ 53	8	11	15	8
0.05	0.10	0.20	0.15	L025	$ 608	55	0.880	3651	66	3	6	11	8	$ 30	$ 61	$ 122	$ 91	3	7	13	10
0.00	0.05	0.05	0.25	L026	$ 608	37	0.880	5235	141	0	2	2	9	$ -	$ 30	$ 30	$ 152	0	7	7	35
0.00	0.05	0.10	0.25	L042	$ 608	37	0.940	5592	151	0	2	4	9	$ -	$ 30	$ 61	$ 152	0	8	15	38
0.00	0.00	0.05	0.10	L043	$ 608	55	0.880	7081	129	0	0	3	6	$ -	$ -	$ 30	$ 61	0	0	6	13
1.00	1.00	1.00	1.00							21	26	33	39	$ 217	$ 308	$ 417	$ 538	45	59	74	110

Area

Weighting				2016 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.00	0.00	L104	$ 1,197	14	0.700	1130	81	1	1	0	0	$ 60	$ 60	$ -	$ -	4	4	0	0
0.10	0.05	0.00	0.00	L105	$ 1,197	14	0.700	1130	81	1	1	0	0	$ 120	$ 60	$ -	$ -	8	4	0	0
0.20	0.10	0.10	0.00	L106	$ 1,197	14	0.700	1130	81	3	1	1	0	$ 239	$ 120	$ 120	$ -	16	8	8	0
0.20	0.15	0.10	0.10	L107	$ 1,124	21	0.700	1695	81	4	3	2	2	$ 225	$ 169	$ 112	$ 112	16	12	8	8
0.20	0.20	0.15	0.10	L136	$ 1,242	50	0.887	4703	94	10	10	8	5	$ 248	$ 248	$ 186	$ 124	19	19	14	9
0.15	0.25	0.25	0.20	L137	$ 1,242	50	0.887	4703	94	8	13	13	10	$ 186	$ 311	$ 311	$ 248	14	24	24	19
0.10	0.15	0.25	0.30	L138	$ 1,275	80	0.887	6781	85	8	12	20	24	$ 128	$ 191	$ 319	$ 383	8	13	21	25
0.00	0.05	0.15	0.30	L139	$ 1,309	105	0.887	8601	82	0	5	16	32	$ -	$ 65	$ 196	$ 393	0	4	12	25
1.00	1.00	1.00	1.00							35	46	59	73	$ 1,206	$ 1,224	$ 1,244	$ 1,260	86	87	87	86
									Average:	26	32	42	48	$ 544	$ 596	$ 702	$ 743	62	66	69	79

Table 56: Drive-Up Windows Calculation Results and LPA Recommendations in Red

		LZ1	LZ2	LZ3	LZ4	
2016	Allowance	40	75	125	200	Watts
	LPW	26	26	26	26	lm/W
2019	LPW	77	77	77	77	lm/W
	Limit of Reduction	13.3	25.2	42.3	67.4	Limit of Reduction
	Proposed LPA	**16**	**30**	**50**	**75**	**Watts**

Table 57: Drive-Up Windows Legacy Product Calculation

Round Ceiling Mounted Downlight

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.05	0.00	0.00	50	PSMH	E054	$ 346	67	0.670	1,337	20	2	1	0	0	7	3	0	0	$ 35	$ 17	$ -	$ -
0.20	0.15	0.05	0.10	70	PSMH	E055	$ 369	92	0.740	2,177	24	5	4	1	2	18	14	5	9	$ 74	$ 55	$ 18	$ 37
0.30	0.25	0.20	0.30	100	PSMH	E056	$ 369	129	0.750	3,216	25	7	6	5	7	39	32	26	39	$ 111	$ 92	$ 74	$ 111
0.40	0.55	0.75	0.60	150	PSMH	E057	$ 499	190	0.740	4,759	25	10	14	19	15	76	105	143	114	$ 199	$ 274	$ 374	$ 299
1	1	1	1									24	25	25	25	140	154	173	162	$ 419	$ 439	$ 466	$ 447

Ceiling Mounted, Full Cut-Off

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.40	0.40	0.40	0.40	70	PSMH	E035	$ 752	92	0.740	2,432	26	11	11	11	11	37	37	37	37	$ 301	$ 301	$ 301	$ 301
0.60	0.60	0.60	0.60	100	PSMH	E036	$ 752	129	0.750	3,593	28	17	17	17	17	77	77	77	77	$ 451	$ 451	$ 451	$ 451
1	1	1	1									27	27	27	27	114	114	114	114	$ 752	$ 752	$ 752	$ 752
											Average:	26	26	26	26	127	134	144	138	$ 585	$ 595	$ 609	$ 599

Table 58: Drive-Up Windows Equivalent LED Calculation

Round Ceiling Mounted Downlight

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.05	0.00	0.00	L054	$ 236	24.1	0.700	1540	64	2	1	0	0	$ 24	$ 12	$ -	$ -	6	3	0	0
0.20	0.15	0.05	0.10	L055	$ 257	34.6	0.700	2130	62	7	5	2	3	$ 51	$ 39	$ 13	$ 26	12	9	3	6
0.30	0.25	0.20	0.30	L056	$ 281	42.3	0.700	2909	69	13	11	8	13	$ 84	$ 70	$ 56	$ 84	21	17	14	21
0.40	0.55	0.75	0.60	L057	$ 365	72.2	0.700	4635	64	29	40	54	43	$ 146	$ 201	$ 274	$ 219	26	35	48	39
1	1	1	1							51	57	64	59	$ 305	$ 321	$ 343	$ 329	65	65	65	65

Ceiling Mounted, Full Cut-Off

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.40	0.40	0.40	0.40	L035	$ 985	24	0.700	2260	94	10	10	10	10	$ 394	$ 394	$ 394	$ 394	38	38	38	38
0.60	0.60	0.60	0.60	L036	$ 985	36	0.700	3105	86	22	22	22	22	$ 591	$ 591	$ 591	$ 591	52	52	52	52
1	1	1	1							31	31	31	31	$ 985	$ 985	$ 985	$ 985	89	89	89	89
									Average:	41	44	48	45	$ 645	$ 653	$ 664	$ 657	77	77	77	77

Table 59: Uncovered Fuel Dispenser Calculation Results and LPA Recommendations in Red

		LZ1	LZ2	LZ3	LZ4	
2016	Allowance	120	175	185	330	Watts
	LPW	31	32	33	34	lm/W
2019	LPW	76	83	88	91	lm/W
	Limit of Reduction	48.6	67.1	68.9	122.4	Limit of Reduction
	Proposed LPA	**55**	**77**	**81**	**135**	**Watts**

Table 60: Uncovered Fuel Dispenser Legacy Product Calculation

Area																							
Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.20	0.10	0.05	0.00	100	PSMH	E070	$ 1,010	129	0.750	3,876	30	6	3	2	0	26	13	6	0	$ 202	$ 101	$ 51	$ -
0.30	0.20	0.10	0.05	150	PSMH	E071	$ 1,010	190	0.740	5,737	30	9	6	3	2	57	38	19	10	$ 303	$ 202	$ 101	$ 51
0.30	0.30	0.30	0.25	175	PSMH	E037	$ 1,062	198	0.700	5,895	30	9	9	9	7	59	59	59	50	$ 319	$ 319	$ 319	$ 266
0.20	0.30	0.35	0.40	250	PSMH	E073	$ 1,205	291	0.700	9,801	34	7	10	12	13	58	87	102	116	$ 241	$ 361	$ 422	$ 482
0.00	0.10	0.20	0.30	400	PSMH	E075	$ 1,205	452	0.700	17,046	38	0	4	8	11	0	45	90	136	$ -	$ 120	$ 241	$ 361
1.00	1.00	1.00	1.00									31	32	33	34	200	243	277	311	$ 1,065	$ 1,104	$ 1,133	$ 1,159
											Average:	31	32	33	34	200	243	277	311	$ 1,065	$ 1,104	$ 1,133	$ 1,159

Table 61: Uncovered Fuel Dispenser Equivalent LED Calculation

Area																							
Weighting				2016 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.20	0.10	0.05	0.00	L070	$ 1,127.69	67	0.940	3677	55	13	7	3	0	$ 226	$ 113	$ 56	$ -	11	5	3	0
0.30	0.20	0.10	0.05	L071	$ 1,796.44	126	0.940	6958	55	38	25	13	6	$ 539	$ 359	$ 180	$ 90	17	11	6	3
0.30	0.30	0.30	0.25	L037	$ 1,364.82	85	0.938	7865	93	26	26	26	21	$ 409	$ 409	$ 409	$ 341	28	28	28	23
0.20	0.30	0.35	0.40	L073	$ 1,775.68	126	0.940	12953	103	25	38	44	50	$ 355	$ 533	$ 621	$ 710	21	31	36	41
0.00	0.10	0.20	0.30	L075	$ 1,551.67	210	0.700	16763	80	0	21	42	63	$ -	$ 155	$ 310	$ 466	0	8	16	24
1.00	1.00	1.00	1.00							102	116	128	141	$ 1,529	$ 1,569	$ 1,577	$ 1,607	76	83	88	91
									Average:	102	116	128	141	$ 1,529	$ 1,569	$ 1,577	$ 1,607	76	83	88	91

Table 62: ATM Machine Lighting Calculation Results and LPA Recommendations in Red

		LZ1	LZ2	LZ3	LZ4	
2016	Allowance	250	250	250	250	Watts
	LPW	25	25	24	24	lm/W
2019	LPW	68	71	82	100	lm/W
	Limit of Reduction	89.6	86.6	74.7	59.9	Limit of Reduction
	Proposed LPA	**100**	**100**	**100**	**100**	**Watts**

Table 63: ATM Machine Lighting Legacy Product Calculation

Wall Mounted

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.20	0.20	0.15	0.05	26	CFL	E020	$ 467	28	0.858	709	25	5	5	4	1	6	6	4	1	$ 85	$ 85	$ 64	$ 21
0.25	0.25	0.25	0.15	32	CFL	E021	$ 470	35	0.860	947	27	7	7	7	4	9	9	9	5	$ 108	$ 108	$ 108	$ 65
0.25	0.20	0.10	0.10	100	PSMH	E025	$ 606	129	0.750	2949	23	6	5	2	2	32	26	13	13	$ 139	$ 111	$ 56	$ 56
0.20	0.20	0.25	0.30	150	PSMH	E026	$ 548	190	0.740	4364	23	5	5	6	7	38	38	48	57	$ 92	$ 92	$ 115	$ 138
0.10	0.10	0.15	0.25	175	PSMH	E042	$ 328	198	0.700	4721	24	2	2	4	6	20	20	30	50	$ 30	$ 30	$ 45	$ 75
0.00	0.05	0.10	0.15	250	PSMH	E043	$ 535	291	0.700	6787	23	0	1	2	3	0	15	29	44	$ -	$ 25	$ 49	$ 74
1.00	1.00	1.00	1.00									25	25	24	24	104	113	132	170	$ 453	$ 450	$ 436	$ 428
											Average:	25	25	24	24	104	113	132	170	$ 453	$ 450	$ 436	$ 428

Table 64: ATM Machine Lighting Equivalent LED Calculation

Wall Mounted

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.20	0.20	0.15	0.05	L020	$ 136	16	0.781	625	39	3	3	2	1	$ 27	$ 27	$ 20	$ 7	8	8	6	2
0.25	0.25	0.25	0.15	L021	$ 136	16	0.781	625	39	4	4	4	2	$ 34	$ 34	$ 34	$ 20	10	10	10	6
0.25	0.20	0.10	0.10	L025	$ 608	55	0.880	3651	66	14	11	6	6	$ 152	$ 122	$ 61	$ 61	17	13	7	7
0.20	0.20	0.25	0.30	L026	$ 608	37	0.880	5235	141	7	7	9	11	$ 122	$ 122	$ 152	$ 182	28	28	35	42
0.10	0.10	0.15	0.25	L042	$ 608	37	0.940	5592	151	4	4	6	9	$ 61	$ 61	$ 91	$ 152	15	15	23	38
0.00	0.05	0.10	0.15	L043	$ 608	55	0.880	7081	129	0	3	6	8	$ -	$ 30	$ 61	$ 91	0	6	13	19
1.00	1.00	1.00	1.00							32	32	32	37	$ 395	$ 395	$ 419	$ 513	78	81	93	114
									Average:	32	32	32	37	$ 395	$ 395	$ 419	$ 513	78	81	93	114

Table 65: Outdoor Sales Frontage Calculation Results and LPA Recommendations in Red

		LZ1	LZ2	LZ3	LZ4	
2016	Allowance	0	22.5	36	45	W/lf
	LPW	37	37	39	40	lm/W
2019	LPW	84	82	79	77	lm/W
	Limit of Reduction	0.0	10.3	17.8	23.6	Limit of Reduction
	Proposed LPA	**0**	**11**	**19**	**25**	**W/lf**

Table 66: Outdoor Sales Frontage Legacy Product Calculation

Area

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.05	0.00	0.00	100	PSMH	E070	$ 1,010	129	0.750	3,876	30	3	2	0	0	13	6	0	0	$ 101	$ 51	$ -	$ -
0.20	0.10	0.00	0.00	150	PSMH	E071	$ 1,010	190	0.740	5,737	30	6	3	0	0	38	19	0	0	$ 202	$ 101	$ -	$ -
0.25	0.20	0.10	0.00	175	PSMH	E037	$ 1,062	198	0.700	5,895	30	7	6	3	0	50	40	20	0	$ 266	$ 212	$ 106	$ -
0.20	0.25	0.20	0.10	250	PSMH	E073	$ 1,205	291	0.700	9,801	34	7	8	7	3	58	73	58	29	$ 241	$ 301	$ 241	$ 120
0.15	0.20	0.20	0.15	320	PSMH	E074	$ 1,205	368	0.700	12,571	34	5	7	7	5	55	74	74	55	$ 181	$ 241	$ 241	$ 181
0.10	0.15	0.25	0.20	400	PSMH	E075	$ 1,205	452	0.700	17,046	38	4	6	9	8	45	68	113	90	$ 120	$ 181	$ 301	$ 241
0.00	0.05	0.15	0.25	750	PSMH	E076	$ 1,762	818	0.700	32,399	40	0	2	6	10	0	41	123	205	$ -	$ 88	$ 264	$ 441
0.00	0.00	0.10	0.30	1000	PSMH	E077	$ 1,762	1080	0.701	49,590	46	0	0	5	14	0	0	108	324	$ -	$ -	$ 176	$ 529
1.00	1.00	1.00	1.00									32	33	37	40	259	320	495	703	$ 1,111	$ 1,175	$ 1,330	$ 1,511

Flood

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.05	0.00	0.00	100	PSMH	E126	$ 1,261	129	0.750	5,315	41	4	2	0	0	13	6	0	0	$ 126	$ 63	$ -	$ -
0.20	0.10	0.00	0.00	150	PSMH	E127	$ 1,276	190	0.740	7,728	41	8	4	0	0	38	19	0	0	$ 255	$ 128	$ -	$ -
0.25	0.20	0.10	0.00	175	PSMH	E078	$ 1,045	198	0.700	8,053	41	10	8	4	0	50	40	20	0	$ 261	$ 209	$ 104	$ -
0.20	0.25	0.20	0.10	250	PSMH	E128	$ 1,482	291	0.700	12,275	42	8	11	8	4	58	73	58	29	$ 296	$ 370	$ 296	$ 148
0.15	0.20	0.20	0.15	320	PSMH	E079	$ 1,053	368	0.700	14,847	40	6	8	8	6	55	74	74	55	$ 158	$ 211	$ 211	$ 158
0.10	0.20	0.30	0.30	400	PSMH	E129	$ 1,482	452	0.700	19,640	43	4	9	13	13	45	90	136	136	$ 148	$ 296	$ 445	$ 445
0.00	0.00	0.20	0.45	1000	PSMH	E130	$ 1,976	1080	0.701	42,582	39	0	0	8	18	0	0	216	486	$ -	$ -	$ 395	$ 889
1.00	1.00	1.00	1.00									41	42	41	41	259	302	503	706	$ 1,245	$ 1,277	$ 1,451	$ 1,640
											Average:	37	37	39	40	259	311	499	705	$ 1,178	$ 1,226	$ 1,391	$ 1,576

Table 67: Outdoor Sales Frontage Equivalent LED Calculation

Area

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.05	0.00	0.00	L070	$ 1,128	67	0.940	3677	55	7	3	0	0	$ 113	$ 56	$ -	$ -	5	3	0	0
0.20	0.10	0.00	0.00	L071	$ 1,796	126	0.940	6958	55	25	13	0	0	$ 359	$ 180	$ -	$ -	11	6	0	0
0.25	0.20	0.10	0.00	L037	$ 1,365	85	0.938	7865	93	21	17	9	0	$ 341	$ 273	$ 136	$ -	23	19	9	0
0.20	0.25	0.20	0.10	L073	$ 1,776	126	0.940	12953	103	25	32	25	13	$ 355	$ 444	$ 355	$ 178	21	26	21	10
0.15	0.20	0.20	0.15	L074	$ 1,552	139	0.700	11494	83	21	28	28	21	$ 233	$ 310	$ 310	$ 233	12	17	17	12
0.10	0.15	0.25	0.20	L075	$ 1,552	210	0.700	16763	80	21	32	53	42	$ 155	$ 233	$ 388	$ 310	8	12	20	16
0.00	0.05	0.15	0.25	L076	$ 1,687	311	0.700	24204	78	0	16	47	78	$ -	$ 84	$ 253	$ 422	0	4	12	19
0.00	0.00	0.10	0.30	L077	$ 1,687	311	0.700	24204	78	0	0	31	93	$ -	$ -	$ 169	$ 506	0	0	8	23
1.00	1.00	1.00	1.00							120	139	192	247	$ 1,556	$ 1,580	$ 1,612	$ 1,649	81	85	86	81

Flood

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.05	0.00	0.00	L126	$ 979	71	0.700	4840	68	7	4	0	0	$ 98	$ 49	$ -	$ -	7	3	0	0
0.20	0.10	0.00	0.00	L127	$ 979	52	0.700	7725	149	10	5	0	0	$ 196	$ 98	$ -	$ -	30	15	0	0
0.25	0.20	0.10	0.00	L078	$ 979	106	0.700	7725	73	27	21	11	0	$ 245	$ 196	$ 98	$ -	18	15	7	0
0.20	0.25	0.20	0.10	L128	$ 1,047	155	0.700	10825	70	31	39	31	16	$ 209	$ 262	$ 209	$ 105	14	17	14	7
0.15	0.20	0.20	0.15	L079	$ 1,552	210	0.700	15099	72	32	42	42	32	$ 233	$ 310	$ 310	$ 233	11	14	14	11
0.10	0.20	0.30	0.30	L129	$ 1,687	261	0.700	18952	73	26	52	78	78	$ 169	$ 337	$ 506	$ 506	7	15	22	22
0.00	0.00	0.20	0.45	L130	$ 1,687	261	0.700	18952	73	0	0	52	117	$ -	$ -	$ 337	$ 759	0	0	15	33
1.00	1.00	1.00	1.00							133	163	214	243	$ 1,149	$ 1,252	$ 1,461	$ 1,603	87	79	72	72

									Average:	126	151	203	245	$ 1,353	$ 1,416	$ 1,536	$ 1,626	84	82	79	77

Table 68: Hardscape Ornamental Lighting Calculation Results and LPA Recommendations in Red

		LZ1	LZ2	LZ3	LZ4	
2016	Allowance	0	0.02	0.04	0.06	W/sf
	LPW	15	16	14	13	lm/W
2019	LPW	68	67	61	57	lm/W
	Limit of Reduction	0.000	0.005	0.009	0.013	Limit of Reduction
	Proposed LPA	**0**	**0.007**	**0.013**	**0.019**	**W/sf**

Table 69: Hardscape Ornamental Lighting Legacy Product Calculation

Decorative Area

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.25	0.15	0.10	0.05	50	PSMH	E132	$ 3,719	67	0.670	584	9	2	1	1	0	17	10	7	3	$ 779	$ 467	$ 312	$ 156
0.20	0.25	0.20	0.20	70	PSMH	E133	$ 3,719	92	0.740	928	10	2	3	2	2	18	23	18	18	$ 623	$ 779	$ 623	$ 623
0.15	0.20	0.30	0.25	100	PSMH	E134	$ 3,719	129	0.750	1256	10	1	2	3	2	19	26	39	32	$ 467	$ 623	$ 935	$ 779
0.05	0.05	0.15	0.30	150	PSMH	E135	$ 3,719	190	0.740	1652	9	0	0	1	3	10	10	29	57	$ 156	$ 156	$ 467	$ 935
0.20	0.15	0.10	0.05	42	CFL	E099	$ 585	46	0.860	1237	27	5	4	3	1	9	7	5	2	$ 107	$ 80	$ 54	$ 27
0.15	0.20	0.15	0.15	57	CFL	E100	$ 610	62	0.860	1662	27	4	5	4	4	9	12	9	9	$ 84	$ 112	$ 84	$ 84
1.00	1.00	1.00	1.00									15	16	14	13	83	88	106	123	$2,215	$2,217	$ 2,473	$ 2,602
											Average:	15	16	14	13	83	88	106	123	$2,215	$2,217	$ 2,473	$ 2,602

Table 70: Hardscape Ornamental Lighting Equivalent LED Calculation

Decorative Area

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.25	0.15	0.10	0.05	L132	$ 1,296	25	0.970	1775	71	6	4	3	1	$ 324	$ 194	$ 130	$ 65	18	11	7	4
0.20	0.25	0.20	0.20	L133	$ 1,296	43	0.970	2947	69	9	11	9	9	$ 259	$ 324	$ 259	$ 259	14	17	14	14
0.15	0.20	0.30	0.25	L134	$ 1,531	48	0.850	2135	44	7	10	14	12	$ 230	$ 306	$ 459	$ 383	7	9	13	11
0.05	0.05	0.15	0.30	L135	$ 2,420	85	0.850	3585	42	4	4	13	26	$ 121	$ 121	$ 363	$ 726	2	2	6	13
0.20	0.15	0.10	0.05	L099	$ 1,197	14	0.700	1130	81	3	2	1	1	$ 239	$ 179	$ 120	$ 60	16	12	8	4
0.15	0.20	0.15	0.15	L100	$ 1,124	21	0.700	1695	81	3	4	3	3	$ 169	$ 225	$ 169	$ 169	12	16	12	12
1.00	1.00	1.00	1.00							32	35	43	51	$ 1,342	$ 1,350	$ 1,499	$ 1,661	68	67	61	57
									Average:	32	35	43	51	$ 1,342	$ 1,350	$ 1,499	$ 1,661	68	67	61	57

Table 71: Building Facades Calculation Results and LPA Recommendations in Red

		LZ1	LZ2	LZ3	LZ4	
2016	Allowance	0.000	0.180	0.350	0.500	W/sq.ft.
	LPW	28	29	30	29	lm/W
2019	LPW	48	58	68	73	lm/W
	Limit of Reduction	0.000	0.091	0.153	0.198	Limit of Reduction
	Proposed LPA	**0.000**	**0.100**	**0.170**	**0.225**	**W/sq.ft.**

Table 72: Building Facades Legacy Product Calculation

Wall Mounted Full Cutoff

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.10	0.05	0.05	26	CFL	E012	$ 343	28	0.858	927	33	3	3	2	2	3	3	1	1	$ 34	$ 34	$ 17	$ 17
0.15	0.10	0.10	0.05	32	CFL	E013	$ 362	35	0.860	1,238	35	5	4	4	2	5	4	4	2	$ 54	$ 36	$ 36	$ 18
0.30	0.25	0.20	0.10	42	CFL	E014	$ 392	46	0.860	1,651	36	11	9	7	4	14	12	9	5	$ 118	$ 98	$ 78	$ 39
0.15	0.20	0.10	0.20	50	PSMH	E023	$ 600	67	0.670	1,225	18	3	4	2	4	10	13	7	13	$ 90	$ 120	$ 60	$ 120
0.15	0.20	0.15	0.10	70	PSMH	E001	$ 303	92	0.740	3,253	35	5	7	5	4	14	18	14	9	$ 45	$ 61	$ 45	$ 30
0.10	0.05	0.20	0.20	100	PSMH	E025	$ 606	129	0.750	2,949	23	2	1	5	5	13	6	26	26	$ 61	$ 30	$ 121	$ 121
0.05	0.05	0.15	0.20	150	PSMH	E026	$ 548	190	0.740	4,364	23	1	1	3	5	10	10	29	38	$ 27	$ 27	$ 82	$ 110
0.00	0.05	0.05	0.10	250	PSMH	E042	$ 328	291	0.700	4,721	16	0	1	1	2	0	15	15	29	$ -	$ 16	$ 16	$ 33
1.00	1.00	1.00	1.00									31	30	28	25	68	80	103	123	$ 430	$ 423	$ 457	$ 488

Ground Mounted Floodlight

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
1.00	0.45	0.25	0.25	100	PSMH	E038	$ 611	129	0.750	4,424	34	34	15	9	9	129	58	32	32	$ 611	$ 275	$ 153	$ 153
0.00	0.45	0.50	0.35	175	PSMH	E039	$ 957	198	0.700	7,680	39	0	17	19	14	0	89	99	69	$ -	$ 431	$ 479	$ 335
0.00	0.10	0.25	0.40	250	PSMH	E040	$ 957	291	0.700	10,081	35	0	3	9	14	0	29	73	116	$ -	$ 96	$ 239	$ 383
1.00	1.00	1.00	1.00									34	36	37	36	129	176	204	218	$ 611	$ 801	$ 871	$ 871

Cylindrical

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.30	0.15	0.05	0.00	50	MR16	E002	$ 187	50	0.900	752	15	5	2	1	0	15	8	3	0	$ 56	$ 28	$ 9	$ -
0.30	0.15	0.10	0.05	75	MR16	E003	$ 187	75	0.900	1,062	14	4	2	1	1	23	11	8	4	$ 56	$ 28	$ 19	$ 9
0.15	0.30	0.25	0.10	50	PSMH	E034	$ 752	67	0.670	1,493	22	3	7	6	2	10	20	17	7	$ 113	$ 226	$ 188	$ 75
0.15	0.25	0.35	0.25	70	PSMH	E035	$ 752	92	0.740	2,432	26	4	7	9	7	14	23	32	23	$ 113	$ 188	$ 263	$ 188
0.10	0.15	0.25	0.60	100	PSMH	E036	$ 752	129	0.750	3,593	28	3	4	7	17	13	19	32	77	$ 75	$ 113	$ 188	$ 451
1.00	1.00	1.00	1.00									19	22	24	26	74	81	91	111	$ 413	$ 582	$ 667	$ 724

Average:	28	29	30	29	90	113	133	151	$ 484	$ 602	$ 665	$ 694

Table 73: Building Facades Equivalent LED Calculation

Wall Mounted Full Cutoff

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.10	0.05	0.05	L012	$ 136	16	0.781	625	39	2	2	1	1	$ 14	$ 14	$ 7	$ 7	4	4	2	2
0.15	0.10	0.10	0.05	L013	$ 225	27	0.700	1222	45	4	3	3	1	$ 34	$ 23	$ 23	$ 11	7	5	5	2
0.30	0.25	0.20	0.10	L014	$ 406	18	0.970	1666	93	5	5	4	2	$ 122	$ 102	$ 81	$ 41	28	23	19	9
0.15	0.20	0.10	0.20	L023	$ 406	18	0.970	1666	93	3	4	2	4	$ 61	$ 81	$ 41	$ 81	14	19	9	19
0.15	0.20	0.15	0.10	L001	$ 450	50	0.960	4123	82	8	10	8	5	$ 68	$ 90	$ 68	$ 45	12	16	12	8
0.10	0.05	0.20	0.20	L025	$ 608	55	0.880	3651	66	6	3	11	11	$ 61	$ 30	$ 122	$ 122	7	3	13	13
0.05	0.05	0.15	0.20	L026	$ 608	37	0.880	5235	141	2	2	6	7	$ 30	$ 30	$ 91	$ 122	7	7	21	28
0.00	0.05	0.05	0.10	L042	$ 608	37	0.940	5592	151	0	2	2	4	$ -	$ 30	$ 30	$ 61	0	8	8	15
1.00	1.00	1.00	1.00							7	6	18	22	$ 91	$ 91	$ 243	$ 304	14	18	42	57

Ground Mounted Floodlight

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
1.00	0.45	0.25	0.25	L038	$ 715	63	0.887	4711	75	63	28	16	16	$ 715	$ 322	$ 179	$ 179	75	34	19	19
0.00	0.45	0.50	0.35	L039	$ 979	106	0.96	10594	100	0	48	53	37	$ -	$ 441	$ 490	$ 343	0	45	50	35
0.00	0.10	0.25	0.40	L040	$ 1,047	155	0.96	14845	96	0	16	39	62	$ -	$ 105	$ 262	$ 419	0	10	24	38
1.00	1.00	1.00	1.00							63	92	108	115	$ 715	$ 867	$ 930	$ 940	75	88	93	92

Cylindrical

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.30	0.15	0.05	0.00	L002	$ 136	16	0.781	625	39	5	2	1	0	$ 41	$ 20	$ 7	$ -	12	6	2	0
0.30	0.15	0.10	0.05	L003	$ 136	16	0.781	625	39	5	2	2	1	$ 41	$ 20	$ 14	$ 7	12	6	4	2
0.15	0.30	0.25	0.10	L034	$ 858	18	0.700	1552	86	3	5	5	2	$ 129	$ 257	$ 214	$ 86	13	26	22	9
0.15	0.25	0.35	0.25	L035	$ 985	24	0.700	2260	94	4	6	8	6	$ 148	$ 246	$ 345	$ 246	14	24	33	24
0.10	0.15	0.25	0.60	L036	$ 985	36	0.700	3105	86	4	5	9	22	$ 98	$ 148	$ 246	$ 591	9	13	22	52
1.00	1.00	1.00	1.00							20	22	24	30	$ 456	$ 692	$ 826	$ 930	59	74	82	86
									Average:	30	40	50	56	$ 421	$ 550	$ 666	$ 725	49	60	72	78

Table 74: Outdoor Sales Lots Calculation Results and LPA Recommendations in Red

		LZ1	LZ2	LZ3	LZ4	
2016	Allowance	0.164	0.555	0.758	1.285	W/sq.ft.
	LPW	29	29	30	30	lm/W
2019	LPW	98	96	100	97	lm/W
	Limit of Reduction	0.049	0.170	0.224	0.392	Limit of Reduction
	Proposed LPA	**0.060**	**0.210**	**0.280**	**0.485**	**W/sq.ft.**

Table 75: Outdoor Sales Lots Legacy Product Calculation

Wall Mounted

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.05	0.00	0.00	100	PSMH	E025	$ 606	129	0.750	2,949	23	2	1	0	0	13	6	0	0	$ 61	$ 30	$ -	$ -
0.20	0.10	0.15	0.05	150	PSMH	E026	$ 548	190	0.740	4,364	23	5	2	3	1	38	19	29	10	$ 110	$ 55	$ 82	$ 27
0.25	0.15	0.20	0.15	175	PSMH	E042	$ 328	198	0.700	4,721	24	6	4	5	4	50	30	40	30	$ 82	$ 49	$ 66	$ 49
0.25	0.30	0.30	0.30	250	PSMH	E043	$ 535	291	0.700	6,787	23	6	7	7	7	73	87	87	87	$ 134	$ 161	$ 161	$ 161
0.20	0.40	0.35	0.50	320	PSMH	E044	$ 535	368	0.700	8,705	24	5	9	8	12	74	147	129	184	$ 107	$ 214	$ 187	$ 268
1.00	1.00	1.00	1.00									23	23	23	24	247	290	284	311	$ 493	$ 509	$ 496	$ 505

Area

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.05	0.00	0.00	100	PSMH	E070	$ 1,010	129	0.750	3,876	30	3	2	0	0	13	6	0	0	$ 101	$ 51	$ -	$ -
0.20	0.10	0.15	0.05	150	PSMH	E048	$ 774	190	0.740	8,037	42	8	4	6	2	38	19	29	10	$ 155	$ 77	$ 116	$ 39
0.25	0.15	0.20	0.15	175	PSMH	E037	$ 1,062	198	0.700	5,895	30	7	4	6	4	50	30	40	30	$ 266	$ 159	$ 212	$ 159
0.25	0.30	0.30	0.30	250	PSMH	E073	$ 1,205	291	0.700	9,801	34	8	10	10	10	73	87	87	87	$ 301	$ 361	$ 361	$ 361
0.20	0.40	0.35	0.50	400	PSMH	E075	$ 1,205	452	0.700	17,046	38	8	15	13	19	90	181	158	226	$ 241	$ 482	$ 422	$ 602
1.00	1.00	1.00	1.00									35	35	36	36	264	323	314	353	$ 1,063	$ 1,131	$ 1,112	$ 1,162

Average:												29	29	30	30	255	306	299	332	$ 778	$ 820	$ 804	$ 833

Table 76: Outdoor Sales Lots Equivalent LED Calculation

Wall Mounted

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.05	0.00	0.00	L025	$ 608	55	0.700	2904	53	6	3	0	0	$ 61	$ 30	$ -	$ -	5	3	0	0
0.20	0.10	0.15	0.05	L026	$ 608	37	0.700	4164	113	7	4	6	2	$ 122	$ 61	$ 91	$ 30	23	11	17	6
0.25	0.15	0.20	0.15	L042	$ 608	37	0.940	5592	151	9	6	7	6	$ 152	$ 91	$ 122	$ 91	38	23	30	23
0.25	0.30	0.30	0.30	L043	$ 608	55	0.700	5633	102	14	17	17	17	$ 152	$ 182	$ 182	$ 182	26	31	31	31
0.20	0.40	0.35	0.50	L044	$ 979	106	0.887	9789	92	21	42	37	53	$ 196	$ 392	$ 343	$ 490	18	37	32	46
1.00	1.00	1.00	1.00							57	71	67	77	$ 682	$ 756	$ 738	$ 793	110	104	110	105

Area

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.05	0.00	0.00	L070	$ 1,128	67	0.940	3677	55	7	3	0	0	$ 113	$ 56	$ -	$ -	5	3	0	0
0.20	0.10	0.15	0.05	L048	$ 1,309	105	0.887	8601	82	21	11	16	5	$ 262	$ 131	$ 196	$ 65	16	8	12	4
0.25	0.15	0.20	0.15	L037	$ 1,365	85	0.938	7865	93	21	13	17	13	$ 341	$ 205	$ 273	$ 205	23	14	19	14
0.25	0.30	0.30	0.30	L073	$ 1,776	126	0.940	12953	103	32	38	38	38	$ 444	$ 533	$ 533	$ 533	26	31	31	31
0.20	0.40	0.35	0.50	L075	$ 1,552	210	0.700	16763	80	42	84	74	105	$ 310	$ 621	$ 543	$ 776	16	32	28	40
1.00	1.00	1.00	1.00							122	148	144	161	$ 1,470	$ 1,545	$ 1,545	$ 1,579	87	88	90	89
									Average:	90	110	105	119	$ 1,076	$ 1,151	$ 1,141	$ 1,186	98	96	100	97

Table 77: Vehicle Service Station Hardscape Calculation Results and LPA Recommendations in Red

		LZ1	LZ2	LZ3	LZ4	
2016	Allowance	0.014	0.155	0.308	0.485	W/sq.ft.
	LPW	30	30	31	31	lm/W
2019	LPW	77	78	78	82	lm/W
	Limit of Reduction	0.0054	0.0599	0.1217	0.1826	Limit of Reduction
	Proposed LPA	**0.006**	**0.068**	**0.138**	**0.200**	**W/sq.ft.**

Table 78: Vehicle Service Station Hardscape Legacy Product Calculation

Area																							
Weighting				2008 Basis of Design								Weighted Watt				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.00	0.00	42	CFL	E099	$ 585	46	0.860	1,237	27	1	1	0	0	2	2	0	0	$ 29	$ 29	$ -	$ -
0.10	0.05	0.05	0.05	57	CFL	E100	$ 610	62	0.860	1,662	27	3	1	1	1	6	3	3	3	$ 61	$ 30	$ 30	$ 30
0.05	0.05	0.05	0.05	70	PSMH	E069	$ 1,010	92	0.740	2,623	29	1	1	1	1	5	5	5	5	$ 51	$ 51	$ 51	$ 51
0.10	0.10	0.15	0.10	100	PSMH	E070	$ 1,010	129	0.750	3,876	30	3	3	5	3	13	13	19	13	$ 101	$ 101	$ 152	$ 101
0.25	0.25	0.25	0.20	150	PSMH	E071	$ 1,010	190	0.740	5,737	30	8	8	8	6	48	48	48	38	$ 253	$ 253	$ 253	$ 202
0.30	0.30	0.25	0.30	175	PSMH	E037	$ 1,062	198	0.700	5,895	30	9	9	7	9	59	59	50	59	$ 319	$ 319	$ 266	$ 319
0.15	0.20	0.25	0.30	250	PSMH	E073	$ 1,205	291	0.700	9,801	34	5	7	8	10	44	58	73	87	$ 181	$ 241	$ 301	$ 361
1.00	1.00	1.00	1.00									30	30	31	31	177	188	197	205	$ 994	$ 1,023	$ 1,052	$ 1,064
											Average:	30	30	31	31	177	188	197	205	$ 994	$ 1,023	$ 1,052	$ 1,064

Table 79: Vehicle Service Station Hardscape Equivalent LED Calculation

Area																							
Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.00	0.00	L099	$ 1,197	14	0.700	1130	81	1	1	0	0	$ 60	$ 60	$ -	$ -	4	4	0	0
0.10	0.05	0.05	0.05	L100	$ 1,124	21	0.700	1695	81	2	1	1	1	$ 112	$ 56	$ 56	$ 56	8	4	4	4
0.05	0.05	0.05	0.05	L069	$ 1,128	67	0.940	3677	55	3	3	3	3	$ 56	$ 56	$ 56	$ 56	3	3	3	3
0.10	0.10	0.15	0.10	L070	$ 1,128	67	0.940	3677	55	7	7	10	7	$ 113	$ 113	$ 169	$ 113	5	5	8	5
0.25	0.25	0.25	0.20	L071	$ 1,796	126	0.940	6958	55	32	32	32	25	$ 449	$ 449	$ 449	$ 359	14	14	14	11
0.30	0.30	0.25	0.30	L037	$ 1,365	85	0.938	7865	93	26	26	21	26	$ 409	$ 409	$ 341	$ 409	28	28	23	28
0.15	0.20	0.25	0.30	L073	$ 1,776	126	0.940	12953	103	19	25	32	38	$ 266	$ 355	$ 444	$ 533	15	21	26	31
1.00	1.00	1.00	1.00							89	94	99	100	$1,466	$1,499	$1,516	$1,527	77	78	78	82
									Average:	89	94	99	100	$1,466	$1,499	$1,516	$1,527	77	78	78	82

Table 80: Vehicle Service Station Canopies Calculation Results and LPA Recommendations in Red

		LZ1	LZ2	LZ3	LZ4	
2016	Allowance	0.514	1.005	1.300	2.200	W/sq.ft.
	LPW	26	26	26	26	lm/W
2019	LPW	70	70	67	65	lm/W
	Limit of Reduction	0.1892	0.3737	0.5092	0.8898	Limit of Reduction
	Proposed LPA	**0.220**	**0.430**	**0.580**	**1.010**	**W/sf**

Table 81: Vehicle Service Station Canopies Legacy Product Calculation

Downlight

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.15	0.15	0.05	0.05	70	PSMH	E049	$ 588	92	0.740	2,234	24	4	4	1	1	14	14	5	5	$ 88	$ 88	$ 29	$ 29
0.20	0.20	0.20	0.10	100	PSMH	E050	$ 477	129	0.750	3,683	29	6	6	6	3	26	26	26	13	$ 95	$ 95	$ 95	$ 48
0.30	0.25	0.20	0.10	175	PSMH	E058	$ 458	198	0.700	5,584	28	8	7	6	3	59	50	40	20	$ 137	$ 115	$ 92	$ 46
0.35	0.40	0.55	0.75	250	PSMH	E059	$ 458	291	0.700	8,028	28	10	11	15	21	102	116	160	218	$ 160	$ 183	$ 252	$ 343
1.00	1.00	1.00	1.00									27	27	28	28	201	206	230	256	$ 481	$ 481	$ 468	$ 466

Recessed Downlights, Fresnel Lens

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.00	0.00	(2) 32	CFL	E051	$ 460	68	0.860	1,876	28	1	1	0	0	3	3	0	0	$ 23	$ 23	$ -	$ -
0.05	0.05	0.05	0.05	(2) 42	CFL	E052	$ 467	93	0.860	2,276	24	1	1	1	1	5	5	5	5	$ 23	$ 23	$ 23	$ 23
0.00	0.05	0.10	0.10	(2) 57	CFL	E053	$ 447	128	0.860	2,800	22	0	1	2	2	0	6	13	13	$ -	$ 22	$ 45	$ 45
0.10	0.05	0.00	0.00	50	PSMH	E054	$ 346	67	0.670	1,337	20	2	1	0	0	7	3	0	0	$ 35	$ 17	$ -	$ -
0.20	0.10	0.05	0.05	70	PSMH	E055	$ 369	92	0.740	2,177	24	5	2	1	1	18	9	5	5	$ 74	$ 37	$ 18	$ 18
0.25	0.20	0.10	0.10	100	PSMH	E056	$ 369	129	0.750	3,216	25	6	5	2	2	32	26	13	13	$ 92	$ 74	$ 37	$ 37
0.35	0.50	0.70	0.70	150	PSMH	E057	$ 499	190	0.740	4,759	25	9	13	18	18	67	95	133	133	$ 174	$ 249	$ 349	$ 349
1.00	1.00	1.00	1.00									24	25	25	25	132	148	168	168	$ 422	$ 446	$ 472	$ 472
											Average:	26	26	26	26	166	177	199	212	$ 451	$ 464	$ 470	$ 469

Table 82: Vehicle Service Station Canopies Equivalent LED Calculation

Downlight

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.15	0.15	0.05	0.05	L049	$ 310.33	28	0.969	3253	116	4	4	1	1	$ 47	$ 47	$ 16	$ 16	17	17	6	6
0.20	0.20	0.20	0.10	L050	$ 358.41	45	0.960	4751	106	9	9	9	5	$ 72	$ 72	$ 72	$ 36	21	21	21	11
0.30	0.25	0.20	0.10	L058	$ 363.33	92	0.700	5479	60	28	23	18	9	$ 109	$ 91	$ 73	$ 36	18	15	12	6
0.35	0.40	0.55	0.75	L059	$ 363.33	92	0.700	5479	60	32	37	51	69	$ 127	$ 145	$ 200	$ 272	21	24	33	45
1.00	1.00	1.00	1.00							73	73	79	84	$ 354	$ 354	$ 360	$ 360	77	77	72	67

Recessed Downlights, Fresnel Lens

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.00	0.00	L051	$ 242.59	31.6	0.700	1603	51	2	2	0	0	$ 12	$ 12	$ -	$ -	3	3	0	0
0.05	0.05	0.05	0.05	L052	$ 255.70	41.1	0.700	2078	51	2	2	2	2	$ 13	$ 13	$ 13	$ 13	3	3	3	3
0.00	0.05	0.10	0.10	L053	$ 267.72	47.1	0.700	2191	47	0	2	5	5	$ -	$ 13	$ 27	$ 27	0	2	5	5
0.10	0.05	0.00	0.00	L054	$ 236.30	24.1	0.700	1540	64	2	1	0	0	$ 24	$ 12	$ -	$ -	6	3	0	0
0.20	0.10	0.05	0.05	L055	$ 256.79	34.6	0.700	2130	62	7	3	2	2	$ 51	$ 26	$ 13	$ 13	12	6	3	3
0.25	0.20	0.10	0.10	L056	$ 281.38	42.3	0.700	2909	69	11	8	4	4	$ 70	$ 56	$ 28	$ 28	17	14	7	7
0.35	0.50	0.70	0.70	L057	$ 364.70	72.2	0.700	4635	64	25	36	51	51	$ 128	$ 182	$ 255	$ 255	22	32	45	45
1.00	1.00	1.00	1.00							49	55	63	63	$ 298	$ 314	$ 336	$ 336	63	63	62	62
									Average:	61	64	71	74	$ 326	$ 334	$ 348	$ 348	70	70	67	65

Table 83: Sales Canopies Calculation Results and LPA Recommendations in Red

		LZ1	LZ2	LZ3	LZ4	
2016	Allowance	0.000	0.655	0.908	1.135	W/sq.ft
	LPW	44	44	43	43	lm/W
2019	LPW	60	62	64	65	lm/W
	Limit of Reduction	0.0000	0.4621	0.6078	0.7445	Limit of Reduction
	Proposed LPA	**0.000**	**0.470**	**0.622**	**0.740**	**W/sq.ft**

Table 84: Sales Canopies Legacy Product Calculation

Downlight

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.05	0.00	0.00	0.00	13	CFL	E004	$ 151.89	16	0.855	476	30	1	0	0	0	1	0	0	0	$ 8	$ -	$ -	$ -
0.05	0.05	0.00	0.00	18	CFL	E005	$ 161.72	20	0.856	693	35	2	2	0	0	1	1	0	0	$ 8	$ 8	$ -	$ -
0.05	0.05	0.05	0.00	26	CFL	E027	$ 365.65	28	0.858	696	25	1	1	1	0	1	1	1	0	$ 18	$ 18	$ 18	$ -
0.10	0.05	0.05	0.05	32	CFL	E028	$ 365.65	35	0.860	930	27	3	1	1	1	4	2	2	2	$ 37	$ 18	$ 18	$ 18
0.10	0.10	0.05	0.05	42	CFL	E029	$ 392.22	46	0.860	1,240	27	3	3	1	1	5	5	2	2	$ 39	$ 39	$ 20	$ 20
0.15	0.10	0.10	0.10	(2) 32	CFL	E051	$ 460.04	68	0.860	1,876	28	4	3	3	3	10	7	7	7	$ 69	$ 46	$ 46	$ 46
0.15	0.10	0.10	0.10	(2) 42	CFL	E052	$ 466.59	93	0.860	2,276	24	4	2	2	2	14	9	9	9	$ 70	$ 47	$ 47	$ 47
0.05	0.05	0.05	0.10	(2) 57	CFL	E053	$ 447.10	128	0.860	2,800	22	1	1	1	2	6	6	6	13	$ 22	$ 22	$ 22	$ 45
0.15	0.05	0.05	0.05	50	PSMH	E054	$ 345.98	67	0.670	1,337	20	3	1	1	1	10	3	3	3	$ 52	$ 17	$ 17	$ 17
0.10	0.15	0.15	0.05	70	PSMH	E055	$ 369.26	92	0.740	2,177	24	2	4	4	1	9	14	14	5	$ 37	$ 55	$ 55	$ 18
0.05	0.15	0.15	0.10	100	PSMH	E056	$ 369.26	129	0.750	3,216	25	1	4	4	2	6	19	19	13	$ 18	$ 55	$ 55	$ 37
0.00	0.10	0.10	0.15	150	PSMH	E057	$ 498.52	190	0.740	4,759	25	0	3	3	4	0	19	19	29	$ -	$ 50	$ 50	$ 75
0.00	0.05	0.10	0.15	175	PSMH	E058	$ 458.07	198	0.700	5,584	28	0	1	3	4	0	10	20	30	$ -	$ 23	$ 46	$ 69
0.00	0.00	0.05	0.10	250	PSMH	E059	$ 457.92	291	0.700	8,028	28	0	0	1	3	0	0	15	29	$ -	$ -	$ 23	$ 46
1.00	1.00	1.00	1.00									25	26	25	25	68	97	118	141	$ 378	$ 400	$ 418	$ 437

Recessed Linear Fluorescent

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.10	0.05	0.05	25	T8	E119	$ 661.10	26	0.921	1,640	63	6	6	3	3	3	3	1	1	$ 66	$ 66	$ 33	$ 33
0.15	0.10	0.05	0.05	32	T8	E121	$ 680.22	33	0.949	2,240	68	10	7	3	3	5	3	2	2	$ 102	$ 68	$ 34	$ 34
0.15	0.10	0.15	0.10	(2) 32	T8	E118	$ 466.59	66	0.949	3,092	47	7	5	7	5	10	7	10	7	$ 70	$ 47	$ 70	$ 47
0.10	0.10	0.10	0.05	21	T5	E120	$ 702.08	25	0.952	2,210	88	9	9	9	4	3	3	3	1	$ 70	$ 70	$ 70	$ 35
0.15	0.10	0.10	0.05	28	T5	E114	$ 458.95	31	0.948	2,006	65	10	6	6	3	5	3	3	2	$ 69	$ 46	$ 46	$ 23
0.10	0.10	0.10	0.10	(2) 21	T5	E123	$ 548.55	50	0.952	2,677	54	5	5	5	5	5	5	5	5	$ 55	$ 55	$ 55	$ 55
0.15	0.10	0.15	0.15	(2) 28	T5	E117	$ 466.59	62	0.948	3,642	59	9	6	9	9	9	6	9	9	$ 70	$ 47	$ 70	$ 70
0.05	0.10	0.15	0.15	54	T5HO	E122	$ 719.83	62	0.950	3,800	61	3	6	9	9	3	6	9	9	$ 36	$ 72	$ 108	$ 108
0.05	0.10	0.10	0.15	(2) 39	T5HO	E124	$ 580.24	82	0.950	4,452	54	3	5	5	8	4	8	8	12	$ 29	$ 58	$ 58	$ 87
0.00	0.10	0.05	0.15	(2) 54	T5HO	E125	$ 598.27	124	0.950	7,600	61	0	6	3	9	0	12	6	19	$ -	$ 60	$ 30	$ 90
1.00	1.00	1.00	1.00									62	62	61	60	46	56	56	67	$ 567	$ 588	$ 574	$ 581
											Average:	44	44	43	43	57	76	87	104	$ 473	$ 494	$ 496	$ 509

Table 85: Canopies Equivalent LED Calculation

Downlight

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.05	0.00	0.00	0.00	L004	$ 85	9	0.700	435	48	0	0	0	0	$ 4	$ -	$ -	$ -	2	0	0	0
0.05	0.05	0.00	0.00	L005	$ 85	9	0.700	435	48	0	0	0	0	$ 4	$ 4	$ -	$ -	2	2	0	0
0.05	0.05	0.05	0.00	L027	$ 136	16	0.781	625	39	1	1	1	0	$ 7	$ 7	$ 7	$ -	2	2	2	0
0.10	0.05	0.05	0.05	L028	$ 225	27	0.700	1222	45	3	1	1	1	$ 23	$ 11	$ 11	$ 11	5	2	2	2
0.10	0.10	0.05	0.05	L029	$ 225	27	0.700	1222	45	3	3	1	1	$ 23	$ 23	$ 11	$ 11	5	5	2	2
0.15	0.10	0.10	0.10	L051	$ 243	31.6	0.700	1603	51	5	3	3	3	$ 36	$ 24	$ 24	$ 24	8	5	5	5
0.15	0.10	0.10	0.10	L052	$ 256	41.1	0.700	2078	51	6	4	4	4	$ 38	$ 26	$ 26	$ 26	8	5	5	5
0.05	0.05	0.05	0.10	L053	$ 268	47.1	0.700	2191	47	2	2	2	5	$ 13	$ 13	$ 13	$ 27	2	2	2	5
0.15	0.05	0.05	0.05	L054	$ 236	24.1	0.700	1540	64	4	1	1	1	$ 35	$ 12	$ 12	$ 12	10	3	3	3
0.10	0.15	0.15	0.05	L055	$ 257	34.6	0.700	2130	62	3	5	5	2	$ 26	$ 39	$ 39	$ 13	6	9	9	3
0.05	0.15	0.15	0.10	L056	$ 281	42.3	0.700	2909	69	2	6	6	4	$ 14	$ 42	$ 42	$ 28	3	10	10	7
0.00	0.10	0.10	0.15	L057	$ 365	72.2	0.700	4635	64	0	7	7	11	$ -	$ 36	$ 36	$ 55	0	6	6	10
0.00	0.05	0.10	0.15	L058	$ 363	92	0.700	5479	60	0	5	9	14	$ -	$ 18	$ 36	$ 54	0	3	6	9
0.00	0.00	0.05	0.10	L059	$ 363	92	0.700	5479	60	0	0	5	9	$ -	$ -	$ 18	$ 36	0	0	3	6
1.00	1.00	1.00	1.00							30	39	47	56	$ 224	$ 255	$ 276	$ 297	53	56	57	57

Recessed Linear Fluorescent

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.10	0.05	0.05	L119	$ 382	37	0.954	2033	55	4	4	2	2	$ 38	$ 38	$ 19	$ 19	5	5	3	3
0.15	0.10	0.05	0.05	L121	$ 382	37	0.954	2709	73	6	4	2	2	$ 57	$ 38	$ 19	$ 19	11	7	4	4
0.15	0.10	0.15	0.10	L118	$ 382	37	0.954	2709	73	6	4	6	4	$ 57	$ 38	$ 57	$ 38	11	7	11	7
0.10	0.10	0.10	0.05	L120	$ 382	37	0.954	1792	48	4	4	4	2	$ 38	$ 38	$ 38	$ 19	5	5	5	2
0.15	0.10	0.10	0.05	L114	$ 382	37	0.954	1792	48	6	4	4	2	$ 57	$ 38	$ 38	$ 19	7	5	5	2
0.10	0.10	0.10	0.10	L123	$ 382	37	0.954	2614	71	4	4	4	4	$ 38	$ 38	$ 38	$ 38	7	7	7	7
0.15	0.10	0.15	0.15	L117	$ 382	37	0.954	3484	94	6	4	6	6	$ 57	$ 38	$ 57	$ 57	14	9	14	14
0.05	0.10	0.15	0.15	L122	$ 382	37	0.954	3484	94	2	4	6	6	$ 19	$ 38	$ 57	$ 57	5	9	14	14
0.05	0.10	0.10	0.15	L124	$ 778	53	0.700	2853	54	3	5	5	8	$ 39	$ 78	$ 78	$ 117	3	5	5	8
0.00	0.10	0.05	0.15	L125	$ 832	53	0.700	3804	72	0	5	3	8	$ -	$ 83	$ 42	$ 125	0	7	4	11
1.00	1.00	1.00	1.00							38	40	39	42	$ 402	$ 467	$ 444	$ 509	68	68	71	73
									Average:	34	40	43	49	$ 313	$ 361	$ 360	$ 403	60	62	64	65

Table 86: Non-sales Canopies and Pedestrian Tunnels Calculation Results and LPA Recommendation in Red

		LZ1	LZ2	LZ3	LZ4	
2016	Allowance	0.084	0.205	0.408	0.585	W/sq.ft
	LPW	49	47	47	46	lm/W
2019	LPW	77	75	76	78	lm/W
	Limit of Reduction	0.0536	0.1292	0.2535	0.3472	Limit of Reduction
	Proposed LPA	**0.057**	**0.137**	**0.270**	**0.370**	**W/sq.ft**

Table 87: Non-sales Canopies and Pedestrian Tunnels Legacy Product Calculation

Downlight

Weighting				2008 Basis of Design							Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.20	0.15	0.10	0.05	13	CFL	E004	$ 152	16	0.855	476	30	6	4	3	1	3	2	2	1	$ 30	$ 23	$ 15	$ 8
0.20	0.20	0.15	0.05	18	CFL	E005	$ 162	20	0.856	693	35	7	7	5	2	4	4	3	1	$ 32	$ 32	$ 24	$ 8
0.20	0.20	0.15	0.10	26	CFL	E027	$ 366	28	0.858	696	25	5	5	4	2	6	6	4	3	$ 73	$ 73	$ 55	$ 37
0.10	0.10	0.15	0.15	32	CFL	E028	$ 366	35	0.860	930	27	3	3	4	4	4	4	5	5	$ 37	$ 37	$ 55	$ 55
0.05	0.10	0.15	0.20	42	CFL	E029	$ 392	46	0.860	1,240	27	1	3	4	5	2	5	7	9	$ 20	$ 39	$ 59	$ 78
0.10	0.05	0.05	0.05	50	PSMH	E054	$ 346	67	0.670	1,337	20	2	1	1	1	7	3	3	3	$ 35	$ 17	$ 17	$ 17
0.10	0.05	0.10	0.10	70	PSMH	E049	$ 588	92	0.740	2,234	24	2	1	2	2	9	5	9	9	$ 59	$ 29	$ 59	$ 59
0.05	0.10	0.10	0.15	100	PSMH	E050	$ 477	129	0.750	3,683	29	1	3	3	4	6	13	13	19	$ 24	$ 48	$ 48	$ 72
0.00	0.05	0.05	0.15	150	PSMH	E057	$ 499	190	0.740	4,759	25	0	1	1	4	0	10	10	29	$ -	$ 25	$ 25	$ 75
1.00	1.00	1.00	1.00									28	28	27	27	41	50	56	79	$ 309	$ 323	$ 357	$ 408

Recessed Linear Fluorescent

Weighting				2008 Basis of Design							Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.05	0.05	25	T8	E119	$ 661	26	0.921	1,640	63	3	3	3	3	1	1	1	1	$ 33	$ 33	$ 33	$ 33
0.20	0.15	0.15	0.10	32	T8	E121	$ 680	33	0.949	2,240	68	14	10	10	7	7	5	5	3	$ 136	$ 102	$ 102	$ 68
0.20	0.20	0.20	0.15	(2) 32	T8	E118	$ 467	66	0.949	3,092	47	9	9	9	7	13	13	13	10	$ 93	$ 93	$ 93	$ 70
0.05	0.05	0.05	0.05	21	T5	E120	$ 702	25	0.952	2,210	88	4	4	4	4	1	1	1	1	$ 35	$ 35	$ 35	$ 35
0.20	0.15	0.15	0.10	28	T5	E114	$ 459	31	0.948	2,006	65	13	10	10	6	6	5	5	3	$ 92	$ 69	$ 69	$ 46
0.05	0.10	0.05	0.05	(2) 21	T5	E123	$ 549	50	0.952	2,677	54	3	5	3	3	3	5	3	3	$ 27	$ 55	$ 27	$ 27
0.20	0.20	0.20	0.15	(2) 28	T5	E117	$ 467	62	0.948	3,642	59	12	12	12	9	12	12	12	9	$ 93	$ 93	$ 93	$ 70
0.00	0.00	0.05	0.10	54	T5HO	E122	$ 720	62	0.950	3,800	61	0	0	3	6	0	0	3	6	$ -	$ -	$ 36	$ 72
0.00	0.00	0.00	0.05	(2) 39	T5HO	E124	$ 580	82	0.950	4,452	54	0	0	0	3	0	0	0	4	$ -	$ -	$ -	$ 29
0.00	0.00	0.00	0.10	(2) 54	T5HO	E125	$ 598	124	0.950	7,600	61	0	0	0	6	0	0	0	12	$ -	$ -	$ -	$ 60
0.95	0.90	0.90	0.90									58	54	54	54	43	43	43	53	$ 510	$ 481	$ 489	$ 510

Gasketed Linear Fluorescent

Weighting				2008 Basis of Design							Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.05	0.05	17	T8	E082	$ 125	19	0.929	1,037	55	3	3	3	3	1	1	1	1	$ 6	$ 6	$ 6	$ 6
0.20	0.15	0.15	0.10	32	T8	E085	$ 122	33	0.949	2,104	64	13	10	10	6	7	5	5	3	$ 24	$ 18	$ 18	$ 12
0.05	0.10	0.05	0.05	(2) 17	T8	E088	$ 131	38	0.929	2,074	55	3	5	3	3	2	4	2	2	$ 7	$ 13	$ 7	$ 7
0.20	0.20	0.20	0.15	(2) 32	T8	E091	$ 130	66	0.949	4,208	64	13	13	13	10	13	13	13	10	$ 26	$ 26	$ 26	$ 20
0.05	0.05	0.05	0.05	14	T5	E081	$ 139	17	0.944	859	51	3	3	3	3	1	1	1	1	$ 7	$ 7	$ 7	$ 7
0.20	0.15	0.15	0.10	28	T5	E084	$ 142	31	0.948	1,853	60	12	9	9	6	6	5	5	3	$ 28	$ 21	$ 21	$ 14
0.05	0.10	0.05	0.05	(2) 14	T5	E087	$ 148	34	0.944	1,719	51	3	5	3	3	2	3	2	2	$ 7	$ 15	$ 7	$ 7
0.20	0.20	0.20	0.15	(2) 28	T5	E090	$ 146	62	0.948	4,133	67	13	13	13	10	12	12	12	9	$ 29	$ 29	$ 29	$ 22
0.00	0.00	0.05	0.05	24	T5HO	E083	$ 144	27	0.950	1,427	53	0	0	3	3	0	0	1	1	$ -	$ -	$ 7	$ 7
0.00	0.00	0.05	0.10	54	T5HO	E086	$ 141	62	0.950	3,569	58	0	0	3	6	0	0	3	6	$ -	$ -	$ 7	$ 14
0.00	0.00	0.00	0.05	(2) 24	T5HO	E089	$ 144	54	0.950	2,561	47	0	0	0	2	0	0	0	3	$ -	$ -	$ -	$ 7
0.00	0.00	0.00	0.10	(2) 54	T5HO	E092	$ 148	124	0.950	5,453	44	0	0	0	4	0	0	0	12	$ -	$ -	$ -	$ 15
1.00	1.00	1.00	1.00									61	60	61	58	44	44	45	54	$ 135	$ 136	$ 136	$ 138
											Average:	49	47	47	46	43	46	48	62	$ 318	$ 313	$ 327	$ 352

Table 88: Non-sales Canopies and Pedestrian Tunnels Equivalent LED Calculation

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.20	0.15	0.10	0.05	L004	$ 85.23	9	0.700	435	48	2	1	1	0	$ 17	$ 13	$ 9	$ 4	10	7	5	2
0.20	0.20	0.15	0.05	L005	$ 85.23	9	0.700	435	48	2	2	1	0	$ 17	$ 17	$ 13	$ 4	10	10	7	2
0.20	0.20	0.15	0.10	L027	$ 135.90	16	0.781	625	39	3	3	2	2	$ 27	$ 27	$ 20	$ 14	8	8	6	4
0.10	0.10	0.15	0.15	L028	$ 225.31	27	0.700	1222	45	3	3	4	4	$ 23	$ 23	$ 34	$ 34	5	5	7	7
0.05	0.10	0.15	0.20	L029	$ 225.31	27	0.700	1222	45	1	3	4	5	$ 11	$ 23	$ 34	$ 45	2	5	7	9
0.10	0.05	0.05	0.05	L054	$ 236.30	24.1	0.700	1540	64	2	1	1	1	$ 24	$ 12	$ 12	$ 12	6	3	3	3
0.10	0.05	0.10	0.10	L049	$ 310.33	28	0.950	3189	114	3	1	3	3	$ 31	$ 16	$ 31	$ 31	11	6	11	11
0.05	0.10	0.10	0.15	L050	$ 358.41	45	0.930	4603	102	2	5	5	7	$ 18	$ 36	$ 36	$ 54	5	10	10	15
0.00	0.05	0.05	0.15	L057	$ 364.70	72.2	0.700	4635	64	0	4	4	11	$ -	$ 18	$ 18	$ 55	0	3	3	10
1.00	1.00	1.00	1.00							18	22	25	34	$ 168	$ 183	$ 206	$ 252	57	56	60	64

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.05	0.05	L119	$ 382.45	37	0.954	2033	55	2	2	2	2	$ 19	$ 19	$ 19	$ 19	3	3	3	3
0.20	0.15	0.15	0.10	L121	$ 382.45	37	0.954	2709	73	7	6	6	4	$ 76	$ 57	$ 57	$ 38	15	11	11	7
0.20	0.20	0.20	0.15	L118	$ 382.45	37	0.954	2709	73	7	7	7	6	$ 76	$ 76	$ 76	$ 57	15	15	15	11
0.05	0.05	0.05	0.05	L120	$ 382.45	37	0.954	1792	48	2	2	2	2	$ 19	$ 19	$ 19	$ 19	2	2	2	2
0.20	0.15	0.15	0.10	L114	$ 382.45	37	0.954	1792	48	7	6	6	4	$ 76	$ 57	$ 57	$ 38	10	7	7	5
0.05	0.10	0.05	0.05	L123	$ 382.45	37	0.954	2614	71	2	4	2	2	$ 19	$ 38	$ 19	$ 19	4	7	4	4
0.20	0.20	0.20	0.15	L117	$ 382.45	37	0.954	3484	94	7	7	7	6	$ 76	$ 76	$ 76	$ 57	19	19	19	14
0.00	0.00	0.05	0.10	L122	$ 382.45	37	0.954	3484	94	0	0	2	4	$ -	$ -	$ 19	$ 38	0	0	5	9
0.00	0.00	0.00	0.05	L124	$ 778.02	53	0.700	2853	54	0	0	0	3	$ -	$ -	$ -	$ 39	0	0	0	3
0.00	0.00	0.00	0.10	L125	$ 831.57	53	0.700	3804	72	0	0	0	5	$ -	$ -	$ -	$ 83	0	0	0	7
0.95	0.90	0.90	0.90							35	33	33	36	$ 363	$ 344	$ 344	$ 409	67	64	65	65

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.05	0.05	L082	$ 264.44	26	0.700	1890	73	1	1	1	1	$ 13	$ 13	$ 13	$ 13	4	4	4	4
0.20	0.15	0.15	0.10	L085	$ 242.59	31	0.887	3709	120	6	5	5	3	$ 49	$ 36	$ 36	$ 24	24	18	18	12
0.05	0.10	0.05	0.05	L088	$ 162.54	40	0.850	4055	101	2	4	2	2	$ 8	$ 16	$ 8	$ 8	5	10	5	5
0.20	0.20	0.20	0.15	L091	$ 231.66	45	0.800	4740	105	9	9	9	7	$ 46	$ 46	$ 46	$ 35	21	21	21	16
0.05	0.05	0.05	0.05	L081	$ 264.44	26	0.700	1890	73	1	1	1	1	$ 13	$ 13	$ 13	$ 13	4	4	4	4
0.20	0.15	0.15	0.10	L084	$ 230.57	31	0.887	3565	115	6	5	5	3	$ 46	$ 35	$ 35	$ 23	23	17	17	11
0.05	0.10	0.05	0.05	L087	$ 148.88	27	0.850	3049	113	1	3	1	1	$ 7	$ 15	$ 7	$ 7	6	11	6	6
0.20	0.20	0.20	0.15	L090	$ 251.33	69	0.800	7062	102	14	14	14	10	$ 50	$ 50	$ 50	$ 38	20	20	20	15
0.00	0.00	0.05	0.05	L083	$ 264.44	26	0.700	1890	73	0	0	1	1	$ -	$ -	$ 13	$ 13	0	0	4	4
0.00	0.00	0.05	0.10	L086	$ 251.33	69	0.887	7830	113	0	0	3	7	$ -	$ -	$ 13	$ 25	0	0	6	11
0.00	0.00	0.00	0.05	L089	$ 162.54	40	0.850	4055	101	0	0	0	2	$ -	$ -	$ -	$ 8	0	0	0	5
0.00	0.00	0.00	0.10	L092	$ 231.66	45	0.800	4740	105	0	0	0	5	$ -	$ -	$ -	$ 23	0	0	0	11
1.00	1.00	1.00	1.00							41	41	43	44	$ 233	$ 225	$ 235	$ 231	106	105	104	103
									Average:	32	32	34	38	$ 255	$ 251	$ 262	$ 298	77	75	76	78

Table 89: Guard Stations Calculation Results and LPA Recommendations in Red

		LZ1	LZ2	LZ3	LZ4	
2016	Allowance	0.154	0.355	0.708	0.985	W/sq.ft.
	LPW	34	33	31	31	lm/W
2019	LPW	71	74	77	84	lm/W
	Limit of Reduction	0.0742	0.1587	0.2887	0.3674	Limit of Reduction
	Proposed LPA	**0.081**	**0.176**	**0.325**	**0.425**	**W/sq.ft.**

Table 90: Guard Stations Legacy Product Calculation

Wall Pack

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.20	0.10	0.05	0.05	26	CFL	E020	$ 466.59	28	0.858	709	25	5	3	1	1	6	3	1	1	$ 93	$ 47	$ 23	$ 23
0.25	0.15	0.05	0.05	32	CFL	E021	$ 469.87	35	0.860	947	27	7	4	1	1	9	5	2	2	$ 117	$ 70	$ 23	$ 23
0.25	0.20	0.10	0.05	42	CFL	E022	$ 469.87	46	0.860	1,262	27	7	5	3	1	12	9	5	2	$ 117	$ 94	$ 47	$ 23
0.15	0.25	0.25	0.15	70	PSMH	E024	$ 599.91	92	0.740	1,996	22	3	5	5	3	14	23	23	14	$ 90	$ 150	$ 150	$ 90
0.10	0.15	0.25	0.20	100	PSMH	E025	$ 606.46	129	0.750	2,949	23	2	3	6	5	13	19	32	26	$ 61	$ 91	$ 152	$ 121
0.05	0.10	0.15	0.20	150	PSMH	E026	$ 548.07	190	0.740	4,364	23	1	2	3	5	10	19	29	38	$ 27	$ 55	$ 82	$ 110
0.00	0.05	0.10	0.20	175	PSMH	E042	$ 327.82	198	0.700	4,721	24	0	1	2	5	0	10	20	40	$ -	$ 16	$ 33	$ 66
0.00	0.00	0.05	0.10	250	PSMH	E043	$ 535.44	291	0.700	6,787	23	0	0	1	2	0	0	15	29	$ -	$ -	$ 27	$ 54
1.00	1.00	1.00	1.00									25	24	23	24	62	89	126	152	$ 506	$ 523	$ 537	$ 510

Area

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.00	0.00	18	CFL	E104	$ 3,719.47	20	0.856	746	37	2	2	0	0	1	1	0	0	$ 186	$ 186	$ -	$ -
0.20	0.10	0.05	0.05	26	CFL	E105	$ 3,719.47	28	0.858	1,077	38	8	4	2	2	6	3	1	1	$ 744	$ 372	$ 186	$ 186
0.20	0.15	0.05	0.05	32	CFL	E106	$ 3,719.47	35	0.860	1,440	41	8	6	2	2	7	5	2	2	$ 744	$ 558	$ 186	$ 186
0.25	0.20	0.10	0.05	42	CFL	E107	$ 3,719.47	46	0.860	1,920	42	10	8	4	2	12	9	5	2	$ 930	$ 744	$ 372	$ 186
0.15	0.20	0.25	0.15	70	PSMH	E069	$ 1,010.17	92	0.740	2,623	29	4	6	7	4	14	18	23	14	$ 152	$ 202	$ 253	$ 152
0.10	0.15	0.25	0.20	100	PSMH	E070	$ 1,010.17	129	0.750	3,876	30	3	5	8	6	13	19	32	26	$ 101	$ 152	$ 253	$ 202
0.05	0.10	0.15	0.20	150	PSMH	E071	$ 1,010.17	190	0.740	5,737	30	2	3	5	6	10	19	29	38	$ 51	$ 101	$ 152	$ 202
0.00	0.05	0.10	0.20	175	PSMH	E037	$ 1,062.13	198	0.700	5,895	30	0	1	3	6	0	10	20	40	$ -	$ 53	$ 106	$ 212
0.00	0.00	0.05	0.10	250	PSMH	E073	$ 1,204.80	291	0.700	9,801	34	0	0	2	3	0	0	15	29	$ -	$ -	$ 60	$ 120
1.00	1.00	1.00	1.00									37	35	32	32	61	85	126	152	$ 2,907	$ 2,367	$ 1,567	$ 1,446

Floodlight

Weighting				2008 Basis of Design								Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.40	0.35	0.20	0.20	100	PSMH	E126	$ 1,261.01	129	0.750	5,315	41	16	14	8	8	52	45	26	26	$ 504	$ 441	$ 252	$ 252
0.25	0.25	0.25	0.25	150	PSMH	E127	$ 1,276.31	190	0.740	7,728	41	10	10	10	10	48	48	48	48	$ 319	$ 319	$ 319	$ 319
0.20	0.20	0.30	0.25	175	PSMH	E078	$ 1,044.65	198	0.700	8,053	41	8	8	12	10	40	40	59	50	$ 209	$ 209	$ 313	$ 261
0.15	0.20	0.25	0.30	250	PSMH	E016	$ 1,165.25	291	0.700	9,660	33	5	7	8	10	44	58	73	87	$ 175	$ 233	$ 291	$ 350
1.00	1.00	1.00	1.00									40	39	39	39	182	190	205	210	$ 1,207	$ 1,202	$ 1,176	$ 1,182
											Average:	34	33	31	31	102	121	152	171	$ 1,540	$ 1,364	$ 1,093	$ 1,046

Table 91: Guard Station Equivalent LED Calculation

Wall Pack

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.20	0.10	0.05	0.05	L020	$ 135.90	16	0.781	625	39	3	2	1	1	$ 27	$ 14	$ 7	$ 7	$ 8	$ 4	$ 2	$ 2
0.25	0.15	0.05	0.05	L021	$ 135.90	16	0.781	625	39	4	2	1	1	$ 34	$ 20	$ 7	$ 7	$ 10	$ 6	$ 2	$ 2
0.25	0.20	0.10	0.05	L022	$ 225.31	27	0.700	1222	45	7	5	3	1	$ 56	$ 45	$ 23	$ 11	$ 11	$ 9	$ 5	$ 2
0.15	0.25	0.25	0.15	L024	$ 533.25	28	0.700	1693	60	4	7	7	4	$ 80	$ 133	$ 133	$ 80	$ 9	$ 15	$ 15	$ 9
0.10	0.15	0.25	0.20	L025	$ 607.56	55	0.700	2904	53	6	8	14	11	$ 61	$ 91	$ 152	$ 122	$ 5	$ 8	$ 13	$ 11
0.05	0.10	0.15	0.20	L026	$ 607.56	37	0.700	4164	113	2	4	6	7	$ 30	$ 61	$ 91	$ 122	$ 6	$ 11	$ 17	$ 23
0.00	0.05	0.10	0.20	L042	$ 607.56	37	0.940	5592	151	0	2	4	7	$ -	$ 30	$ 61	$ 122	$ -	$ 8	$ 15	$ 30
0.00	0.00	0.05	0.10	L043	$ 607.56	55	0.700	5633	102	0	0	3	6	$ -	$ -	$ 30	$ 61	$ -	$ -	$ 5	$ 10
1.00	1.00	1.00	1.00							26	30	37	38	$ 289	$ 395	$ 504	$ 530	49	61	74	89

Area

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.00	0.00	L104	$ 1,196.54	14	0.700	1130	81	1	1	0	0	$ 60	$ 60	$ -	$ -	$ 4	$ 4	$ -	$ -
0.20	0.10	0.05	0.05	L105	$ 1,196.54	14	0.700	1130	81	3	1	1	1	$ 239	$ 120	$ 60	$ 60	$ 16	$ 8	$ 4	$ 4
0.20	0.15	0.05	0.05	L106	$ 1,196.54	14	0.700	1130	81	3	2	1	1	$ 239	$ 179	$ 60	$ 60	$ 16	$ 12	$ 4	$ 4
0.25	0.20	0.10	0.05	L107	$ 1,124.14	21	0.700	1695	81	5	4	2	1	$ 281	$ 225	$ 112	$ 56	$ 20	$ 16	$ 8	$ 4
0.15	0.20	0.25	0.15	L069	$ 1,127.69	67	0.940	3677	55	10	13	17	10	$ 169	$ 226	$ 282	$ 169	$ 8	$ 11	$ 14	$ 8
0.10	0.15	0.25	0.20	L070	$ 1,127.69	67	0.940	3677	55	7	10	17	13	$ 113	$ 169	$ 282	$ 226	$ 5	$ 8	$ 14	$ 11
0.05	0.10	0.15	0.20	L071	$ 1,796.44	126	0.940	6958	55	6	13	19	25	$ 90	$ 180	$ 269	$ 359	$ 3	$ 6	$ 8	$ 11
0.00	0.05	0.10	0.20	L037	$ 1,364.82	85	0.938	7865	93	0	4	9	17	$ -	$ 68	$ 136	$ 273	$ -	$ 5	$ 9	$ 19
0.00	0.00	0.05	0.10	L073	$ 1,775.68	126	0.940	12953	103	0	0	6	13	$ -	$ -	$ 89	$ 178	$ -	$ -	$ 5	$ 10
1.00	1.00	1.00	1.00							35	49	71	81	$1,191	$1,226	$1,291	$1,380	73	70	66	71

Floodlight

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.40	0.35	0.20	0.20	L126	$ 979.08	71	0.700	4840	68	28	25	14	14	$ 392	$ 343	$ 196	$ 196	$ 27	$ 24	$ 14	$ 14
0.25	0.25	0.25	0.25	L127	$ 979.08	52	0.700	7725	149	13	13	13	13	$ 245	$ 245	$ 245	$ 245	$ 37	$ 37	$ 37	$ 37
0.20	0.20	0.30	0.25	L078	$ 979.08	106	0.700	7725	73	21	21	32	27	$ 196	$ 196	$ 294	$ 245	$ 15	$ 15	$ 22	$ 18
0.15	0.20	0.25	0.30	L016	$ 834.84	166	0.955	12414	75	25	33	42	50	$ 125	$ 167	$ 209	$ 250	$ 11	$ 15	$ 19	$ 22
1.00	1.00	1.00	1.00							88	92	101	104	$ 957	$ 950	$ 943	$ 936	90	91	91	91
									Average:	49	57	69	74	812	857	912	949	71	74	77	84

Table 92: Student Pick-up/Drop Off Zones Calculation Results and LPA Recommendations in Red

		LZ1	LZ2	LZ3	LZ4	
2016	Allowance	0	0.12	0.45	0	W/sq.ft.
	LPW	29	29	29	30	lm/W
2019	LPW	68	69	76	81	lm/W
	Limit of Reduction	0.000	0.051	0.174	0.000	Limit of Reduction
	Proposed LPA	**0.000**	**0.056**	**0.200**	**0.000**	W/sf

Table 93: Student Pick-Up/Drop-Off Zones Legacy Product Calculation

Downlight

Weighting				2008 Basis of Design							Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.10	0.05	0.00	32	CFL	E095	$ 314.71	35	0.860	940	27	3	3	1	0	4	4	2	0	$ 31	$ 31	$ 16	$ -
0.25	0.10	0.05	0.05	42	CFL	E096	$ 307.06	46	0.860	1,254	27	7	3	1	1	12	5	2	2	$ 77	$ 31	$ 15	$ 15
0.25	0.20	0.20	0.10	70	PSMH	E097	$ 292.40	92	0.740	1,895	21	5	4	4	2	23	18	18	9	$ 73	$ 58	$ 58	$ 29
0.15	0.20	0.20	0.25	100	PSMH	E098	$ 299.49	129	0.750	2,801	22	3	4	4	5	19	26	26	32	$ 45	$ 60	$ 60	$ 75
0.15	0.20	0.25	0.30	150	PSMH	E057	$ 498.52	190	0.740	4,759	25	4	5	6	8	29	38	48	57	$ 75	$ 100	$ 125	$ 150
0.10	0.20	0.25	0.30	175	PSMH	E058	$ 458.07	198	0.700	5,584	28	3	6	7	8	20	40	50	59	$ 46	$ 92	$ 115	$ 137
1.00	1.00	1.00	1.00									24	25	24	25	106	130	145	160	$ 347	$ 372	$ 389	$ 406

Wall Pack

Weighting				2008 Basis of Design							Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.10	0.05	0.00	26	CFL	E020	$ 466.59	28	0.858	709	25	3	3	1	0	3	3	1	0	$ 47	$ 47	$ 23	$ -
0.15	0.10	0.10	0.05	32	CFL	E021	$ 469.87	35	0.860	947	27	4	3	3	1	5	4	4	2	$ 70	$ 47	$ 47	$ 23
0.20	0.15	0.10	0.10	42	CFL	E022	$ 469.87	46	0.860	1,262	27	5	4	3	3	9	7	5	5	$ 94	$ 70	$ 47	$ 47
0.25	0.20	0.15	0.10	70	PSMH	E024	$ 599.91	92	0.740	1,996	22	5	4	3	2	23	18	14	9	$ 150	$ 120	$ 90	$ 60
0.15	0.25	0.15	0.15	100	PSMH	E025	$ 606.46	129	0.750	2,949	23	3	6	3	3	19	32	19	19	$ 91	$ 152	$ 91	$ 91
0.10	0.15	0.25	0.20	150	PSMH	E026	$ 548.07	190	0.740	4,364	23	2	3	6	5	19	29	48	38	$ 55	$ 82	$ 137	$ 110
0.05	0.05	0.15	0.25	175	PSMH	E042	$ 327.82	198	0.700	4,721	24	1	1	4	6	10	10	30	50	$ 16	$ 16	$ 49	$ 82
0.00	0.00	0.05	0.15	250	PSMH	E043	$ 535.44	291	0.700	6,787	23	0	0	1	3	0	0	15	44	$ -	$ -	$ 27	$ 80
1.00	1.00	1.00	1.00									24	24	24	24	89	102	134	166	$ 523	$ 534	$ 511	$ 493

Area

Weighting				2008 Basis of Design							Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.00	0.00	18	CFL	E104	$ 3,719.47	20	0.856	746	37	2	2	0	0	1	1	0	0	$ 186	$ 186	$ -	$ -
0.05	0.05	0.05	0.00	26	CFL	E105	$ 3,719.47	28	0.858	1,077	38	2	2	2	0	1	1	1	0	$ 186	$ 186	$ 186	$ -
0.10	0.10	0.10	0.05	32	CFL	E106	$ 3,719.47	35	0.860	1,440	41	4	4	4	2	4	4	4	2	$ 372	$ 372	$ 372	$ 186
0.20	0.15	0.20	0.10	42	CFL	E107	$ 3,719.47	46	0.860	1,920	42	8	6	8	4	9	7	9	5	$ 744	$ 558	$ 744	$ 372
0.30	0.20	0.20	0.15	50	PSMH	E045	$ 686.23	67	0.670	2,257	34	10	7	7	5	20	13	13	10	$ 206	$ 137	$ 137	$ 103
0.20	0.20	0.20	0.25	70	PSMH	E046	$ 686.23	92	0.740	3,675	40	8	8	8	10	18	18	18	23	$ 137	$ 137	$ 137	$ 172
0.05	0.15	0.15	0.25	100	PSMH	E047	$ 696.07	129	0.750	5,431	42	2	6	6	11	6	19	19	32	$ 35	$ 104	$ 104	$ 174
0.05	0.10	0.10	0.20	150	PSMH	E048	$ 773.75	190	0.740	8,037	42	2	4	4	8	10	19	19	38	$ 39	$ 77	$ 77	$ 155
1.00	1.00	1.00	1.00									39	39	40	40	70	83	84	110	$ 1,904	$ 1,758	$ 1,758	$ 1,161
											Average:	29	29	29	30	88	105	121	145	$ 925	$ 888	$ 886	$ 687

Table 94: Student Pick-Up/Drop-Off Zones Equivalent LED Calculation

Downlight

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.10	0.05	0.00	L095	$ 140.96	13	0.700	732	57	1	1	1	0	$ 14	$ 14	$ 7	$ -	6	6	3	0
0.25	0.10	0.05	0.05	L096	$ 154.07	21	0.700	1086	53	5	2	1	1	$ 39	$ 15	$ 8	$ 8	13	5	3	3
0.25	0.20	0.20	0.10	L097	$ 242.59	32	0.700	1603	51	8	6	6	3	$ 61	$ 49	$ 49	$ 24	13	10	10	5
0.15	0.20	0.20	0.25	L098	$ 1,127.69	67	0.940	3677	55	10	13	13	17	$ 169	$ 226	$ 226	$ 282	8	11	11	14
0.15	0.20	0.25	0.30	L057	$ 364.70	72	0.700	4635	64	11	14	18	22	$ 55	$ 73	$ 91	$ 109	10	13	16	19
0.10	0.20	0.25	0.30	L058	$ 363.33	92	0.700	5479	60	9	18	23	28	$ 36	$ 73	$ 91	$ 109	6	12	15	18
1.00	1.00	1.00	1.00							44	56	62	70	$ 373	$ 449	$ 471	$ 532	55	57	58	59

Wall Pack

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.10	0.05	0.00	L020	$ 135.90	16	0.781	625	39	2	2	1	0	$ 14	$ 14	$ 7	$ -	4	4	2	0
0.15	0.10	0.10	0.05	L021	$ 135.90	16	0.781	625	39	2	2	2	1	$ 20	$ 14	$ 14	$ 7	6	4	4	2
0.20	0.15	0.10	0.10	L022	$ 225.31	27	0.700	1222	45	5	4	3	3	$ 45	$ 34	$ 23	$ 23	9	7	5	5
0.25	0.20	0.15	0.10	L024	$ 533.25	28	0.700	1693	60	7	6	4	3	$ 133	$ 107	$ 80	$ 53	15	12	9	6
0.15	0.25	0.15	0.15	L025	$ 607.56	55	0.700	2904	53	8	14	8	8	$ 91	$ 152	$ 91	$ 91	8	13	8	8
0.10	0.15	0.25	0.20	L026	$ 607.56	37	0.700	4164	113	4	6	9	7	$ 61	$ 91	$ 152	$ 122	11	17	28	23
0.05	0.05	0.15	0.25	L042	$ 607.56	37	0.940	5592	151	2	2	6	9	$ 30	$ 30	$ 91	$ 152	8	8	23	38
0.00	0.00	0.05	0.15	L043	$ 607.56	55	0.700	5633	102	0	0	3	8	$ -	$ -	$ 30	$ 91	0	0	5	15
1.00	1.00	1.00	1.00							30	34	35	39	$ 395	$ 441	$ 487	$ 538	61	64	83	96

Area

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.00	0.00	L104	$ 1,196.54	14	0.700	1130	81	1	1	0	0	$ 60	$ 60	$ -	$ -	4	4	0	0
0.05	0.05	0.05	0.00	L105	$ 1,196.54	14	0.700	1130	81	1	1	1	0	$ 60	$ 60	$ 60	$ -	4	4	4	0
0.10	0.10	0.10	0.05	L106	$ 1,196.54	14	0.700	1130	81	1	1	1	1	$ 120	$ 120	$ 120	$ 60	8	8	8	4
0.20	0.15	0.20	0.10	L107	$ 1,124.14	21	0.700	1695	81	4	3	4	2	$ 225	$ 169	$ 225	$ 112	16	12	16	8
0.30	0.20	0.20	0.15	L045	$ 1,242.43	50	0.887	4703	94	15	10	10	8	$ 373	$ 248	$ 248	$ 186	28	19	19	14
0.20	0.20	0.20	0.25	L046	$ 1,242.43	50	0.887	4703	94	10	10	10	13	$ 248	$ 248	$ 248	$ 311	19	19	19	24
0.05	0.15	0.15	0.25	L047	$ 1,275.21	80	0.887	6781	85	4	12	12	20	$ 64	$ 191	$ 191	$ 319	4	13	13	21
0.05	0.10	0.10	0.20	L048	$ 1,309.09	105	0.887	8601	82	5	11	11	21	$ 65	$ 131	$ 131	$ 262	4	8	8	16
1.00	1.00	1.00	1.00							41	48	49	64	$ 1,215	$ 1,227	$ 1,223	$ 1,250	88	87	87	87
									Average:	39	46	49	58	$ 661	$ 706	$ 727	$ 773	$ 68	$ 69	$ 76	$ 81

Table 95: Outdoor Dining Calculation Results and LPA Recommendations in Red

		LZ1	LZ2	LZ3	LZ4	
2016	Allowance	0.014	0.135	0.240	0.400	W/sf
	LPW	7	6	6	5	lm/W
2019	LPW	48	48	47	45	lm/W
	Limit of Reduction	0.002	0.018	0.029	0.047	Limit of Reduction
	Proposed LPA	**0.004**	**0.030**	**0.050**	**0.075**	W/sf

Table 96: Outdoor Dining Legacy Product Calculation

Area

Weighting				2008 Basis of Design								Weighted Watt				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.15	0.10	0.05	0.00	15	B10	E108	$ 0.70	15	0.82	78	5	1	1	0	0	2	2	1	0	$ 0	$ 0	$ 0	$-
0.20	0.10	0.05	0.05	25	B10	E109	$ 0.81	25	0.82	180	7	1	1	0	0	5	3	1	1	$ 0	$ 0	$ 0	$ 0
0.25	0.30	0.30	0.20	40	B10	E110	$ 0.73	40	0.82	303	8	2	2	2	2	10	12	12	8	$ 0	$ 0	$ 0	$ 0
0.20	0.30	0.35	0.40	15	G16	E111	$ 0.76	15	0.82	86	6	1	2	2	2	3	5	5	6	$ 0	$ 0	$ 0	$ 0
0.20	0.10	0.05	0.05	25	G16	E112	$ 1.88	25	0.82	246	10	2	1	0	0	5	3	1	1	$ 0	$ 0	$ 0	$ 0
0.00	0.10	0.20	0.30	40	G16	E113	$ 0.89	40	0.82	77	2	0	0	0	1	0	4	8	12	$-	$ 0	$ 0	$ 0
												7	6	6	5	25	27	29	29	$ 1	$ 1	$ 1	$ 1
1.00	1.00	1.00	1.00																				
											Average:	7	6	6	5	25	27	29	29	$ 1	$ 1	$ 1	$ 1

Table 97: Outdoor Dining Equivalent LED Calculation

Area

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.15	0.10	0.05	0.00	L108	$ 1.91	4	0.700	140	35	1	0	0	0	$ 0	$ 0	$ 0	$ -	5	4	2	0
0.20	0.10	0.05	0.05	L109	$ 1.91	4	0.700	140	35	1	0	0	0	$ 0	$ 0	$ 0	$ 0	7	4	2	2
0.25	0.30	0.30	0.20	L110	$ 6.31	4.5	0.700	315	70	1	1	1	1	$ 2	$ 2	$ 2	$ 1	18	21	21	14
0.20	0.30	0.35	0.40	L111	$ 4.36	4.5	0.700	126	28	1	1	2	2	$ 1	$ 1	$ 2	$ 2	6	8	10	11
0.20	0.10	0.05	0.05	L112	$ 6.55	3.5	0.700	228	65	1	0	0	0	$ 1	$ 1	$ 0	$ 0	13	7	3	3
0.00	0.10	0.20	0.30	L113	$ 6.51	5	0.700	245	49	0	1	1	2	$ -	$ 1	$ 1	$ 2	0	5	10	15
										4	4	5	5	$ 4	$ 5	$ 5	$ 5	48	48	47	45
1.00	1.00	1.00	1.00																		
									Average:	4	4	5	5	$ 4	$ 5	$ 5	$ 5	48	48	47	45

Table 98: Special Security Lighting for Retail Parking and Pedestrian Hardscape Calculation Results and LPA Recommendations in Red

		LZ1	LZ2	LZ3	LZ4	
2016	Allowance	0.007	0.009	0.019	0	W/sq.ft
	LPW	31	31	29	29	lm/W
2019	LPW	61	63	66	72	lm/W
	Limit of Reduction	0.0036	0.0045	0.0085	0.0000	Limit of Reduction
	Proposed LPA	**0.004**	**0.005**	**0.010**	**0.000**	W/sq.ft

Table 99: Special Security Lighting for Retail Parking and Pedestrian Hardscape Legacy Product Calculation

Wall Pack

Weighting				2008 Basis of Design							Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.25	0.15	0.10	0.10	26	CFL	E020	$ 466.59	28	0.858	709	25	6	4	3	3	7	4	3	3	$ 117	$ 70	$ 47	$ 47
0.25	0.25	0.15	0.15	32	CFL	E021	$ 469.87	35	0.860	947	27	7	7	4	4	9	9	5	5	$ 117	$ 117	$ 70	$ 70
0.25	0.25	0.20	0.15	42	CFL	E022	$ 469.87	46	0.860	1,262	27	7	7	5	4	12	12	9	7	$ 117	$ 117	$ 94	$ 70
0.10	0.15	0.15	0.10	70	PSMH	E024	$ 599.91	92	0.740	1,996	22	2	3	3	2	9	14	14	9	$ 60	$ 90	$ 90	$ 60
0.10	0.10	0.20	0.15	100	PSMH	E025	$ 606.46	129	0.750	2,949	23	2	2	5	3	13	13	26	19	$ 61	$ 61	$ 121	$ 91
0.05	0.10	0.15	0.20	150	PSMH	E026	$ 548.07	190	0.740	4,364	23	1	2	3	5	10	19	29	38	$ 27	$ 55	$ 82	$ 110
0.00	0.00	0.05	0.10	175	PSMH	E042	$ 327.82	198	0.700	4,721	24	0	0	1	2	0	0	10	20	$ -	$ -	$ 16	$ 33
0.00	0.00	0.00	0.05	250	PSMH	E043	$ 535.44	291	0.700	6,787	23	0	0	0	1	0	0	0	15	$ -	$ -	$ -	$ 27
1.00	1.00	1.00	1.00									26	25	25	24	59	70	95	116	$ 500	$ 510	$ 521	$ 508

Area

Weighting				2008 Basis of Design							Weighted LPW				Weighted Watt				Weighted Cost			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	2020 Estimated Luminaire Cost	System Watts	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.10	0.05	0.00	18	CFL	E104	$ 3,719.47	20	0.856	746	37	4	4	2	0	2	2	1	0	$ 372	$ 372	$ 186	$ -
0.25	0.15	0.10	0.10	26	CFL	E105	$ 3,719.47	28	0.858	1,077	38	10	6	4	4	7	4	3	3	$ 930	$ 558	$ 372	$ 372
0.20	0.20	0.15	0.15	32	CFL	E106	$ 3,719.47	35	0.860	1,440	41	8	8	6	6	7	7	5	5	$ 744	$ 744	$ 558	$ 558
0.20	0.25	0.15	0.15	42	CFL	E107	$ 3,719.47	46	0.860	1,920	42	8	10	6	6	9	12	7	7	$ 744	$ 930	$ 558	$ 558
0.10	0.15	0.15	0.10	70	PSMH	E069	$ 1,010.17	92	0.740	2,623	29	3	4	4	3	9	14	14	9	$ 101	$ 152	$ 152	$ 101
0.10	0.10	0.20	0.15	100	PSMH	E070	$ 1,010.17	129	0.750	3,876	30	3	3	6	5	13	13	26	19	$ 101	$ 101	$ 202	$ 152
0.05	0.05	0.15	0.20	150	PSMH	E071	$ 1,010.17	190	0.740	5,737	30	2	2	5	6	10	10	29	38	$ 51	$ 51	$ 152	$ 202
0.00	0.00	0.05	0.10	175	PSMH	E037	$ 1,062.13	198	0.700	5,895	30	0	0	1	3	0	0	10	20	$ -	$ -	$ 53	$ 106
0.00	0.00	0.00	0.05	250	PSMH	E073	$ 1,204.80	291	0.700	9,801	34	0	0	0	2	0	0	0	15	$ -	$ -	$ -	$ 60
1.00	1.00	1.00	1.00									37	37	34	34	57	61	94	116	$3,042	$2,907	$2,232	$2,109
											Average:	31	31	29	29	58	66	95	116	$1,771	$1,709	$1,376	$1,308

Table 100: Special Security Lighting for Retail Parking and Pedestrian Hardscape Equivalent LED Calculation

Wall Pack

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.25	0.15	0.10	0.10	L020	$ 135.90	16	0.781	625	39	4	2	2	2	$ 34	$ 20	$ 14	$ 14	10	6	4	4
0.25	0.25	0.15	0.15	L021	$ 135.90	16	0.781	625	39	4	4	2	2	$ 34	$ 34	$ 20	$ 20	10	10	6	6
0.25	0.25	0.20	0.15	L022	$ 225.31	27	0.700	1222	45	7	7	5	4	$ 56	$ 56	$ 45	$ 34	11	11	9	7
0.10	0.15	0.15	0.10	L024	$ 533.25	28	0.700	1693	60	3	4	4	3	$ 53	$ 80	$ 80	$ 53	6	9	9	6
0.10	0.10	0.20	0.15	L025	$ 607.56	55	0.700	2904	53	6	6	11	8	$ 61	$ 61	$ 122	$ 91	5	5	11	8
0.05	0.10	0.15	0.20	L026	$ 607.56	37	0.700	4164	113	2	4	6	7	$ 30	$ 61	$ 91	$ 122	6	11	17	23
0.00	0.00	0.05	0.10	L042	$ 607.56	37	0.940	5592	151	0	0	2	4	$ -	$ -	$ 30	$ 61	0	0	8	15
0.00	0.00	0.00	0.05	L043	$ 607.56	55	0.700	5633	102	0	0	0	3	$ -	$ -	$ -	$ 30	0	0	0	5
1.00	1.00	1.00	1.00							25	27	32	33	$ 269	$ 312	$ 402	$ 425	48	53	63	73

Area

Weighting				2017 LED Equivalency						Weighted 2017 Watt				Weighted Cost				Weighted LPW			
LZ1	LZ2	LZ3	LZ4	Luminaire	2020 Estimated Luminaire Cost	2017 System Watts	LED L70 lifetime hours (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4	LZ1	LZ2	LZ3	LZ4
0.10	0.10	0.05	0.00	L104	$ 1,196.54	14	0.700	1130	81	1	1	1	0	$ 120	$ 120	$ 60	$ -	8	8	4	0
0.25	0.15	0.10	0.10	L105	$ 1,196.54	14	0.700	1130	81	4	2	1	1	$ 299	$ 179	$ 120	$ 120	20	12	8	8
0.20	0.20	0.15	0.15	L106	$ 1,196.54	14	0.700	1130	81	3	3	2	2	$ 239	$ 239	$ 179	$ 179	16	16	12	12
0.20	0.25	0.15	0.15	L107	$ 1,124.14	21	0.700	1695	81	4	5	3	3	$ 225	$ 281	$ 169	$ 169	16	20	12	12
0.10	0.15	0.15	0.10	L069	$ 1,127.69	67	0.940	3677	55	7	10	10	7	$ 113	$ 169	$ 169	$ 113	5	8	8	5
0.10	0.10	0.20	0.15	L070	$ 1,127.69	67	0.940	3677	55	7	7	13	10	$ 113	$ 113	$ 226	$ 169	5	5	11	8
0.05	0.05	0.15	0.20	L071	$ 1,796.44	126	0.940	6958	55	6	6	19	25	$ 90	$ 90	$ 269	$ 359	3	3	8	11
0.00	0.00	0.05	0.10	L037	$ 1,364.82	85	0.938	7865	93	0	0	4	9	$ -	$ -	$ 68	$ 136	0	0	5	9
0.00	0.00	0.00	0.05	L073	$ 1,775.68	126	0.940	12953	103	0	0	0	6	$ -	$ -	$ -	$ 89	0	0	0	5
1.00	1.00	1.00	1.00							32	35	54	63	$ 1,198	$ 1,191	$ 1,260	$ 1,334	74	73	68	71
									Average:	28	31	43	48	$ 734	$ 752	$ 831	$ 880	61	63	66	72

Energy savings were calculated by the difference in wattage between legacy products and LED products for the specific applications. That wattage difference was applied on an hour-by-hour basis across an entire year using statewide use schedules. Full load hours of operation vary by the different specific applications. The operating hours include the impact of outdoor lighting controls.

Appendix F: LUMEN MAINTENANCE DATA

The General Hardscape models utilized luminaires with longer lumen maintenance than assumed in the 2016 models, based on technology improvements. Today, many outdoor site and area lighting LED luminaires are offered with L70 values of 100,000 hours or greater. The lumen maintenance at 60,000 hours is often reported as 90 percent or higher. The table below shows the luminaires used in the General Hardscape model, listed by Luminaire ID, with make and model redacted. These luminaires are all commercially available and represent offerings from four different manufacturers.

Table 101: General Hardscape LED Luminaire Reported Lumen Maintenance

Luminaire ID	Reported Life	Reported Lumen Maintenance at 60,000hr
PL01	100,000	0.990
PL03	100,000	0.990
PL05	100,000	0.990
PL06	60,000	0.930
PL07	60,000	0.930
PL08	60,000	0.700
PL09	60,000	0.700
PL11	100,000	0.840
PL12	100,000	0.840
PL13	154,000	0.910
PL14	100,000	0.887
PL15	100,000	0.887
PL16	100,000	0.887
PL17	100,000	0.887
PL18	100,000	0.887
PL19	90,000	0.864
PL20	100,000	0.887
PL21	100,000	0.887
PL22	100,000	0.887
PL23	100,000	0.887
PL24	100,000	0.887
PL25	100,000	0.887
PL26	154,000	0.910
PL27	154,000	0.910
PL29	150,000	0.950
PL30	150,000	0.950
PL31	150,000	0.950
PL32	150,000	0.950
PL33	150,000	0.950
PL34	150,000	0.950
PL35	150,000	0.950
Average	111,032	0.900

Table 102: Specific Applications Light Source Maintenance Period

			Years between relamps										Total relamps in 15 Years									
Lamp Type	Lamp Wattage	Reported Light Source Life	Schedule A	Schedule B	Schedule C	General Hardscape	Retail	ATM	Service Station Hardscape	Service Station Canopies	Outdoor Dining	Outdoor Sales Lots	Schedule A	Schedule B	Schedule C	General Hardscape	Retail	ATM	Service Station Hardscape	Service Station Canopies	Outdoor Dining	Outdoor Sales Lots
PSMH	50	10,000	2.1	6.4	5.2	3.6	3.1	3.0	2.7	2.7	5.2	3.3	7	2	2	4	4	4	5	5	2	4
PSMH	70	20,000	4.3	12.8	10.4	7.2	6.3	6.0	5.5	5.5	10.4	6.7	3	1	1	2	2	2	2	2	1	2
PSMH	100	20,000	4.3	12.8	10.4	7.2	6.3	6.0	5.5	5.5	10.4	6.7	3	1	1	2	2	2	2	2	1	2
PSMH	150	20,000	4.3	12.8	10.4	7.2	6.3	6.0	5.5	5.5	10.4	6.7	3	1	1	2	2	2	2	2	1	2
PSMH	175	14,000	3.0	8.9	7.2	5.1	4.4	4.2	3.8	3.8	7.2	4.7	5	1	2	2	3	3	3	3	2	3
PSMH	250	14,000	3.0	8.9	7.2	5.1	4.4	4.2	3.8	3.8	7.2	4.7	5	1	2	2	3	3	3	3	2	3
PSMH	320	20,000	4.3	12.8	10.4	7.2	6.3	6.0	5.5	5.5	10.4	6.7	3	1	1	2	2	2	2	2	1	2
PSMH	400	20,000	4.3	12.8	10.4	7.2	6.3	6.0	5.5	5.5	10.4	6.7	3	1	1	2	2	2	2	2	1	2
PSMH	750	12,000	2.6	7.7	6.2	4.3	3.8	3.6	3.3	3.3	6.2	4.0	5	1	2	3	3	4	4	4	2	3
PSMH	1000	12,000	2.6	7.7	6.2	4.3	3.8	3.6	3.3	3.3	6.2	4.0	5	1	2	3	3	4	4	4	2	3
CFL	18	10,000	2.1	6.4	5.2	3.6	3.1	3.0	2.7	2.7	5.2	3.3	7	2	2	4	4	4	5	5	2	4
CFL	26	10,000	2.1	6.4	5.2	3.6	3.1	3.0	2.7	2.7	5.2	3.3	7	2	2	4	4	4	5	5	2	4
CFL	32	16,000	3.4	10.2	8.3	5.8	5.0	4.8	4.4	4.4	8.3	5.3	4	1	1	2	2	3	3	3	1	2
CFL	42	16,000	3.4	10.2	8.3	5.8	5.0	4.8	4.4	4.4	8.3	5.3	4	1	1	2	2	3	3	3	1	2
T8	17	30,000	6.4	19.1	15.5	10.8	9.4	9.1	8.2	8.2	15.5	10.0	2	0	0	1	1	1	1	1	0	1
T8	25	30,000	6.4	19.1	15.5	10.8	9.4	9.1	8.2	8.2	15.5	10.0	2	0	0	1	1	1	1	1	0	1
T8	32	30,000	6.4	19.1	15.5	10.8	9.4	9.1	8.2	8.2	15.5	10.0	2	0	0	1	1	1	1	1	0	1
T5	14	25,000	5.3	16.0	12.9	9.0	7.8	7.5	6.8	6.8	12.9	8.3	2	0	1	1	1	1	2	2	1	1
T5	21	25,000	5.3	16.0	12.9	9.0	7.8	7.5	6.8	6.8	12.9	8.3	2	0	1	1	1	1	2	2	1	1
T5	28	25,000	5.3	16.0	12.9	9.0	7.8	7.5	6.8	6.8	12.9	8.3	2	0	1	1	1	1	2	2	1	1
T5HO	24	25,000	5.3	16.0	12.9	9.0	7.8	7.5	6.8	6.8	12.9	8.3	2	0	1	1	1	1	2	2	1	1
T5HO	39	25,000	5.3	16.0	12.9	9.0	7.8	7.5	6.8	6.8	12.9	8.3	2	0	1	1	1	1	2	2	1	1
T5HO	54	25,000	5.3	16.0	12.9	9.0	7.8	7.5	6.8	6.8	12.9	8.3	2	0	1	1	1	1	2	2	1	1
MR16	50	6,000	1.3	3.8	3.1	2.2	1.9	1.8	1.6	1.6	3.1	2.0	11	3	4	6	7	8	9	9	4	7
MR16	70	6,000	1.3	3.8	3.1	2.2	1.9	1.8	1.6	1.6	3.1	2.0	11	3	4	6	7	8	9	9	4	7
G16.5	15	1,500	0.3	1.0	0.8	0.5	0.5	0.5	0.4	0.4	0.8	0.5	46	15	19	27	31	33	36	36	19	30
G16.5	25	1,500	0.3	1.0	0.8	0.5	0.5	0.5	0.4	0.4	0.8	0.5	46	15	19	27	31	33	36	36	19	30
G16.5	40	1,500	0.3	1.0	0.8	0.5	0.5	0.5	0.4	0.4	0.8	0.5	46	15	19	27	31	33	36	36	19	30
B10	15	1,500	0.3	1.0	0.8	0.5	0.5	0.5	0.4	0.4	0.8	0.5	46	15	19	27	31	33	36	36	19	30
B10	25	1,500	0.3	1.0	0.8	0.5	0.5	0.5	0.4	0.4	0.8	0.5	46	15	19	27	31	33	36	36	19	30
B10	40	1,500	0.3	1.0	0.8	0.5	0.5	0.5	0.4	0.4	0.8	0.5	46	15	19	27	31	33	36	36	19	30
LED Average		93,000	19.8	59.3	48.1	31.6	29.1	25.5	25.5	33.6	48.1	31.0	0	0	0	0	0	0	0	0	0	0

Table 103: Specific Applications LED Luminaire Reported Life

Luminaire ID	Reported Life	Reported Lumen Maintenance at 60,000 hr
L001	100,000	0.960
L002	70,000	0.781
L003	70,000	0.781
L004	50,000	0.700
L005	50,000	0.700
L006	50,000	0.700
L007	50,000	0.700
L008	50,000	0.700
L009	50,000	0.700
L010	50,000	0.700
L011	50,000	0.700
L012	70,000	0.781
L013	60,000	0.700
L014	100,000	0.970
L015	205,000	0.900
L016	205,000	0.900
L017	205,000	0.900
L018	205,000	0.900
L019	205,000	0.900
L020	70,000	0.781
L021	70,000	0.781
L022	60,000	0.700
L023	100,000	0.970
L024	100,000	0.880
L025	100,000	0.880
L026	100,000	0.880
L027	70,000	0.781
L028	60,000	0.700
L029	60,000	0.700
L030	60,000	0.700
L031	60,000	0.700
L032	250,000	0.961
L033	250,000	0.961
L034	60,000	0.700
L035	60,000	0.700
L036	60,000	0.700
L037	150,000	0.938
L038	100,000	0.887
L039	100,000	0.960
L040	100,000	0.960
L041	100,000	0.880
L042	100,000	0.940
L043	100,000	0.880
L044	100,000	0.960
L045	100,000	0.887
L046	100,000	0.887
L047	100,000	0.887
L048	100,000	0.887
L049	100,000	0.950
L050	100,000	0.930
L051	60,000	0.700
L052	60,000	0.700
L053	60,000	0.700
L054	60,000	0.700
L055	60,000	0.700
L056	60,000	0.700
L057	60,000	0.700
L058	60,000	0.700
L059	60,000	0.700
L060	100,000	0.962
L061	100,000	0.962
L062	100,000	0.964
L063	100,000	0.964
L064	100,000	0.964
L065	100,000	0.959
L066	100,000	0.959
L067	60,000	0.700
L068	60,000	0.700
L069	100,000	0.940
L070	100,000	0.940
L071	100,000	0.940
L072	100,000	0.940
L073	100,000	0.940
L074	100,000	0.960
L075	100,000	0.960
L076	100,000	0.960
L077	100,000	0.960
L078	100,000	0.960
L079	100,000	0.960
L080	100,000	0.887
L081	50,000	0.700
L082	50,000	0.700
L083	50,000	0.700
L084	100,000	0.887
L085	100,000	0.887
L086	100,000	0.887
L087	60,000	0.850
L088	60,000	0.850
L089	60,000	0.850
L090	60,000	0.800
L091	60,000	0.800
L092	60,000	0.800
L093	100,000	0.900
L094	100,000	0.900
L095	50,000	0.700
L096	50,000	0.700
L097	60,000	0.700
L098	100,000	0.940
L099	60,000	0.700
L100	60,000	0.700
L101	100,000	0.960
L089	60,000	0.850
L103	100,000	0.900
L104	60,000	0.700
L105	60,000	0.700
L106	60,000	0.700
L107	60,000	0.700
L108	60,000	0.700
L109	60,000	0.700
L110	60,000	0.700
L111	60,000	0.700
L112	60,000	0.700
L113	60,000	0.700
L114	200,000	0.954
L115	200,000	0.954
L116	200,000	0.954
L117	200,000	0.954
L118	200,000	0.954
L119	200,000	0.954
L120	200,000	0.954
L121	200,000	0.954
L122	200,000	0.954
L123	200,000	0.954
L124	60,000	0.700
L125	60,000	0.700
L126	60,000	0.700
L127	60,000	0.700
L128	60,000	0.700
L129	100,000	0.960
L130	100,000	0.960
L131	70,000	0.781
L132	60,000	0.970
L133	60,000	0.970
L134	60,000	0.850
L135	60,000	0.850
Average	**93,000**	**0.831**

Table 104: Maintenance Labor Cost

	Maintenance Staff Labor Rate (man-hr)	Duration of Lamp Replacement (hr)	Total Cost of Labor
Easy Maintenance Access	$ 54.52	0.5	$ 27.26
Moderate Maintenance Access	$ 54.52	1.0	$ 54.52
Difficult Maintenance Access	$ 54.52	1.5	$ 81.78

Table 105: Legacy Product Easy Maintenance Access Cost

Lamp Type	Lamp Wattage	2017 Lamp Cost	2020 Lamp Escalation	Reported Light Source Life	Present Value - Easy Access Maintenance Cost									
					Schedule A	Schedule B	Schedule C	General Hardscape	Retail	ATM	Service Station Hardscape	Service Station Canopies	Outdoor Dining	Outdoor Sales Lots
PSMH	50	$ 20.96	$ 22.90	10,000	$ 351	$ 100	$ 100	$ 201	$ 201	$ 201	$ 251	$ 251	$ 100	$ 201
PSMH	70	$ 20.15	$ 22.02	20,000	$ 148	$ 49	$ 49	$ 99	$ 99	$ 99	$ 99	$ 99	$ 49	$ 99
PSMH	100	$ 27.99	$ 30.59	20,000	$ 174	$ 58	$ 58	$ 116	$ 116	$ 116	$ 116	$ 116	$ 58	$ 116
PSMH	150	$ 20.96	$ 22.90	20,000	$ 150	$ 50	$ 50	$ 100	$ 100	$ 100	$ 100	$ 100	$ 50	$ 100
PSMH	175	$ 37.50	$ 40.98	14,000	$ 341	$ 68	$ 136	$ 136	$ 205	$ 205	$ 205	$ 205	$ 136	$ 205
PSMH	250	$ 15.67	$ 17.12	14,000	$ 222	$ 44	$ 89	$ 89	$ 133	$ 133	$ 133	$ 133	$ 89	$ 133
PSMH	320	$ 23.91	$ 26.13	20,000	$ 160	$ 53	$ 53	$ 107	$ 107	$ 107	$ 107	$ 107	$ 53	$ 107
PSMH	400	$ 17.06	$ 18.64	20,000	$ 138	$ 46	$ 46	$ 92	$ 92	$ 92	$ 92	$ 92	$ 46	$ 92
PSMH	750	$ 27.66	$ 30.22	12,000	$ 287	$ 57	$ 115	$ 172	$ 172	$ 230	$ 230	$ 230	$ 115	$ 172
PSMH	1000	$ 26.13	$ 28.55	12,000	$ 279	$ 56	$ 112	$ 167	$ 167	$ 223	$ 223	$ 223	$ 112	$ 167
CFL	18	$ 3.83	$ 4.19	10,000	$ 220	$ 63	$ 63	$ 126	$ 126	$ 126	$ 157	$ 157	$ 63	$ 126
CFL	26	$ 2.86	$ 3.13	10,000	$ 213	$ 61	$ 61	$ 122	$ 122	$ 122	$ 152	$ 152	$ 61	$ 122
CFL	32	$ 3.55	$ 3.88	16,000	$ 125	$ 31	$ 31	$ 62	$ 62	$ 93	$ 93	$ 93	$ 31	$ 62
CFL	42	$ 3.77	$ 4.12	16,000	$ 126	$ 31	$ 31	$ 63	$ 63	$ 94	$ 94	$ 94	$ 31	$ 63
T8	17	$ 2.58	$ 2.82	30,000	$ 60	$ -	$ -	$ 30	$ 30	$ 30	$ 30	$ 30	$ -	$ 30
T8	25	$ 3.81	$ 4.16	30,000	$ 63	$ -	$ -	$ 31	$ 31	$ 31	$ 31	$ 31	$ -	$ 31
T8	32	$ 1.94	$ 2.12	30,000	$ 59	$ -	$ -	$ 29	$ 29	$ 29	$ 29	$ 29	$ -	$ 29
T5	14	$ 3.55	$ 3.88	25,000	$ 62	$ -	$ 31	$ 31	$ 31	$ 31	$ 62	$ 62	$ 31	$ 31
T5	21	$ 3.89	$ 4.25	25,000	$ 63	$ -	$ 32	$ 32	$ 32	$ 32	$ 63	$ 63	$ 32	$ 32
T5	28	$ 2.86	$ 3.13	25,000	$ 61	$ -	$ 30	$ 30	$ 30	$ 30	$ 61	$ 61	$ 30	$ 30
T5HO	24	$ 4.02	$ 4.39	25,000	$ 63	$ -	$ 32	$ 32	$ 32	$ 32	$ 63	$ 63	$ 32	$ 32
T5HO	39	$ 3.72	$ 4.06	25,000	$ 63	$ -	$ 31	$ 31	$ 31	$ 31	$ 63	$ 63	$ 31	$ 31
T5HO	54	$ 2.31	$ 2.52	25,000	$ 60	$ -	$ 30	$ 30	$ 30	$ 30	$ 60	$ 60	$ 30	$ 30
MR16	50	$ 1.52	$ 1.66	6,000	$ 318	$ 87	$ 116	$ 174	$ 202	$ 231	$ 260	$ 260	$ 116	$ 202
MR16	70	$ 5.65	$ 6.17	6,000	$ 368	$ 100	$ 134	$ 201	$ 234	$ 267	$ 301	$ 301	$ 134	$ 234
G16.5	15	$ 0.63	$ 0.69	1,500	$ 1,286	$ 419	$ 531	$ 755	$ 866	$ 922	$ 1,006	$ 1,006	$ 531	$ 838
G16.5	25	$ 0.63	$ 0.69	1,500	$ 1,286	$ 419	$ 531	$ 755	$ 866	$ 922	$ 1,006	$ 1,006	$ 531	$ 838
G16.5	40	$ 1.42	$ 1.55	1,500	$ 1,325	$ 432	$ 547	$ 778	$ 893	$ 951	$ 1,037	$ 1,037	$ 547	$ 864
B10	15	$ 0.64	$ 0.70	1,500	$ 1,286	$ 419	$ 531	$ 755	$ 867	$ 923	$ 1,007	$ 1,007	$ 531	$ 839
B10	25	$ 0.93	$ 1.02	1,500	$ 1,301	$ 424	$ 537	$ 763	$ 877	$ 933	$ 1,018	$ 1,018	$ 537	$ 848
B10	40	$ 1.06	$ 1.16	1,500	$ 1,307	$ 426	$ 540	$ 767	$ 881	$ 938	$ 1,023	$ 1,023	$ 540	$ 853
LED Average				93,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Table 106: Legacy Product Moderate Maintenance Access Cost

Lamp Type	Lamp Wattage	2017 Lamp Cost	2020 Lamp Escalation	Reported Light Source Life	Present Value - Moderate Access Maintenance Cost									
					Schedule A	Schedule B	Schedule C	General Hardscape	Retail	ATM	Service Station Hardscape	Service Station Canopies	Outdoor Dining	Outdoor Sales Lots
PSMH	50	$ 20.96	$ 22.90	10,000	$ 542	$ 155	$ 155	$ 310	$ 310	$ 310	$ 387	$ 387	$ 155	$ 310
PSMH	70	$ 20.15	$ 22.02	20,000	$ 230	$ 77	$ 77	$ 153	$ 153	$ 153	$ 153	$ 153	$ 77	$ 153
PSMH	100	$ 27.99	$ 30.59	20,000	$ 255	$ 85	$ 85	$ 170	$ 170	$ 170	$ 170	$ 170	$ 85	$ 170
PSMH	150	$ 20.96	$ 22.90	20,000	$ 232	$ 77	$ 77	$ 155	$ 155	$ 155	$ 155	$ 155	$ 77	$ 155
PSMH	175	$ 37.50	$ 40.98	14,000	$ 477	$ 95	$ 191	$ 191	$ 286	$ 286	$ 286	$ 286	$ 191	$ 286
PSMH	250	$ 15.67	$ 17.12	14,000	$ 358	$ 72	$ 143	$ 143	$ 215	$ 215	$ 215	$ 215	$ 143	$ 215
PSMH	320	$ 23.91	$ 26.13	20,000	$ 242	$ 81	$ 81	$ 161	$ 161	$ 161	$ 161	$ 161	$ 81	$ 161
PSMH	400	$ 17.06	$ 18.64	20,000	$ 219	$ 73	$ 73	$ 146	$ 146	$ 146	$ 146	$ 146	$ 73	$ 146
PSMH	750	$ 27.66	$ 30.22	12,000	$ 424	$ 85	$ 169	$ 254	$ 254	$ 339	$ 339	$ 339	$ 169	$ 254
PSMH	1000	$ 26.13	$ 28.55	12,000	$ 415	$ 83	$ 166	$ 249	$ 249	$ 332	$ 332	$ 332	$ 166	$ 249
CFL	18	$ 3.83	$ 4.19	10,000	$ 411	$ 117	$ 117	$ 235	$ 235	$ 235	$ 294	$ 294	$ 117	$ 235
CFL	26	$ 2.86	$ 3.13	10,000	$ 404	$ 115	$ 115	$ 231	$ 231	$ 231	$ 288	$ 288	$ 115	$ 231
CFL	32	$ 3.55	$ 3.88	16,000	$ 234	$ 58	$ 58	$ 117	$ 117	$ 175	$ 175	$ 175	$ 58	$ 117
CFL	42	$ 3.77	$ 4.12	16,000	$ 235	$ 59	$ 59	$ 117	$ 117	$ 176	$ 176	$ 176	$ 59	$ 117
T8	17	$ 2.58	$ 2.82	30,000	$ 115	$ -	$ -	$ 57	$ 57	$ 57	$ 57	$ 57	$ -	$ 57
T8	25	$ 3.81	$ 4.16	30,000	$ 117	$ -	$ -	$ 59	$ 59	$ 59	$ 59	$ 59	$ -	$ 59
T8	32	$ 1.94	$ 2.12	30,000	$ 113	$ -	$ -	$ 57	$ 57	$ 57	$ 57	$ 57	$ -	$ 57
T5	14	$ 3.55	$ 3.88	25,000	$ 117	$ -	$ 58	$ 58	$ 58	$ 58	$ 117	$ 117	$ 58	$ 58
T5	21	$ 3.89	$ 4.25	25,000	$ 118	$ -	$ 59	$ 59	$ 59	$ 59	$ 118	$ 118	$ 59	$ 59
T5	28	$ 2.86	$ 3.13	25,000	$ 115	$ -	$ 58	$ 58	$ 58	$ 58	$ 115	$ 115	$ 58	$ 58
T5HO	24	$ 4.02	$ 4.39	25,000	$ 118	$ -	$ 59	$ 59	$ 59	$ 59	$ 118	$ 118	$ 59	$ 59
T5HO	39	$ 3.72	$ 4.06	25,000	$ 117	$ -	$ 59	$ 59	$ 59	$ 59	$ 117	$ 117	$ 59	$ 59
T5HO	54	$ 2.31	$ 2.52	25,000	$ 114	$ -	$ 57	$ 57	$ 57	$ 57	$ 114	$ 114	$ 57	$ 57
MR16	50	$ 1.52	$ 1.66	6,000	$ 618	$ 169	$ 225	$ 337	$ 393	$ 449	$ 506	$ 506	$ 225	$ 393
MR16	70	$ 5.65	$ 6.17	6,000	$ 668	$ 182	$ 243	$ 364	$ 425	$ 486	$ 546	$ 546	$ 243	$ 425
G16.5	15	$ 0.63	$ 0.69	1,500	$ 2,540	$ 828	$ 1,049	$ 1,491	$ 1,711	$ 1,822	$ 1,988	$ 1,988	$ 1,049	$ 1,656
G16.5	25	$ 0.63	$ 0.69	1,500	$ 2,540	$ 828	$ 1,049	$ 1,491	$ 1,711	$ 1,822	$ 1,988	$ 1,988	$ 1,049	$ 1,656
G16.5	40	$ 1.42	$ 1.55	1,500	$ 2,579	$ 841	$ 1,065	$ 1,514	$ 1,738	$ 1,850	$ 2,019	$ 2,019	$ 1,065	$ 1,682
B10	15	$ 0.64	$ 0.70	1,500	$ 2,540	$ 828	$ 1,049	$ 1,491	$ 1,712	$ 1,822	$ 1,988	$ 1,988	$ 1,049	$ 1,657
B10	25	$ 0.93	$ 1.02	1,500	$ 2,555	$ 833	$ 1,055	$ 1,499	$ 1,722	$ 1,833	$ 1,999	$ 1,999	$ 1,055	$ 1,666
B10	40	$ 1.06	$ 1.16	1,500	$ 2,561	$ 835	$ 1,058	$ 1,503	$ 1,726	$ 1,837	$ 2,004	$ 2,004	$ 1,058	$ 1,670
LED Average				93,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Table 107: Legacy Product Moderate Difficult Access Cost

Lamp Type	Lamp Wattage	2017 Lamp Cost	2020 Lamp Escalation	Reported Light Source Life	Present Value - Difficult Access Maintenance Cost									
					Schedule A	Schedule B	Schedule C	General Hardscape	Retail	ATM	Service Station Hardscape	Service Station Canopies	Outdoor Dining	Outdoor Sales Lots
PSMH	50	$ 20.96	$ 22.90	10,000	$ 733	$ 209	$ 209	$ 419	$ 419	$ 419	$ 523	$ 523	$ 209	$ 419
PSMH	70	$ 20.15	$ 22.02	20,000	$ 311	$ 104	$ 104	$ 208	$ 208	$ 208	$ 208	$ 208	$ 104	$ 208
PSMH	100	$ 27.99	$ 30.59	20,000	$ 337	$ 112	$ 112	$ 225	$ 225	$ 225	$ 225	$ 225	$ 112	$ 225
PSMH	150	$ 20.96	$ 22.90	20,000	$ 314	$ 105	$ 105	$ 209	$ 209	$ 209	$ 209	$ 209	$ 105	$ 209
PSMH	175	$ 37.50	$ 40.98	14,000	$ 614	$ 123	$ 246	$ 246	$ 368	$ 368	$ 368	$ 368	$ 246	$ 368
PSMH	250	$ 15.67	$ 17.12	14,000	$ 495	$ 99	$ 198	$ 198	$ 297	$ 297	$ 297	$ 297	$ 198	$ 297
PSMH	320	$ 23.91	$ 26.13	20,000	$ 324	$ 108	$ 108	$ 216	$ 216	$ 216	$ 216	$ 216	$ 108	$ 216
PSMH	400	$ 17.06	$ 18.64	20,000	$ 301	$ 100	$ 100	$ 201	$ 201	$ 201	$ 201	$ 201	$ 100	$ 201
PSMH	750	$ 27.66	$ 30.22	12,000	$ 560	$ 112	$ 224	$ 336	$ 336	$ 448	$ 448	$ 448	$ 224	$ 336
PSMH	1000	$ 26.13	$ 28.55	12,000	$ 552	$ 110	$ 221	$ 331	$ 331	$ 441	$ 441	$ 441	$ 221	$ 331
CFL	18	$ 3.83	$ 4.19	10,000	$ 602	$ 172	$ 172	$ 344	$ 344	$ 344	$ 430	$ 430	$ 172	$ 344
CFL	26	$ 2.86	$ 3.13	10,000	$ 594	$ 170	$ 170	$ 340	$ 340	$ 340	$ 425	$ 425	$ 170	$ 340
CFL	32	$ 3.55	$ 3.88	16,000	$ 343	$ 86	$ 86	$ 171	$ 171	$ 257	$ 257	$ 257	$ 86	$ 171
CFL	42	$ 3.77	$ 4.12	16,000	$ 344	$ 86	$ 86	$ 172	$ 172	$ 258	$ 258	$ 258	$ 86	$ 172
T8	17	$ 2.58	$ 2.82	30,000	$ 169	$ -	$ -	$ 85	$ 85	$ 85	$ 85	$ 85	$ -	$ 85
T8	25	$ 3.81	$ 4.16	30,000	$ 172	$ -	$ -	$ 86	$ 86	$ 86	$ 86	$ 86	$ -	$ 86
T8	32	$ 1.94	$ 2.12	30,000	$ 168	$ -	$ -	$ 84	$ 84	$ 84	$ 84	$ 84	$ -	$ 84
T5	14	$ 3.55	$ 3.88	25,000	$ 171	$ -	$ 86	$ 86	$ 86	$ 86	$ 171	$ 171	$ 86	$ 86
T5	21	$ 3.89	$ 4.25	25,000	$ 172	$ -	$ 86	$ 86	$ 86	$ 86	$ 172	$ 172	$ 86	$ 86
T5	28	$ 2.86	$ 3.13	25,000	$ 170	$ -	$ 85	$ 85	$ 85	$ 85	$ 170	$ 170	$ 85	$ 85
T5HO	24	$ 4.02	$ 4.39	25,000	$ 172	$ -	$ 86	$ 86	$ 86	$ 86	$ 172	$ 172	$ 86	$ 86
T5HO	39	$ 3.72	$ 4.06	25,000	$ 172	$ -	$ 86	$ 86	$ 86	$ 86	$ 172	$ 172	$ 86	$ 86
T5HO	54	$ 2.31	$ 2.52	25,000	$ 169	$ -	$ 84	$ 84	$ 84	$ 84	$ 169	$ 169	$ 84	$ 84
MR16	50	$ 1.52	$ 1.66	6,000	$ 918	$ 250	$ 334	$ 501	$ 584	$ 668	$ 751	$ 751	$ 334	$ 584
MR16	70	$ 5.65	$ 6.17	6,000	$ 967	$ 264	$ 352	$ 528	$ 616	$ 704	$ 792	$ 792	$ 352	$ 616
G16.5	15	$ 0.63	$ 0.69	1,500	$ 3,794	$ 1,237	$ 1,567	$ 2,227	$ 2,557	$ 2,721	$ 2,969	$ 2,969	$ 1,567	$ 2,474
G16.5	25	$ 0.63	$ 0.69	1,500	$ 3,794	$ 1,237	$ 1,567	$ 2,227	$ 2,557	$ 2,721	$ 2,969	$ 2,969	$ 1,567	$ 2,474
G16.5	40	$ 1.42	$ 1.55	1,500	$ 3,833	$ 1,250	$ 1,583	$ 2,250	$ 2,583	$ 2,750	$ 3,000	$ 3,000	$ 1,583	$ 2,500
B10	15	$ 0.64	$ 0.70	1,500	$ 3,794	$ 1,237	$ 1,567	$ 2,227	$ 2,557	$ 2,722	$ 2,969	$ 2,969	$ 1,567	$ 2,474
B10	25	$ 0.93	$ 1.02	1,500	$ 3,809	$ 1,242	$ 1,573	$ 2,235	$ 2,567	$ 2,732	$ 2,981	$ 2,981	$ 1,573	$ 2,484
B10	40	$ 1.06	$ 1.16	1,500	$ 3,815	$ 1,244	$ 1,576	$ 2,239	$ 2,571	$ 2,737	$ 2,986	$ 2,986	$ 1,576	$ 2,488
LED Average				93,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

Table 108: Building Entrances and Exits Legacy Product Maintenance

Area Light

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.20	0.10	0.05	0.00	18	CFL	E104	$ 411	Moderate	0.856	746	37	$ 82	$ 41	$ 21	$ -
0.25	0.15	0.05	0.05	26	CFL	E105	$ 404	Moderate	0.858	1,077	38	$ 101	$ 61	$ 20	$ 20
0.25	0.20	0.15	0.10	32	CFL	E106	$ 234	Moderate	0.860	1,440	41	$ 59	$ 47	$ 35	$ 23
0.15	0.25	0.25	0.10	42	CFL	E107	$ 235	Moderate	0.860	1,920	42	$ 35	$ 59	$ 59	$ 24
0.10	0.15	0.15	0.05	50	PSMH	E045	$ 542	Moderate	0.670	2,257	34	$ 54	$ 81	$ 81	$ 27
0.05	0.10	0.20	0.10	70	PSMH	E046	$ 230	Moderate	0.740	3,675	40	$ 12	$ 23	$ 46	$ 23
0.00	0.05	0.10	0.30	100	PSMH	E047	$ 337	Difficult	0.750	5,431	42	$ -	$ 17	$ 34	$ 101
0.00	0.00	0.05	0.30	150	PSMH	E048	$ 314	Difficult	0.740	8,037	42	$ -	$ -	$ 16	$ 94
1	1	1	1									$ 343	$ 328	$ 311	$ 313

Wall Mounted Luminaire

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.20	0.10	0.05	0.00	26	CFL	E020	$ 404	Moderate	0.858	709	25	$ 81	$ 40	$ 20	$ -
0.25	0.15	0.05	0.05	26	CFL	E020	$ 404	Moderate	0.858	709	25	$ 101	$ 61	$ 20	$ 20
0.25	0.20	0.15	0.10	32	CFL	E021	$ 234	Moderate	0.860	947	27	$ 59	$ 47	$ 35	$ 23
0.15	0.25	0.25	0.10	42	CFL	E022	$ 235	Moderate	0.860	1,262	27	$ 35	$ 59	$ 59	$ 24
0.10	0.15	0.15	0.05	50	PSMH	E023	$ 542	Moderate	0.670	1,225	18	$ 54	$ 81	$ 81	$ 27
0.05	0.10	0.20	0.10	70	PSMH	E024	$ 230	Moderate	0.740	1,996	22	$ 12	$ 23	$ 46	$ 23
0.00	0.05	0.10	0.30	100	PSMH	E025	$ 337	Difficult	0.750	2,949	23	$ -	$ 17	$ 34	$ 101
0.00	0.00	0.05	0.30	150	PSMH	E026	$ 314	Difficult	0.740	4,364	23	$ -	$ -	$ 16	$ 94
1	1	1	1									$ 341	$ 328	$ 311	$ 313

Table 109: Primary Entrance Legacy Product Maintenance

Downlight

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.50	0.35	0.10	0.05	32	CFL	E140	$ 164	Moderate	0.860	685	20	$ 82	$ 57	$ 16	$ 8
0.30	0.30	0.20	0.15	42	CFL	E141	$ 164	Moderate	0.860	913	20	$ 49	$ 49	$ 33	$ 25
0.15	0.20	0.25	0.25	70	PSMH	E097	$ 109	Moderate	0.740	1,895	21	$ 16	$ 22	$ 27	$ 27
0.05	0.10	0.30	0.30	100	PSMH	E098	$ 164	Difficult	0.750	2,801	22	$ 8	$ 16	$ 49	$ 49
1	1	1	1									$ 155	$ 144	$ 125	$ 109

Wall Pack

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.40	0.20	0.10	0.00	26	CFL	E020	$ 136	Easy	0.858	709	25	$ 55	$ 27	$ 14	$ -
0.25	0.25	0.15	0.05	32	CFL	E021	$ 164	Moderate	0.860	947	27	$ 41	$ 41	$ 25	$ 8
0.20	0.20	0.15	0.10	42	CFL	E022	$ 164	Moderate	0.860	1,262	27	$ 33	$ 33	$ 25	$ 16
0.10	0.15	0.20	0.10	70	PSMH	E024	$ 109	Moderate	0.740	1,996	22	$ 11	$ 16	$ 22	$ 11
0.05	0.10	0.20	0.15	100	PSMH	E025	$ 164	Difficult	0.750	2,949	23	$ 8	$ 16	$ 33	$ 25
0.00	0.05	0.05	0.25	150	PSMH	E026	$ 164	Difficult	0.740	4,364	23	$ -	$ 8	$ 8	$ 41
0.00	0.05	0.10	0.25	175	PSMH	E042	$ 245	Difficult	0.700	4,721	24	$ -	$ 12	$ 25	$ 61
0.00	0.00	0.05	0.10	250	PSMH	E043	$ 245	Difficult	0.700	6,787	23	$ -	$ -	$ 12	$ 25
1.00	1.00	1.00	1.00									$ 147	$ 154	$ 162	$ 187

Area

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.00	0.00	18	CFL	E104	$ 273	Moderate	0.856	746	37	$ 14	$ 14	$ -	$ -
0.10	0.05	0.00	0.00	26	CFL	E105	$ 409	Difficult	0.858	1,077	38	$ 41	$ 20	$ -	$ -
0.20	0.10	0.10	0.00	32	CFL	E106	$ 245	Difficult	0.860	1,440	41	$ 49	$ 25	$ 25	$ -
0.20	0.15	0.10	0.10	42	CFL	E107	$ 245	Difficult	0.860	1,920	42	$ 49	$ 37	$ 25	$ 25
0.20	0.20	0.15	0.10	50	PSMH	E136	$ 409	Difficult	0.670	1,558	23	$ 82	$ 82	$ 61	$ 41
0.15	0.25	0.25	0.20	70	PSMH	E137	$ 164	Difficult	0.740	3,098	34	$ 25	$ 41	$ 41	$ 33
0.10	0.15	0.25	0.30	100	PSMH	E138	$ 164	Difficult	0.750	4,736	37	$ 16	$ 25	$ 41	$ 49
0.00	0.05	0.15	0.30	150	PSMH	E139	$ 164	Difficult	0.705	6,372	34	$ -	$ 8	$ 25	$ 49
1.00	1.00	1.00	1.00									$ 275	$ 251	$ 217	$ 196

Table 110: Drive-Up Windows Legacy Product Maintenance

Round Ceiling Mounted Downlight

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.10	0.05	0.00	0.00	50	PSMH	E054	$ 542	Moderate	0.670	1,337	20	$ 54	$ 27	$ -	$ -
0.20	0.15	0.05	0.10	70	PSMH	E055	$ 230	Moderate	0.740	2,177	24	$ 46	$ 35	$ 12	$ 23
0.30	0.25	0.20	0.30	100	PSMH	E056	$ 337	Difficult	0.750	3,216	25	$ 101	$ 84	$ 67	$ 101
0.40	0.55	0.75	0.60	150	PSMH	E057	$ 314	Difficult	0.740	4,759	25	$ 126	$ 173	$ 236	$ 188
1	1	1	1									$ 327	$ 319	$ 314	$ 313

Ceiling Mounted, Full Cut-Off

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.40	0.40	0.40	0.40	70	PSMH	E035	$ 230	Moderate	0.740	2,432	26	$ 92	$ 92	$ 92	$ 92
0.60	0.60	0.60	0.60	100	PSMH	E036	$ 337	Difficult	0.750	3,593	28	$ 202	$ 202	$ 202	$ 202
1	1	1	1									$ 294	$ 294	$ 294	$ 294

Table 111: Uncovered Fuel Dispenser Legacy Product Maintenance

Area

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.20	0.10	0.05	0.00	100	PSMH	E070	$ 255	Moderate	0.750	3,876	30	$ 51	$ 26	$ 13	$ -
0.30	0.20	0.10	0.05	150	PSMH	E071	$ 232	Moderate	0.740	5,737	30	$ 70	$ 46	$ 23	$ 12
0.30	0.30	0.30	0.25	175	PSMH	E037	$ 477	Moderate	0.700	5,895	30	$ 143	$ 143	$ 143	$ 119
0.20	0.30	0.35	0.40	250	PSMH	E073	$ 358	Moderate	0.700	9,801	34	$ 72	$ 107	$ 125	$ 143
0.00	0.10	0.20	0.30	400	PSMH	E075	$ 219	Moderate	0.700	17,046	38	$ -	$ 22	$ 44	$ 66
1.00	1.00	1.00	1.00									$ 335	$ 344	$ 348	$ 340

Table 112: ATM Machine Lighting Legacy Product Maintenance

Wall Mounted															
Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.20	0.20	0.15	0.05	26	CFL	E020	$ 231	Moderate	0.858	709	25	$ 46	$ 46	$ 35	$ 12
0.25	0.25	0.25	0.15	32	CFL	E021	$ 117	Moderate	0.860	947	27	$ 29	$ 29	$ 29	$ 18
0.25	0.20	0.10	0.10	100	PSMH	E025	$ 170	Moderate	0.750	2949	23	$ 43	$ 34	$ 17	$ 17
0.20	0.20	0.25	0.30	150	PSMH	E026	$ 155	Moderate	0.740	4364	23	$ 31	$ 31	$ 39	$ 46
0.10	0.10	0.15	0.25	175	PSMH	E042	$ 286	Moderate	0.700	4721	24	$ 29	$ 29	$ 43	$ 72
0.00	0.05	0.10	0.15	250	PSMH	E043	$ 215	Moderate	0.700	6787	23	$ -	$ 11	$ 21	$ 32
1.00	1.00	1.00	1.00									$ 177	$ 180	$ 184	$ 196

Table 113: Outdoor Sales Frontage Legacy Product Maintenance

Area

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.10	0.05	0.00	0.00	100	PSMH	E070	$ 337	Difficult	0.750	3,876	30	$ 34	$ 17	$ -	$ -
0.20	0.10	0.00	0.00	150	PSMH	E071	$ 314	Difficult	0.740	5,737	30	$ 63	$ 31	$ -	$ -
0.25	0.20	0.10	0.00	175	PSMH	E037	$ 614	Difficult	0.700	5,895	30	$ 154	$ 123	$ 61	$ -
0.20	0.25	0.20	0.10	250	PSMH	E073	$ 495	Difficult	0.700	9,801	34	$ 99	$ 124	$ 99	$ 50
0.15	0.20	0.20	0.15	320	PSMH	E074	$ 324	Difficult	0.700	12,571	34	$ 49	$ 65	$ 65	$ 49
0.10	0.15	0.25	0.20	400	PSMH	E075	$ 301	Difficult	0.700	17,046	38	$ 30	$ 45	$ 75	$ 60
0.00	0.05	0.15	0.25	750	PSMH	E076	$ 560	Difficult	0.700	32,399	40	$ -	$ 28	$ 84	$ 140
0.00	0.00	0.10	0.30	1000	PSMH	E077	$ 552	Difficult	0.701	49,590	46	$ -	$ -	$ 55	$ 166
1.00	1.00	1.00	1.00									$ 428	$ 433	$ 440	$ 464

Flood

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.10	0.05	0.00	0.00	100	PSMH	E126	$ 337	Difficult	0.750	5,315	41	$ 34	$ 17	$ -	$ -
0.20	0.10	0.00	0.00	150	PSMH	E127	$ 314	Difficult	0.740	7,728	41	$ 63	$ 31	$ -	$ -
0.25	0.20	0.10	0.00	175	PSMH	E078	$ 614	Difficult	0.700	8,053	41	$ 154	$ 123	$ 61	$ -
0.20	0.25	0.20	0.10	250	PSMH	E128	$ 495	Difficult	0.700	12,275	42	$ 99	$ 124	$ 99	$ 50
0.15	0.20	0.20	0.15	320	PSMH	E079	$ 324	Difficult	0.700	14,847	40	$ 49	$ 65	$ 65	$ 49
0.10	0.20	0.30	0.30	400	PSMH	E129	$ 301	Difficult	0.700	19,640	43	$ 30	$ 60	$ 90	$ 90
0.00	0.00	0.20	0.45	1000	PSMH	E130	$ 552	Difficult	0.701	42,582	39	$ -	$ -	$ 110	$ 248
1.00	1.00	1.00	1.00									$ 428	$ 420	$ 426	$ 437

Table 114: Hardscape Ornamental Lighting Legacy Product Maintenance

Decorative Area															
Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.25	0.15	0.10	0.05	50	PSMH	E132	$ 542	Moderate	0.670	584	9	$ 136	$ 81	$ 54	$ 27
0.20	0.25	0.20	0.20	70	PSMH	E133	$ 230	Moderate	0.740	928	10	$ 46	$ 58	$ 46	$ 46
0.15	0.20	0.30	0.25	100	PSMH	E134	$ 255	Moderate	0.750	1256	10	$ 38	$ 51	$ 77	$ 64
0.05	0.05	0.15	0.30	150	PSMH	E135	$ 232	Moderate	0.740	1652	9	$ 12	$ 12	$ 35	$ 70
0.20	0.15	0.10	0.05	42	CFL	E099	$ 235	Moderate	0.860	1237	27	$ 47	$ 35	$ 24	$ 12
0.15	0.20	0.15	0.15	57	CFL	E100	$ 235	Moderate	0.860	1662	27	$ 35	$ 47	$ 35	$ 35
1.00	1.00	1.00	1.00									$ 314	$ 284	$ 270	$ 253

Table 115: Building Facades Legacy Product Maintenance

Wall Mounted Full Cutoff

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.10	0.10	0.05	0.05	26	CFL	E012	$ 231	Moderate	0.858	927	33	$ 23	$ 23	$ 12	$ 12
0.15	0.10	0.10	0.05	32	CFL	E013	$ 117	Moderate	0.860	1,238	35	$ 18	$ 12	$ 12	$ 6
0.30	0.25	0.20	0.10	42	CFL	E014	$ 117	Moderate	0.860	1,651	36	$ 35	$ 29	$ 23	$ 12
0.15	0.20	0.10	0.20	50	PSMH	E023	$ 310	Moderate	0.670	1,225	18	$ 47	$ 62	$ 31	$ 62
0.15	0.20	0.15	0.10	70	PSMH	E001	$ 153	Moderate	0.740	3,253	35	$ 23	$ 31	$ 23	$ 15
0.10	0.05	0.20	0.20	100	PSMH	E025	$ 170	Moderate	0.750	2,949	23	$ 17	$ 9	$ 34	$ 34
0.05	0.05	0.15	0.20	150	PSMH	E026	$ 115	Moderate	0.740	4,364	23	$ 6	$ 6	$ 17	$ 23
0.00	0.05	0.05	0.10	250	PSMH	E042	$ 215	Moderate	0.700	4,721	16	$ -	$ 11	$ 11	$ 22
1.00	1.00	1.00	1.00									$ 168	$ 182	$ 163	$ 185

Ground Mounted Floodlight

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
1.00	0.45	0.25	0.25	100	PSMH	E038	$ 116	Easy	0.750	4,424	34	$ 116	$ 52	$ 29	$ 29
0.00	0.45	0.50	0.35	175	PSMH	E039	$ 205	Easy	0.700	7,680	39	$ -	$ 92	$ 103	$ 72
0.00	0.10	0.25	0.40	250	PSMH	E040	$ 133	Easy	0.700	10,081	35	$ -	$ 13	$ 33	$ 53
1.00	1.00	1.00	1.00									$ 116	$ 158	$ 165	$ 154

Cylindrical

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.30	0.15	0.05	0.00	50	MR16	E002	$ 393	Moderate	0.900	752	15	$ 118	$ 59	$ 20	$ -
0.30	0.15	0.10	0.05	75	MR16	E003	$ 425	Moderate	0.900	1,062	14	$ 128	$ 64	$ 43	$ 21
0.15	0.30	0.25	0.10	50	PSMH	E034	$ 310	Moderate	0.670	1,493	22	$ 47	$ 93	$ 78	$ 31
0.15	0.25	0.35	0.25	70	PSMH	E035	$ 153	Moderate	0.740	2,432	26	$ 23	$ 38	$ 54	$ 38
0.10	0.15	0.25	0.60	100	PSMH	E036	$ 170	Moderate	0.750	3,593	28	$ 17	$ 26	$ 43	$ 102
1.00	1.00	1.00	1.00									$ 332	$ 279	$ 236	$ 193

Table 116: Outdoor Sales Lots Legacy Product Maintenance

Wall Mounted

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.10	0.05	0.00	0.00	100	PSMH	E025	$ 337	Difficult	0.750	2,949	23	$ 34	$ 17	$ -	$ -
0.20	0.10	0.15	0.05	150	PSMH	E026	$ 314	Difficult	0.740	4,364	23	$ 63	$ 31	$ 47	$ 16
0.25	0.15	0.20	0.15	175	PSMH	E042	$ 614	Difficult	0.700	4,721	24	$ 153	$ 92	$ 123	$ 92
0.25	0.30	0.30	0.30	250	PSMH	E043	$ 495	Difficult	0.700	6,787	23	$ 124	$ 148	$ 148	$ 148
0.20	0.40	0.35	0.50	320	PSMH	E044	$ 324	Difficult	0.700	8,705	24	$ 65	$ 129	$ 113	$ 162
1.00	1.00	1.00	1.00									$ 438	$ 418	$ 432	$ 418

Area

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.10	0.05	0.00	0.00	100	PSMH	E070	$ 337	Difficult	0.750	3,876	30	$ 34	$ 17	$ -	$ -
0.20	0.10	0.15	0.05	150	PSMH	E048	$ 314	Difficult	0.740	7,926	42	$ 63	$ 31	$ 47	$ 16
0.25	0.15	0.20	0.15	175	PSMH	E037	$ 614	Difficult	0.700	5,895	30	$ 153	$ 92	$ 123	$ 92
0.25	0.30	0.30	0.30	250	PSMH	E073	$ 495	Difficult	0.700	9,801	34	$ 124	$ 148	$ 148	$ 148
0.20	0.40	0.35	0.50	400	PSMH	E075	$ 301	Difficult	0.700	17,046	38	$ 60	$ 121	$ 105	$ 151
1.00	1.00	1.00	1.00									$ 434	$ 409	$ 424	$ 407

Table 117: Vehicle Service Station Hardscapes Legacy Product Maintenance

Wall Mounted

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.10	0.05	0.00	0.00	100	PSMH	E025	$ 337	Difficult	0.750	2,949	23	$ 34	$ 17	$ -	$ -
0.20	0.10	0.15	0.05	150	PSMH	E026	$ 314	Difficult	0.740	4,364	23	$ 63	$ 31	$ 47	$ 16
0.25	0.15	0.20	0.15	175	PSMH	E042	$ 614	Difficult	0.700	4,721	24	$ 153	$ 92	$ 123	$ 92
0.25	0.30	0.30	0.30	250	PSMH	E043	$ 495	Difficult	0.700	6,787	23	$ 124	$ 148	$ 148	$ 148
0.20	0.40	0.35	0.50	320	PSMH	E044	$ 324	Difficult	0.700	8,705	24	$ 65	$ 129	$ 113	$ 162
1.00	1.00	1.00	1.00									$ 438	$ 418	$ 432	$ 418

Area

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.10	0.05	0.00	0.00	100	PSMH	E070	$ 337	Difficult	0.750	3,876	30	$ 34	$ 17	$ -	$ -
0.20	0.10	0.15	0.05	150	PSMH	E048	$ 314	Difficult	0.740	7,926	42	$ 63	$ 31	$ 47	$ 16
0.25	0.15	0.20	0.15	175	PSMH	E037	$ 614	Difficult	0.700	5,895	30	$ 153	$ 92	$ 123	$ 92
0.25	0.30	0.30	0.30	250	PSMH	E073	$ 495	Difficult	0.700	9,801	34	$ 124	$ 148	$ 148	$ 148
0.20	0.40	0.35	0.50	400	PSMH	E075	$ 301	Difficult	0.700	17,046	38	$ 60	$ 121	$ 105	$ 151
1.00	1.00	1.00	1.00									$ 434	$ 409	$ 424	$ 407

Table 118: Vehicle Service Station-Canopies Legacy Product Maintenance

Downlight															
Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.15	0.15	0.05	0.05	70	PSMH	E049	$ 230	Moderate	0.740	2,234	24	$ 35	$ 35	$ 12	$ 12
0.20	0.20	0.20	0.10	100	PSMH	E050	$ 255	Moderate	0.750	3,683	29	$ 51	$ 51	$ 51	$ 26
0.30	0.25	0.20	0.10	175	PSMH	E058	$ 382	Moderate	0.700	5,584	28	$ 115	$ 96	$ 76	$ 38
0.35	0.40	0.55	0.75	250	PSMH	E059	$ 287	Moderate	0.700	8,028	28	$ 100	$ 115	$ 158	$ 215
1.00	1.00	1.00	1.00									$ 301	$ 296	$ 297	$ 290

Recessed Downlights, Fresnel Lens															
Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.00	0.00	(2) 32	CFL	E051	$ 117	Moderate	0.860	1,876	28	$ 6	$ 6	$ -	$ -
0.05	0.05	0.05	0.05	(2) 42	CFL	E052	$ 117	Moderate	0.860	2,276	24	$ 6	$ 6	$ 6	$ 6
0.00	0.05	0.10	0.10	(2) 57	CFL	E053	$ 117	Moderate	0.860	2,800	22	$ -	$ 6	$ 12	$ 12
0.10	0.05	0.00	0.00	50	PSMH	E054	$ 310	Moderate	0.670	1,337	20	$ 31	$ 15	$ -	$ -
0.20	0.10	0.05	0.05	70	PSMH	E055	$ 153	Moderate	0.740	2,177	24	$ 31	$ 15	$ 8	$ 8
0.25	0.20	0.10	0.10	100	PSMH	E056	$ 170	Moderate	0.750	3,216	25	$ 43	$ 34	$ 17	$ 17
0.35	0.50	0.70	0.70	150	PSMH	E057	$ 155	Moderate	0.740	4,759	25	$ 54	$ 77	$ 108	$ 108
1.00	1.00	1.00	1.00									$ 170	$ 160	$ 151	$ 151

Table 119: Sales Canopies Legacy Product Maintenance

Downlight															
Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.05	0.00	0.00	0.00	13	CFL	E004	$ 235	Moderate	0.855	476	30	$ 12	$ -	$ -	$ -
0.05	0.05	0.00	0.00	18	CFL	E005	$ 235	Moderate	0.856	693	35	$ 12	$ 12	$ -	$ -
0.05	0.05	0.05	0.00	26	CFL	E027	$ 231	Moderate	0.858	696	25	$ 12	$ 12	$ 12	$ -
0.10	0.05	0.05	0.05	32	CFL	E028	$ 117	Moderate	0.860	930	27	$ 12	$ 6	$ 6	$ 6
0.10	0.10	0.05	0.05	42	CFL	E029	$ 117	Moderate	0.860	1,240	27	$ 12	$ 12	$ 6	$ 6
0.15	0.10	0.10	0.10	(2) 32	CFL	E051	$ 234	Moderate	0.860	1,876	28	$ 35	$ 23	$ 23	$ 23
0.15	0.10	0.10	0.10	(2) 42	CFL	E052	$ 234	Moderate	0.860	2,276	24	$ 35	$ 23	$ 23	$ 23
0.05	0.05	0.05	0.10	(2) 57	CFL	E053	$ 344	Difficult	0.860	2,800	22	$ 17	$ 17	$ 17	$ 34
0.15	0.05	0.05	0.05	50	PSMH	E054	$ 310	Moderate	0.670	1,337	20	$ 47	$ 16	$ 16	$ 16
0.10	0.15	0.15	0.05	70	PSMH	E055	$ 153	Moderate	0.740	2,177	24	$ 15	$ 23	$ 23	$ 8
0.05	0.15	0.15	0.10	100	PSMH	E056	$ 170	Moderate	0.750	3,216	25	$ 9	$ 26	$ 26	$ 17
0.00	0.10	0.10	0.15	150	PSMH	E057	$ 209	Difficult	0.740	4,759	25	$ -	$ 21	$ 21	$ 31
0.00	0.05	0.10	0.15	175	PSMH	E058	$ 368	Difficult	0.700	5,584	28	$ -	$ 18	$ 37	$ 55
0.00	0.00	0.05	0.10	250	PSMH	E059	$ 297	Difficult	0.700	8,028	28	$ -	$ -	$ 15	$ 30
1.00	1.00	1.00	1.00									$ 216	$ 208	$ 224	$ 249

Recessed Linear Fluorescent															
Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.10	0.10	0.05	0.05	25	T8	E119	$ 27	Moderate	0.921	1,640	63	$ 3	$ 3	$ 1	$ 1
0.15	0.10	0.05	0.05	32	T8	E121	$ 28	Moderate	0.949	2,240	68	$ 4	$ 3	$ 1	$ 1
0.15	0.10	0.15	0.10	(2) 32	T8	E118	$ 56	Moderate	0.949	3,092	47	$ 8	$ 6	$ 8	$ 6
0.10	0.10	0.10	0.05	21	T5	E120	$ 59	Moderate	0.952	2,210	88	$ 6	$ 6	$ 6	$ 3
0.15	0.10	0.10	0.05	28	T5	E114	$ 58	Moderate	0.948	2,006	65	$ 9	$ 6	$ 6	$ 3
0.10	0.10	0.10	0.10	(2) 21	T5	E123	$ 118	Moderate	0.952	2,677	54	$ 12	$ 12	$ 12	$ 12
0.15	0.10	0.15	0.15	(2) 28	T5	E117	$ 116	Moderate	0.948	3,642	59	$ 17	$ 12	$ 17	$ 17
0.05	0.10	0.15	0.15	54	T5HO	E122	$ 57	Moderate	0.950	3,800	61	$ 3	$ 6	$ 9	$ 9
0.05	0.10	0.10	0.15	(2) 39	T5HO	E124	$ 118	Moderate	0.950	4,452	54	$ 6	$ 12	$ 12	$ 18
0.00	0.10	0.05	0.15	(2) 54	T5HO	E125	$ 114	Moderate	0.950	7,600	61	$ -	$ 11	$ 6	$ 17
1.00	1.00	1.00	1.00									$ 68	$ 75	$ 78	$ 87

Table 120: Non-Sales Canopies and Pedestrian Tunnels Legacy Product Maintenance

Downlight

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.20	0.15	0.10	0.05	13	CFL	E004	$ 273	Moderate	0.855	476	30	$ 55	$ 41	$ 27	$ 14
0.20	0.20	0.15	0.05	18	CFL	E005	$ 273	Moderate	0.856	693	35	$ 55	$ 55	$ 41	$ 14
0.20	0.20	0.15	0.10	26	CFL	E027	$ 273	Moderate	0.858	696	25	$ 55	$ 55	$ 41	$ 27
0.10	0.10	0.15	0.15	32	CFL	E028	$ 164	Moderate	0.860	930	27	$ 16	$ 16	$ 25	$ 25
0.05	0.10	0.15	0.20	42	CFL	E029	$ 164	Moderate	0.860	1,240	27	$ 8	$ 16	$ 25	$ 33
0.10	0.05	0.05	0.05	50	PSMH	E054	$ 273	Moderate	0.670	1,337	20	$ 27	$ 14	$ 14	$ 14
0.10	0.05	0.10	0.10	70	PSMH	E049	$ 109	Moderate	0.740	2,234	24	$ 11	$ 5	$ 11	$ 11
0.05	0.10	0.10	0.15	100	PSMH	E050	$ 164	Difficult	0.750	3,683	29	$ 8	$ 16	$ 16	$ 25
0.00	0.05	0.05	0.15	150	PSMH	E057	$ 164	Difficult	0.740	4,759	25	$ -	$ 8	$ 8	$ 25
1.00	1.00	1.00	1.00									$ 234	$ 226	$ 207	$ 185

Recessed Linear Fluorescent

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.05	0.05	25	T8	E119	$ 55	Moderate	0.921	1,640	63	$ 3	$ 3	$ 3	$ 3
0.20	0.15	0.15	0.10	32	T8	E121	$ 55	Moderate	0.949	2,240	68	$ 11	$ 8	$ 8	$ 5
0.20	0.20	0.20	0.15	(2) 32	T8	E118	$ 109	Moderate	0.949	3,092	47	$ 22	$ 22	$ 22	$ 16
0.05	0.05	0.05	0.05	21	T5	E120	$ 109	Moderate	0.952	2,210	88	$ 5	$ 5	$ 5	$ 5
0.20	0.15	0.15	0.10	28	T5	E114	$ 109	Moderate	0.948	2,006	65	$ 22	$ 16	$ 16	$ 11
0.05	0.10	0.05	0.05	(2) 21	T5	E123	$ 218	Moderate	0.952	2,677	54	$ 11	$ 22	$ 11	$ 11
0.20	0.20	0.20	0.15	(2) 28	T5	E117	$ 218	Moderate	0.948	3,642	59	$ 44	$ 44	$ 44	$ 33
0.00	0.00	0.05	0.10	54	T5HO	E122	$ 109	Moderate	0.950	3,800	61	$ -	$ -	$ 5	$ 11
0.00	0.00	0.00	0.05	(2) 39	T5HO	E124	$ 218	Moderate	0.950	4,452	54	$ -	$ -	$ -	$ 11
0.00	0.00	0.00	0.10	(2) 54	T5HO	E125	$ 218	Moderate	0.950	7,600	61	$ -	$ -	$ -	$ 22
0.95	0.90	0.90	0.90									$ 117	$ 120	$ 114	$ 128

Gasketed Linear Fluorescent

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.05	0.05	17	T8	E082	$ 55	Moderate	0.929	1,037	55	$ 3	$ 3	$ 3	$ 3
0.20	0.15	0.15	0.10	32	T8	E085	$ 55	Moderate	0.949	2,104	64	$ 11	$ 8	$ 8	$ 5
0.05	0.10	0.05	0.05	(2) 17	T8	E088	$ 109	Moderate	0.929	2,074	55	$ 5	$ 11	$ 5	$ 5
0.20	0.20	0.20	0.15	(2) 32	T8	E091	$ 109	Moderate	0.949	4,208	64	$ 22	$ 22	$ 22	$ 16
0.05	0.05	0.05	0.05	14	T5	E081	$ 109	Moderate	0.944	859	51	$ 5	$ 5	$ 5	$ 5
0.20	0.15	0.15	0.10	28	T5	E084	$ 109	Moderate	0.948	1,853	60	$ 22	$ 16	$ 16	$ 11
0.05	0.10	0.05	0.05	(2) 14	T5	E087	$ 218	Moderate	0.944	1,719	51	$ 11	$ 22	$ 11	$ 11
0.20	0.20	0.20	0.15	(2) 28	T5	E090	$ 218	Moderate	0.948	4,133	67	$ 44	$ 44	$ 44	$ 33
0.00	0.00	0.05	0.05	24	T5HO	E083	$ 109	Moderate	0.950	1,427	53	$ -	$ -	$ 5	$ 5
0.00	0.00	0.05	0.10	54	T5HO	E086	$ 109	Moderate	0.950	3,569	58	$ -	$ -	$ 5	$ 11
0.00	0.00	0.00	0.05	(2) 24	T5HO	E089	$ 218	Moderate	0.950	2,561	47	$ -	$ -	$ -	$ 11
0.00	0.00	0.00	0.10	(2) 54	T5HO	E092	$ 218	Moderate	0.950	5,453	44	$ -	$ -	$ -	$ 22
1.00	1.00	1.00	1.00									$ 123	$ 131	$ 125	$ 139

Table 121: Guard Station Legacy Product Maintenance

Wall Pack

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.20	0.10	0.05	0.05	26	CFL	E020	$ 404	Moderate	0.858	709	25	$ 81	$ 40	$ 20	$ 20
0.25	0.15	0.05	0.05	32	CFL	E021	$ 234	Moderate	0.860	947	27	$ 58	$ 35	$ 12	$ 12
0.25	0.20	0.10	0.05	42	CFL	E022	$ 235	Moderate	0.860	1,262	27	$ 59	$ 47	$ 23	$ 12
0.15	0.25	0.25	0.15	70	PSMH	E024	$ 230	Moderate	0.740	1,996	22	$ 34	$ 57	$ 57	$ 34
0.10	0.15	0.25	0.20	100	PSMH	E025	$ 337	Difficult	0.750	2,949	23	$ 34	$ 51	$ 84	$ 67
0.05	0.10	0.15	0.20	150	PSMH	E026	$ 314	Difficult	0.740	4,364	23	$ 16	$ 31	$ 47	$ 63
0.00	0.05	0.10	0.20	175	PSMH	E042	$ 614	Difficult	0.700	4,721	24	$ -	$ 31	$ 61	$ 123
0.00	0.00	0.05	0.10	250	PSMH	E043	$ 495	Difficult	0.700	6,787	23	$ -	$ -	$ 25	$ 49
1.00	1.00	1.00	1.00									$ 282	$ 292	$ 330	$ 380

Area

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.00	0.00	18	CFL	E104	$ 411	Moderate	0.856	746	37	$ 21	$ 21	$ -	$ -
0.20	0.10	0.05	0.05	26	CFL	E105	$ 404	Moderate	0.858	1,077	38	$ 81	$ 40	$ 20	$ 20
0.20	0.15	0.05	0.05	32	CFL	E106	$ 234	Moderate	0.860	1,440	41	$ 47	$ 35	$ 12	$ 12
0.25	0.20	0.10	0.05	42	CFL	E107	$ 235	Moderate	0.860	1,920	42	$ 59	$ 47	$ 23	$ 12
0.15	0.20	0.25	0.15	70	PSMH	E069	$ 311	Difficult	0.740	2,623	29	$ 47	$ 62	$ 78	$ 47
0.10	0.15	0.25	0.20	100	PSMH	E070	$ 337	Difficult	0.750	3,876	30	$ 34	$ 51	$ 84	$ 67
0.05	0.10	0.15	0.20	150	PSMH	E071	$ 314	Difficult	0.740	5,737	30	$ 16	$ 31	$ 47	$ 63
0.00	0.05	0.10	0.20	175	PSMH	E037	$ 614	Difficult	0.700	5,895	30	$ -	$ 31	$ 61	$ 123
0.00	0.00	0.05	0.10	250	PSMH	E073	$ 495	Difficult	0.700	9,801	34	$ -	$ -	$ 25	$ 49
1.00	1.00	1.00	1.00									$ 303	$ 318	$ 351	$ 393

Floodlight

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.40	0.35	0.20	0.20	100	PSMH	E126	$ 337	Difficult	0.750	5,315	41	$ 135	$ 118	$ 67	$ 67
0.25	0.25	0.25	0.25	150	PSMH	E127	$ 314	Difficult	0.740	7,728	41	$ 79	$ 79	$ 79	$ 79
0.20	0.20	0.30	0.25	175	PSMH	E078	$ 614	Difficult	0.700	8,053	41	$ 123	$ 123	$ 184	$ 153
0.15	0.20	0.25	0.30	250	PSMH	E016	$ 495	Difficult	0.700	9,660	33	$ 74	$ 99	$ 124	$ 148
1.00	1.00	1.00	1.00									$ 410	$ 418	$ 454	$ 448

Table 122: Student Pick Up Legacy Product Maintenance

Downlight

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.10	0.10	0.05	0.00	32	CFL	E095	$ 58	Moderate	0.860	940	27	$ 6	$ 6	$ 3	$ -
0.25	0.10	0.05	0.05	42	CFL	E096	$ 59	Moderate	0.860	1,254	27	$ 15	$ 6	$ 3	$ 3
0.25	0.20	0.20	0.10	70	PSMH	E097	$ 77	Moderate	0.740	1,895	21	$ 19	$ 15	$ 15	$ 8
0.15	0.20	0.20	0.25	100	PSMH	E098	$ 112	Difficult	0.750	2,801	22	$ 17	$ 22	$ 22	$ 28
0.15	0.20	0.25	0.30	150	PSMH	E057	$ 105	Difficult	0.740	4,759	25	$ 16	$ 21	$ 26	$ 31
0.10	0.20	0.25	0.30	175	PSMH	E058	$ 123	Difficult	0.700	5,584	28	$ 12	$ 25	$ 31	$ 37
1.00	1.00	1.00	1.00									$ 84	$ 95	$ 100	$ 107

Wall Pack

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.10	0.10	0.05	0.00	26	CFL	E020	$ 115	Moderate	0.858	709	25	$ 12	$ 12	$ 6	$ -
0.15	0.10	0.10	0.05	32	CFL	E021	$ 58	Moderate	0.860	947	27	$ 9	$ 6	$ 6	$ 3
0.20	0.15	0.10	0.10	42	CFL	E022	$ 59	Moderate	0.860	1,262	27	$ 12	$ 9	$ 6	$ 6
0.25	0.20	0.15	0.10	70	PSMH	E024	$ 77	Moderate	0.740	1,996	22	$ 19	$ 15	$ 11	$ 8
0.15	0.25	0.15	0.15	100	PSMH	E025	$ 112	Difficult	0.750	2,949	23	$ 17	$ 28	$ 17	$ 17
0.10	0.15	0.25	0.20	150	PSMH	E026	$ 105	Difficult	0.740	4,364	23	$ 10	$ 16	$ 26	$ 21
0.05	0.05	0.15	0.25	175	PSMH	E042	$ 123	Difficult	0.700	4,721	24	$ 6	$ 6	$ 18	$ 31
0.00	0.00	0.05	0.15	250	PSMH	E043	$ 99	Difficult	0.700	6,787	23	$ -	$ -	$ 5	$ 15
1.00	1.00	1.00	1.00									$ 85	$ 91	$ 95	$ 100

Area

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.05	0.05	0.00	0.00	18	CFL	E104	$ 117	Moderate	0.856	746	37	$ 6	$ 6	$ -	$ -
0.05	0.05	0.05	0.00	26	CFL	E105	$ 115	Moderate	0.858	1,077	38	$ 6	$ 6	$ 6	$ -
0.10	0.10	0.10	0.05	32	CFL	E106	$ 58	Moderate	0.860	1,440	41	$ 6	$ 6	$ 6	$ 3
0.20	0.15	0.20	0.10	42	CFL	E107	$ 59	Moderate	0.860	1,920	42	$ 12	$ 9	$ 12	$ 6
0.30	0.20	0.20	0.15	50	PSMH	E045	$ 209	Difficult	0.670	2,257	34	$ 63	$ 42	$ 42	$ 31
0.20	0.20	0.20	0.25	70	PSMH	E046	$ 104	Difficult	0.740	3,675	40	$ 21	$ 21	$ 21	$ 26
0.05	0.15	0.15	0.25	100	PSMH	E047	$ 112	Difficult	0.750	5,431	42	$ 6	$ 17	$ 17	$ 28
0.05	0.10	0.10	0.20	150	PSMH	E048	$ 105	Difficult	0.740	8,037	42	$ 5	$ 10	$ 10	$ 21
1.00	1.00	1.00	1.00									$ 124	$ 116	$ 113	$ 115

Table 123: Outdoor Dining Legacy Product Maintenance

Area															
Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.15	0.10	0.05	0.00	15	B10	E108	$ 867	Easy	0.82	78	5	$ 130	$ 87	$ 43	$ -
0.20	0.10	0.05	0.05	25	B10	E109	$ 877	Easy	0.82	180	7	$ 175	$ 88	$ 44	$ 44
0.25	0.30	0.30	0.20	40	B10	E110	$ 881	Easy	0.82	303	8	$ 220	$ 264	$ 264	$ 176
0.20	0.30	0.35	0.40	15	G16	E111	$ 866	Easy	0.82	86	6	$ 173	$ 260	$ 303	$ 347
0.20	0.10	0.05	0.05	25	G16	E112	$ 866	Easy	0.82	246	10	$ 173	$ 87	$ 43	$ 43
0.00	0.10	0.20	0.30	40	G16	E113	$ 893	Easy	0.82	77	2	$ -	$ 89	$ 179	$ 268
1.00	1.00	1.00	1.00									$ 872	$ 874	$ 877	$ 878

Table 124: Special Security for Retail and Pedestrian Hardscape Legacy Product Maintenance

Wall Pack

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.25	0.15	0.10	0.10	26	CFL	E020	$ 404	Moderate	0.858	709	25	$ 101	$ 61	$ 40	$ 40
0.25	0.25	0.15	0.15	32	CFL	E021	$ 234	Moderate	0.860	947	27	$ 58	$ 58	$ 35	$ 35
0.25	0.25	0.20	0.15	42	CFL	E022	$ 235	Moderate	0.860	1,262	27	$ 59	$ 59	$ 47	$ 35
0.10	0.15	0.15	0.10	70	PSMH	E024	$ 311	Difficult	0.740	1,996	22	$ 31	$ 47	$ 47	$ 31
0.10	0.10	0.20	0.15	100	PSMH	E025	$ 337	Difficult	0.750	2,949	23	$ 34	$ 34	$ 67	$ 51
0.05	0.10	0.15	0.20	150	PSMH	E026	$ 314	Difficult	0.740	4,364	23	$ 16	$ 31	$ 47	$ 63
0.00	0.00	0.05	0.10	175	PSMH	E042	$ 614	Difficult	0.700	4,721	24	$ -	$ -	$ 31	$ 61
0.00	0.00	0.00	0.05	250	PSMH	E043	$ 495	Difficult	0.700	6,787	23	$ -	$ -	$ -	$ 25
1.00	1.00	1.00	1.00									$ 298	$ 289	$ 314	$ 341

Area

Weighting				2008 Basis of Design								Weighted Maintenance			
LZ1	LZ2	LZ3	LZ4	Lamp Wattage	Lamp Type	Luminaire	15-year Maintenance Cost	Maintenance Access	Luminaire Lumen Depreciation (LLD)	Maintained Luminaire Lumens	Lumens per Watt (LPW)	LZ1	LZ2	LZ3	LZ4
0.10	0.10	0.05	0.00	18	CFL	E104	$ 411	Moderate	0.856	746	37	$ 41	$ 41	$ 21	$ -
0.25	0.15	0.10	0.10	26	CFL	E105	$ 404	Moderate	0.858	1,077	38	$ 101	$ 61	$ 40	$ 40
0.20	0.20	0.15	0.15	32	CFL	E106	$ 234	Moderate	0.860	1,440	41	$ 47	$ 47	$ 35	$ 35
0.20	0.25	0.15	0.15	42	CFL	E107	$ 235	Moderate	0.860	1,920	42	$ 47	$ 59	$ 35	$ 35
0.10	0.15	0.15	0.10	70	PSMH	E069	$ 311	Difficult	0.740	2,623	29	$ 31	$ 47	$ 47	$ 31
0.10	0.10	0.20	0.15	100	PSMH	E070	$ 337	Difficult	0.750	3,876	30	$ 34	$ 34	$ 67	$ 51
0.05	0.05	0.15	0.20	150	PSMH	E071	$ 314	Difficult	0.740	5,737	30	$ 16	$ 16	$ 47	$ 63
0.00	0.00	0.05	0.10	175	PSMH	E037	$ 614	Difficult	0.700	5,895	30	$ -	$ -	$ 31	$ 61
0.00	0.00	0.00	0.05	250	PSMH	E073	$ 495	Difficult	0.700	9,801	34	$ -	$ -	$ -	$ 25
1.00	1.00	1.00	1.00									$ 316	$ 303	$ 323	$ 341

Appendix G: NARROW BAND LED LUMINAIRE EFFICACY COMPARISON

Table 125 provides a comparison of various 3000K white light LED luminaires with the equivalent narrow band spectrum LED luminaire as offered by each manufacturer. Each of the narrow band spectrum sources were shown to meet the appropriate CALGreen requirements.

Table 125: Narrow Band LED Luminaires Comparison

Type	3000K White Light Luminaire			Narrow Band LED luminaire			
	ID	Lumens	Lm/W	ID	Lumens	Lm/W	BUG Rating
Area	W01	3863	84	A01	3090	67	not documented
Area	W02	6197	84	A02	4958	67	not documented
Area	W07	9375	105	A07	1491	16	B0-U0-G1
Area	W08	7354	107	A08	1177	17	B0-U0-G0
Area	W09	5330	99	A09	853	16	B0-U0-G0
Area	W10	6178	110	A10	1533	51	B1-U0-G0
Area	W11	6178	110	A11	2276	57	B1-U0-G1
Area	W12	6178	110	A12	3452	66	B1-U0-G1
Area	W23	3777	59	A23	3081	32	not documented
Area	W24	2833	59	A24	1541	32	not documented
Area	W25	5240	79	A25	5312	33	not documented
Bollard	W03	888	44	A03	374	19	B0-U0-G1
Bollard	W05	729	48	A05	656	44	B0-U0-G1
Bollard	W13	1083	70	A13	239	21	B0-U0-G0
Ingrade	W19	155	52	A19	73	24	not documented
Linear	W20	149	50	A20	144	48	not documented
Pathway (Puck)	W21	14	14	A21	14	14	B0-U1-G0
Tape	W15	64	25	A15	37	14	B0-U1-G0
Tape	W16	380	32	A16	64	8	not documented
Tape	W17	490	43	A17	174	22	not documented
Wall	W22	840	93	A22	299	43	not documented

The average difference in efficacies of warm white light LED luminaires and narrow band LED luminaires was determined in Table 126. The total efficacy ratio was used to determine an appropriate LPA multiplier for use when narrow band spectrum luminaires are required.

Table 126: Average Efficacies of White Light Luminaires Compared to Narrow Band LED Luminaires

	Average 3000K Efficacy (lm/W)	Average Narrow Band Efficacy (lm/W)	3000K: Narrow Band Efficacy
Area Light	92	41	222%
Area Light[1] Excluding Luminaires 09-11	87	51	171%
Bollard	54	28	196%
Ingrade	52	24	212%
Linear	50	48	103%
Pathway (puck light)	14	14	100%
Wall Mounted	93	43	219%
Tape Light	33	15	225%
Total	**49**	**29**	**182%**

[1]Area Light Excluding Luminaires 09-11 is shown for reference only. This value is not considered in the total 3000K: Narrow Band Efficacy.

Appendix H: General Hardscape Statewide Savings Assumptions

The following is an excerpt from the 2016 Nonresidential Outdoor Lighting Power Allowance CASE Study that explains how the assumptions were developed to translate indoor construction forecasts to General Hardscape.

-----Start of Excerpt-----

Since the outdoor hardscape is not estimated as part of the construction forecasts, statewide impacts must be completed by making proxies with reasonable estimates of the relationship of the line item to the potential gross square footage of indoor spaces associated with the measure.

In effect, the estimates relate the unit of the measure (square foot of hardscape), with an equivalent unit of gross interior space, which can then be projected using the construction forecasts. Most measure line items only apply to certain building types (retail or small office, for example), and this is taken into account as well.

The process to develop the relationship of General Hardscape square footage to building gross square footage for statewide construction estimates is as follows:

1. Establish the square footage of a parking space (which will be the basic unit of comparison because of the code use of minimum spaces per square foot).
2. Determine any modifications to the basic unit required for specific building types to accommodate specific design requirements. This is primarily to adjust for warehouse buildings.
3. Determine the basic parking requirements for the listed building types in the construction forecasts.
4. Create a table of adjustment factors to apply to the respective building types, normalizing the value back to a single square footage unit to make the calculations work in a direct manner.

Step #1: Establish 'per space' Square Footage

The Statewide CASE Team first established the approximate square footage of hardscape associated with a single parking space, using the following assumptions that are based on general design documents and traditional design standards:

- Each parking space is approximately 144 square feet (8 feet by 18 feet).
- There is a drive lane to gain access to the space, and the minimum amount is one-half of the drive lane directly in front of the parking space. This adds 80 square feet (8 feet by 10 feet).
- The parking is only 'funded' to 75 percent on-site. This reduces the vehicle hardscape from 224 square feet to 168 square feet. There are many reasons this may occur, including trade-offs with mass transit, on-street parking, garage space parking, etc. Many municipalities permit trades of this kind. The actual amount is unclear, so this adjustment is an estimate based on reasonable expectations.
- There is vehicular hardscape that is not specifically associated with the parking lot. This adds 40 square feet per space. This constitutes all of the hardscape on a site that is oriented to vehicles, but not specifically included in the parking space requirements that the municipalities are establishing, including loading docks, access drives, pick-up and drop-off zones, etc. However, warehouse buildings have a large requirement for loading dock and access hardscape that is underrepresented in this without increasing this value to 1,800 square feet.
- There is hardscape that is not vehicle oriented that must be included. This constitutes all the rest of the hardscape on a site, and includes sidewalks required to gain access to the building. The non-vehicular hardscape adds 40 square feet to the hardscape per space.

This results in a net of 250 square feet of hardscape per parking space for the basic Parking Space unit.

Step #2: Modifications for Specific Building Types

The majority of building types in the construction forecasts can use the 250 square feet per space estimate. However, warehouses are an exception to this and need adjustment to these values.

- Parking space - 144 square feet.
- Drive lane - 80 square feet.
- The parking is only 'funded' to 75 percent on-site - 168 square feet.
- Other vehicular hardscape - Warehouse buildings have a large requirement for loading dock and access hardscape that is underrepresented without using a much higher hardscape value because the number of people in the buildings is low relative to the size of the building and the large vehicles on the site. Based on reasonable estimates, this addition should be 390 square feet.
- Non-vehicular hardscape - 40 square feet.

This results in a net of 600 square feet of hardscape per parking space for warehouses. This will be applied as an adjustment multiplier in step #4.

Step #3: Determine General Parking Requirements

The general hardscape square footage values are based on the requirements for parking spaces in various building development codes. These vary depending on the building density and location; how urban or suburban the region is. The parking space requirements also vary depending on the use of the building, and other variables. Figure 38 provides information from three metropolitan areas that show the range of minimum parking space accommodation requirements in the local building standards (NRC2013), (MTC2012), (LADBS2013).

	Parking Space Minimums (One space Per...)								
Metro Region	Office	Retail	Restaurant	Mixed Use	Warehouse	Hotel	Industrial	School	College
Los Angeles Area[1.]	500sf	250sf	100sf	-	500sf up to 10,000sf, 5,000sf after		500sf	Classroom (elementary)	5 seats (classroom)
San Diego Area[2.]	250sf to 330sf	200sf to 1,000sf	70sf to 1,000sf	-	1,000sf	Each hotel room, and Per 100sf convention space	400sf to 650sf	.5 Classroom (elementary), 5 students (high school)	-
Bay Area Metro Region[3.]	200sf to 400sf	200sf to 500sf	-	500sf to 1,000sf	1,000sf	-	-	-	-

1. *Los Angeles City Department of Bulding and Safety, 2013. P/ZC 2002-011.*
2. *Dan Diego Municipal Code, 2009. Chapter 4: General Regulations.*
3. *Survey of Bay Area Cities' Parking Requirements: Summary Report. Includes cities in Alameda, Contra Costa, Napa, San Mateo, Santa Clara, Solano, and Sonoma counties.*

Figure 13: Parking Space Requirements for Various Metropolitan Regions

Using reasonable estimates from the wide range of parking space requirements, the minimums were translated into reasonable single values for individual building types that match the construction estimate forecasts. These values are shown in Figure 14.

	Representative Code-Collected Parking Minimums (One space per)								
	Office, LG & SM	Retail	Restaurant	Food (Grocery)	Warehouse, Ref & NR	Hotel	School	College	Other
Value Employed	250sf	360sf	250sf	250sf	2,000sf	360sf	360sf	250sf	360sf

Figure 14: Representative Code Parking Space Requirements Employed

These values were grouped into three basic groups; 250ft^2, 360ft^2, and 2,000ft^2. These will also be applied as adjustment multiplier in step #4.

Step #4: Create a Table of Adjustment Factors.

The best method to apply general hardscape to each building type is to determine a single unit of adjustment and apply that unit to the construction square footage uniformly if possible.

In this case, the unit selected is a single Parking Space, which represents 250 square feet of hardscape, as was determined in Step #1.

However, since some building types require more square footage per space, and the various buildings have different densities for the spaces, a table must be developed to adjust this unit for the specifics of the individual building types.

Figure 15 below provides this table and represents the process for making the adjustments to the influence factors that are applied in the statewide impacts calculations.

	Area Multipliers to Apply to Building Types (Using 250sf as Basic Unit)						
	Basic Parking Unit	Adjustment for Site Differences		Adjustment for Code Requirement Differences		Final Value	**Converted Into "Basic (250sf) Parking Units"**
		S. F. Per Space Required	Adjustment	Per Space Min. Required	Adjustment		
Parking Space for Office, Grocery, Restaurant, College Building Types	250sf	---	---	250sf	1	250sf	**1**
Parking Space for Retail, Hotel, School, Other Building Types	250sf	---	----	360sf	0.7	360sf	**0.7**
Parking Space for Warehouse, REF & NR	250sf	600sf	2.4	2,000sf	0.125	830sf	**0.3**

Figure 15: Parking Space Area Multipliers Applied in Statewide Calculations

As a result, the energy savings in the first row of building types are applied at the rate of 250 square feet of hardscape for each 250 square feet of gross building area. The second row of building types savings are applied at the rate of 250 square feet of hardscape to 360 square feet of gross building area. Warehouse savings are applied at the rate of 250 square feet for every 830 square feet of warehouse gross area, which is equivalent to 600 square feet of hardscape in 2,000 square feet for warehouse.

Appendix I: Specific Applications Statewide Savings Assumptions

The majority of the statewide savings assumptions for Table 140.7-B Specific Applications were taken from the 2016 Nonresidential Outdoor Lighting Power Allowance CASE Report. However, the Statewide CASE Team performed additional analyses to refine some of the assumptions. Specifically, the Statewide CASE Team examined Building Facades, Outdoor Sales Lots, Outdoor Sales Frontage, Vehicle Service Station Canopies, and Vehicle Service Station Hardscape.

Building Façade

The Statewide CASE Team calculated new statewide savings after refining the assumptions for Building Façades. The following equation was developed and used to determine the illuminated façade wall area to floor ratio:

$$weighted\ wall\ to\ floor\ ratio\ (\%) * fraction\ of\ buildings\ lit * fraction\ of\ walls\ lit = illuminated\ facade\ wall\ area\ to\ floor\ ratio$$

The Statewide CASE Team used 2016 Census floorspace data from the Commercial Buildings Energy Consumption Survey (CBECS) to determine the weighted wall to floor ratio. This analysis was completed by examining the number buildings (split into categories of square footage and number of floors) and total floorspace (also split by square footage and number of floors). The total floorspace was divided by the total number of buildings and average number of floors to create an average floorspace per floor (for each category of square footage and number of floors). A floor height (assumed average of 12 feet) was multiplied by a 2-to-1 floor to wall aspect ratio and divided by the square root of the average floorspace per floor (also multiplied by the 2-to-1 floor to wall aspect ratio) to give the wall area to floor ratio (by square footage and number of floors). Each of the wall area to floor ratios was then weighted by total floorspace and summed to produce the weighted wall to floor ratio.

The fraction of buildings lit assumption is based on a lighting project and observations at the University of California, Berkeley campus; the assumption is that approximately eight percent of buildings have façade lighting.

The fraction of walls lit is an assumption on the percent of building walls (on one building) that are lit based on the experience of lighting designers. The Statewide CASE Team assumed that 37.5 percent of building walls (on one building) are lit; this translates to roughly one to two sides of a building is generally lit.

All three of these variables are combined to produce the illuminated façade wall area to floor ratio of 1.22 percent; i.e. for every 100 square feet newly constructed indoor space, there is approximately 1.22 square feet of building façade space constructed. The statewide savings assumptions were adjusted to match this ratio. See Table 37 for the updated assumptions.

Outdoor Sales Lots and Outdoor Sales Frontage

The Statewide CASE Team modeled a medium and large sized auto dealership lot to help refine and verify assumptions for the statewide savings estimates for Outdoor Sales Lots and Outdoor Sales Frontage. For the analysis, the Statewide CASE Team selected Lighting Zone 3 with high activity levels per IES 10th Edition Handbook (Table 34.2). The Statewide CASE Team assumed a lumen maintenance of 90 percent at 60,000 hours for luminaires that would meet the proposed 2019 LPAs and CALGreen requirements. A 90 percent dirt depreciation factor was also applied to the luminaires to achieve a total light loss factor of 0.81. The results showed that Outdoor Sales Frontage for the medium sized auto

dealership accounted for approximately 90 percent of the installed wattage while Outdoor Sales Lots only accounted for roughly 10 percent of installed wattage. Similarly, the results of the large sized auto dealership showed that despite Outdoor Sales Frontage only accounting for roughly six percent of the total area, it still contained approximately 65 percent of the installed wattage. See Figure 16 and Figure 17 for diagrams of the medium and large sized auto dealerships.

The Statewide CASE Team adjusted the assumptions to achieve the following results: Outdoor Sales Frontage accounts for approximately ten percent of Outdoor Sales Lots area and roughly 61 percent of the energy savings. See Table 37 for the updated assumptions.

Table 127: Modeled Auto Dealership Lots for Sales Lots and Sales Frontage

	Medium Sized Auto Dealership	Large Sized Auto Dealership
Sales Lot Area (square feet)	37,000	195,700
Sales Lot Perimeter (feet)	985	1,817
Sales Lot Wattage (watts)	488	4,410
Sales Frontage Area (square feet)	6,600	11,440
Sales Frontage Perimeter (feet)	819	1,354
Sales Frontage Wattage (watts)	4,434	8,132
Ratio of Frontage to Lot area	17.84%	5.85%
Total Wattage (watts)	4922	12,542
Ratio of Frontage to Lot wattage	90.09%	64.84%

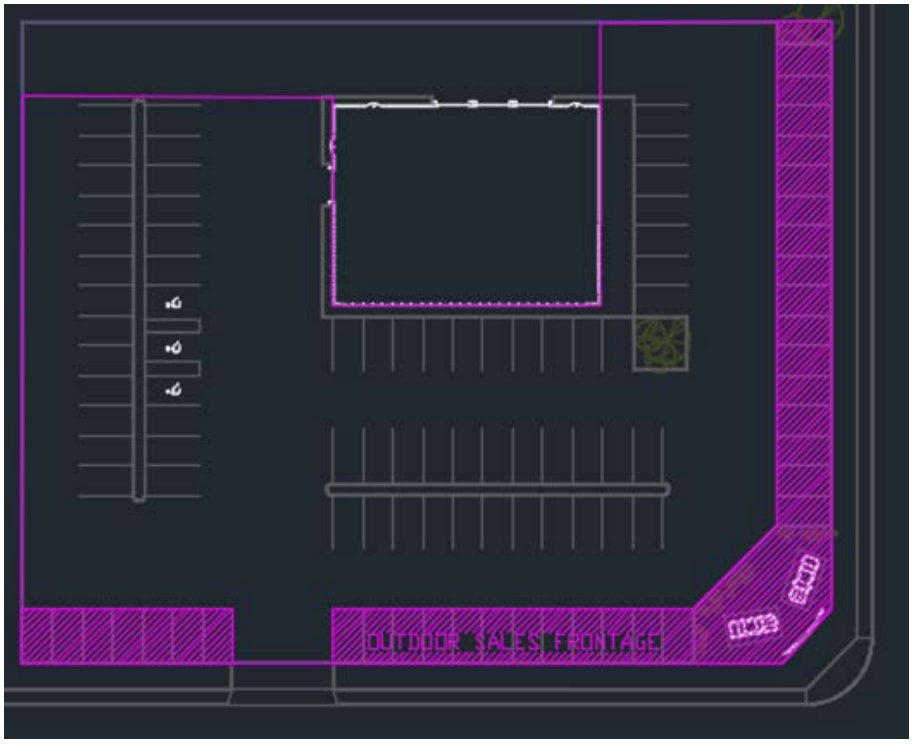

Figure 16: Modeled medium sized auto dealership – purple shaded area represents sales frontage

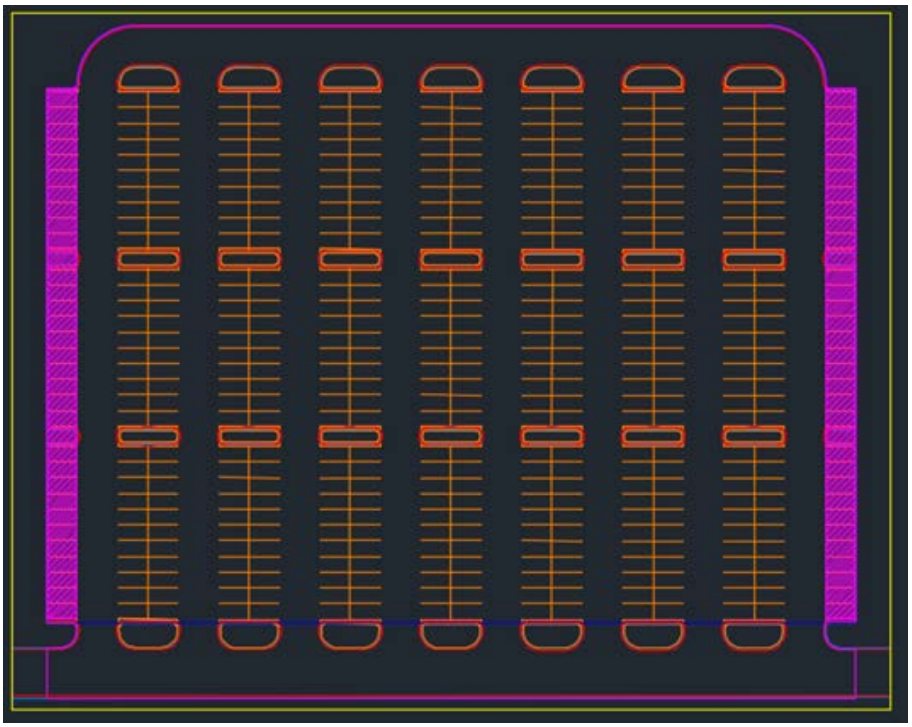

Figure 17: Modeled large sized auto dealership – purple shaded area represents sales frontage

Vehicle Service Station Canopies and Hardscape

The Statewide CASE Team verified the Vehicle Service Station Canopies and Vehicle Service Station Hardscape assumptions by examining a number of gas stations located throughout California. The Statewide CASE Team found a listing of gas stations for sale online and used the listings to obtain addresses, lot sizes, and building sizes. The Statewide CASE Team then used a measurement tool in Google maps to estimate canopy and hardscape size. Based on the gas stations sampled, an average hardscape to canopy (H/C) ratio was calculated to be ten to one. In other words, for every one square foot of gas station (vehicle service station) canopy built, ten square feet of gas station (vehicle service station) hardscape is built.

The Statewide CASE Team took the results of this analysis and weighted it by gas station density, applied by county. Figure 18 is a map of California which estimates gas station density by county. The results of the weighted average are essentially the same as the non-weighted average. The results of this analysis validated the Statewide CASE Team's assumptions for Vehicle Service Station Canopies and Vehicle Service Station Hardscape which resulted in no changes to the assumptions.

Table 128: Vehicle Service Station Canopies and Hardscape Assumptions Analysis Results

County	Building Size (ft^2)	Canopy Size (ft^2)	Hardscape Size (ft^2)	Lot Size (ft^2)	H/C Ratio
Los Angeles	800	6083	16199	22500	3
West Covina	1596	2700	25760	30056	10
Alameda	3000	2091	19825	36547	9
Santa Clara	2735	1306	22379	29620	17
Orange	3050	1699	17467	22216	10
San Bernardino	1862	1612	13079	16553	8
Riverside	4100	3223	79797	87120	25
San Diego	912	3575	18513	24829	5
Fresno	921	2868	34774	40000	12
Kern	2050	2657	13982	26349	5
Sacramento	3800	2311	14252	18820	6
Average	**2257**	**2739**	**25093**	**32237**	**10**

Source: California Energy Commission
Stations by fuel type will not equal total respondents due to stations often dispensing multiple fuel types.
Note: 2013 information is currently unavailable. Staff is in the process of cleaning report submissions and plans to release this information by December 2016.

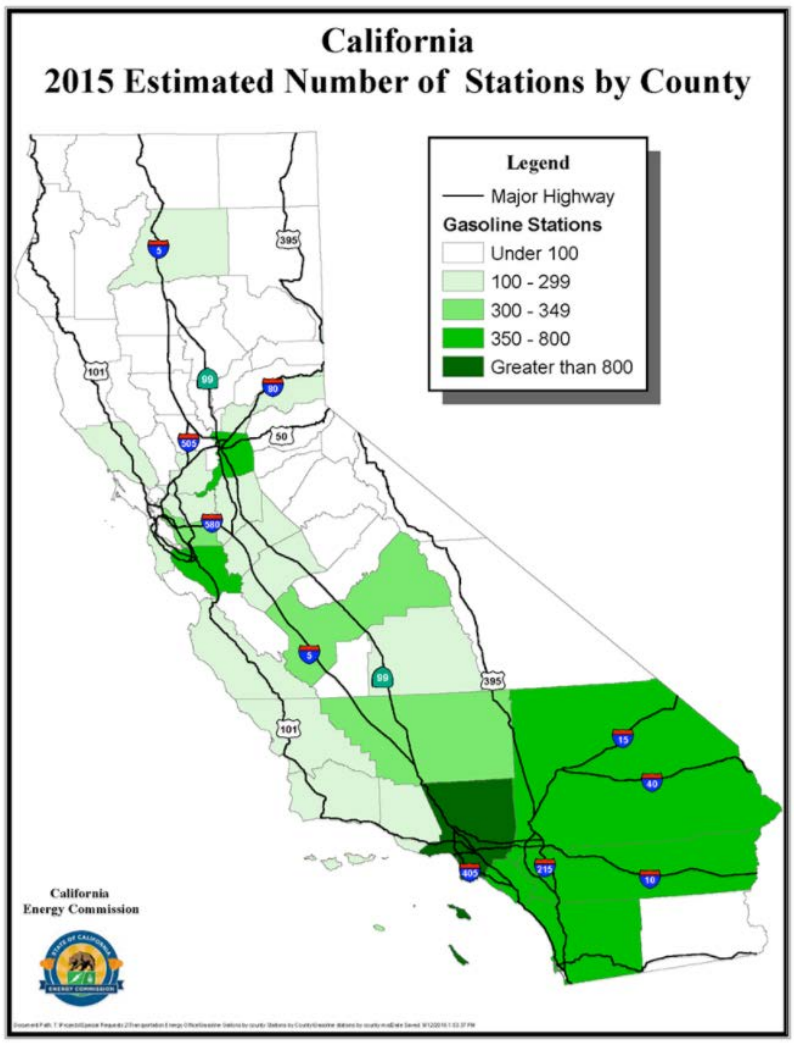

Figure 18: California Energy Commission gas station density estimates by county

Appendix J: STAKEHOLDER SURVEY

The Statewide CASE Team conducted as survey in 2017 to solicit feedback on the proposed code changes from a wide variety of stakeholder. The anonymized responses are shown in Figure 19 through Figure 34.

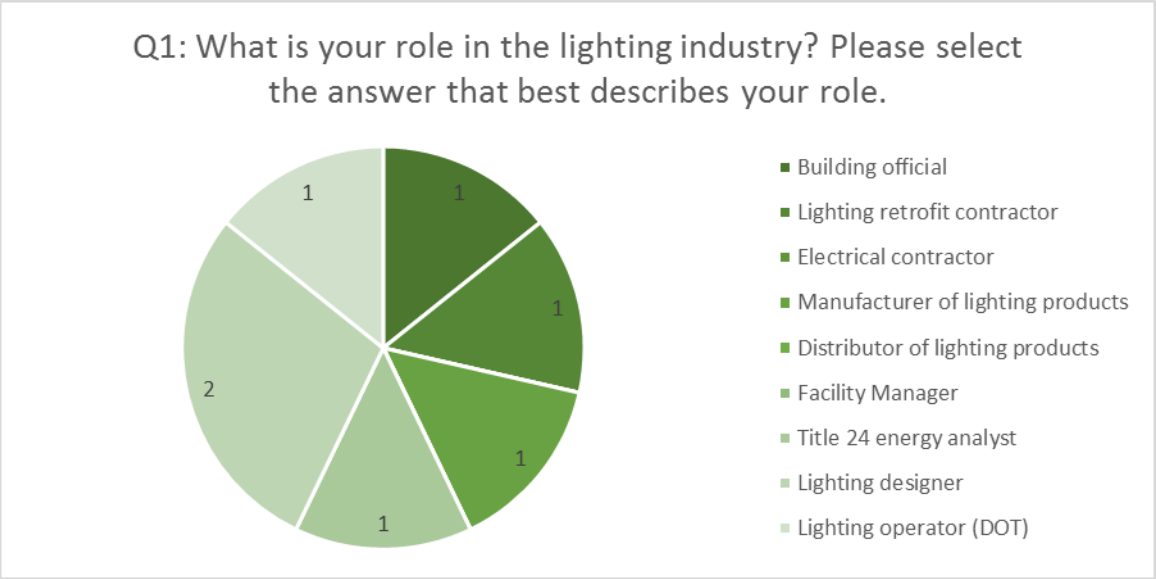

Figure 19: Stakeholder survey respondents' industry role.

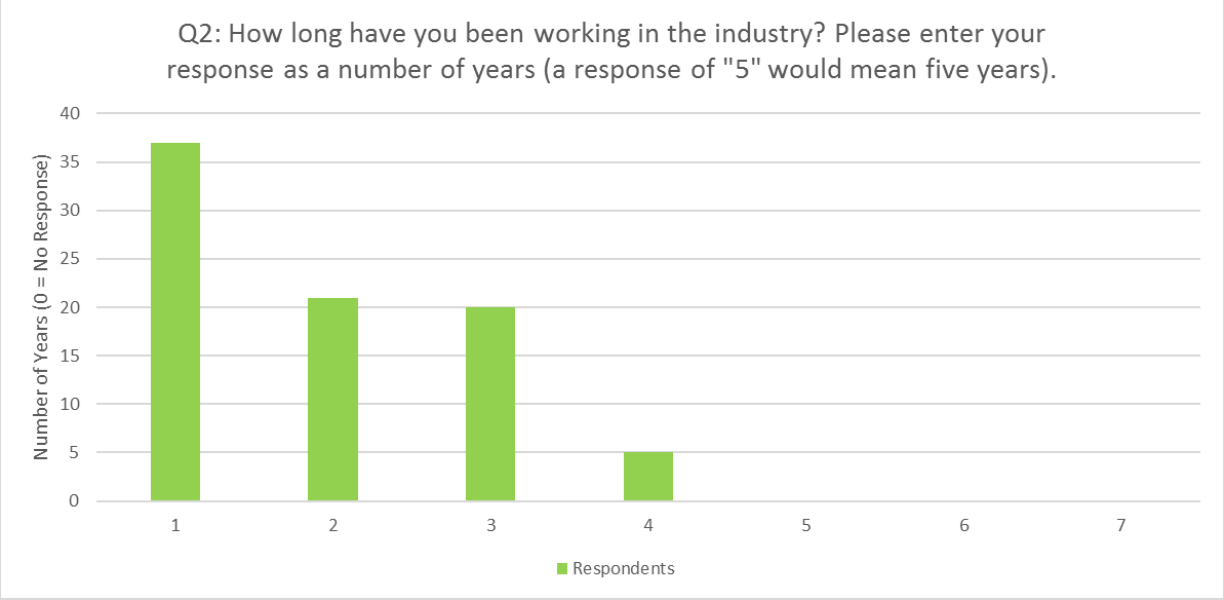

Figure 20: Stakeholder survey respondents' experience in lighting industry (as number of years).

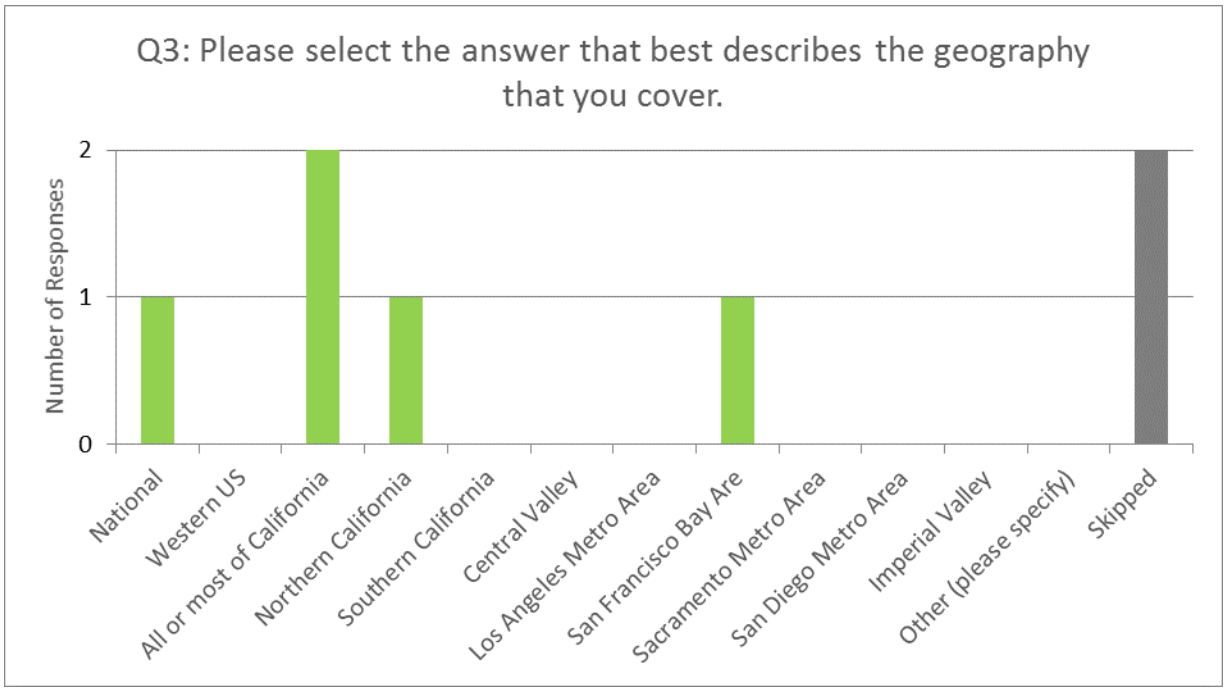

Figure 21: Stakeholder survey respondents' geography.

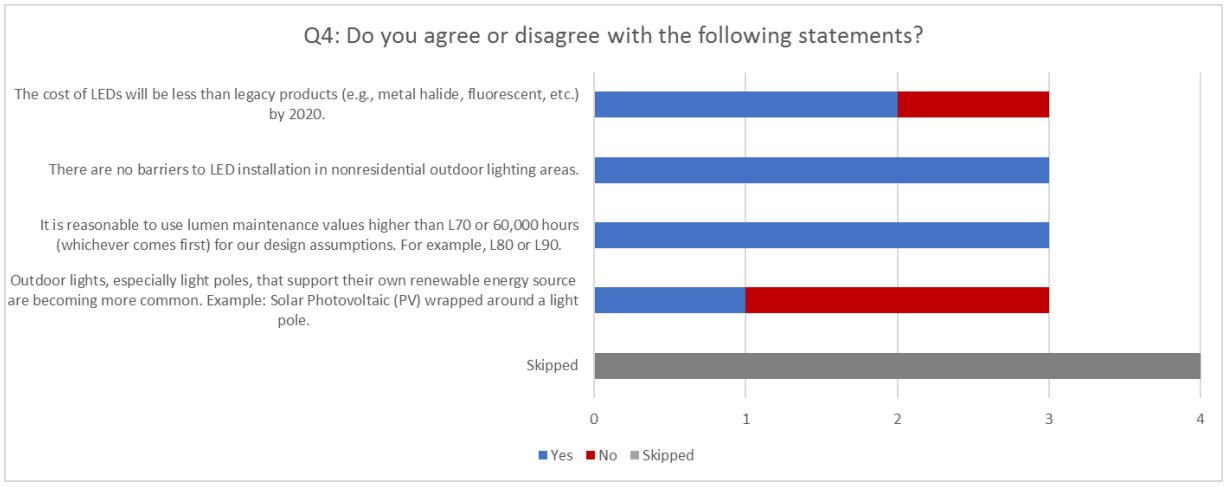

Figure 22: Assumptions for LED modeling.

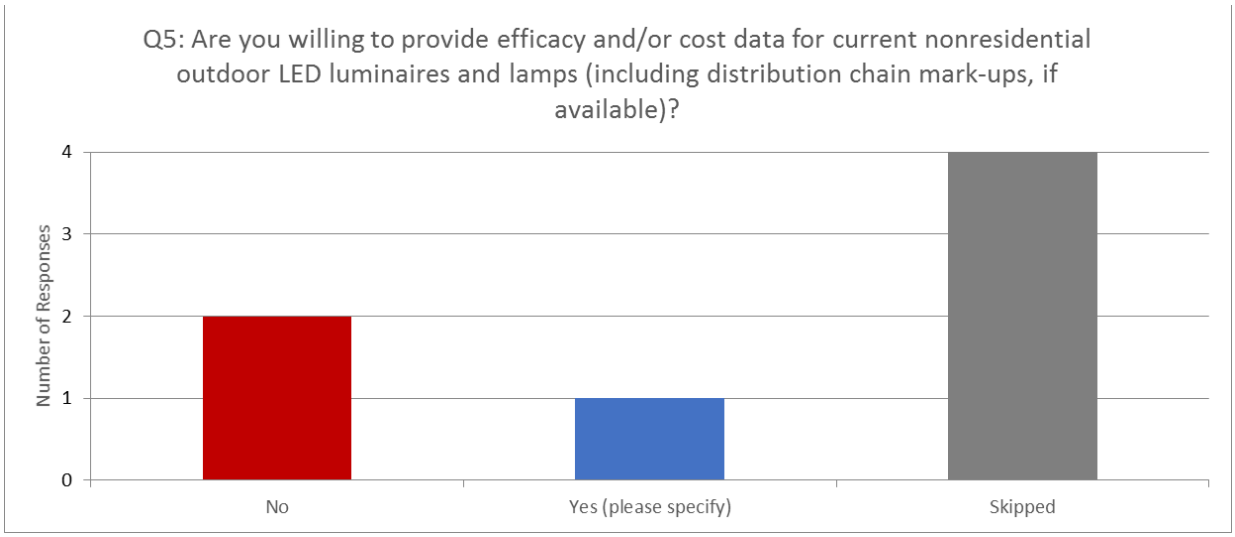

Figure 23: Willingness to provide data.

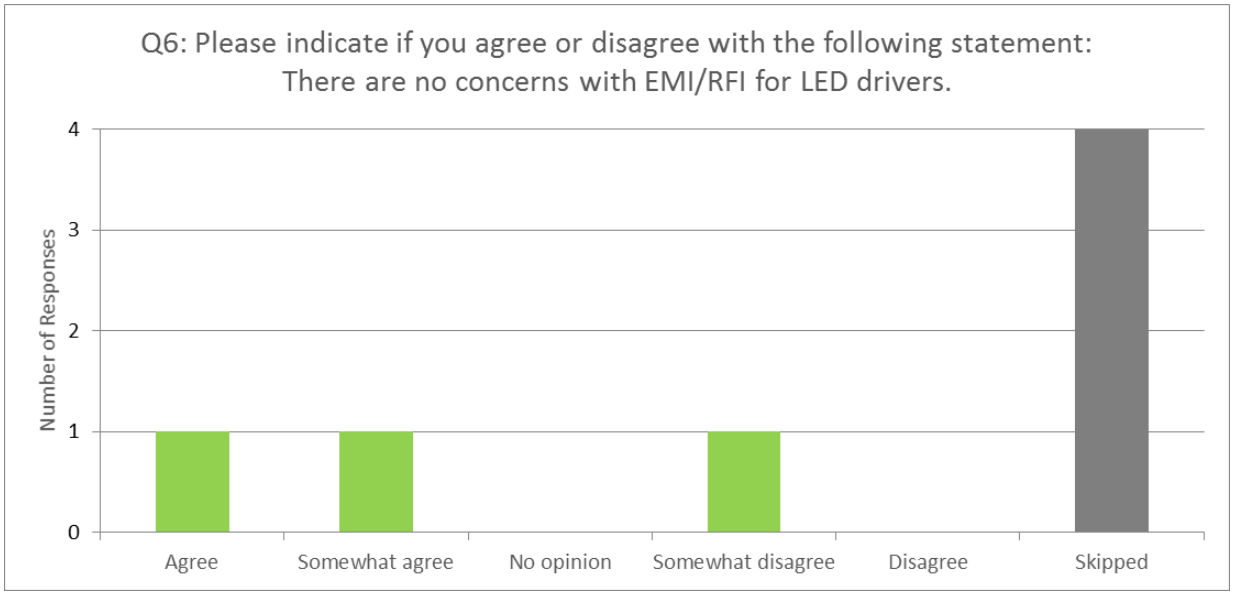

Figure 24: EMI/RFI assumptions for LEDs.

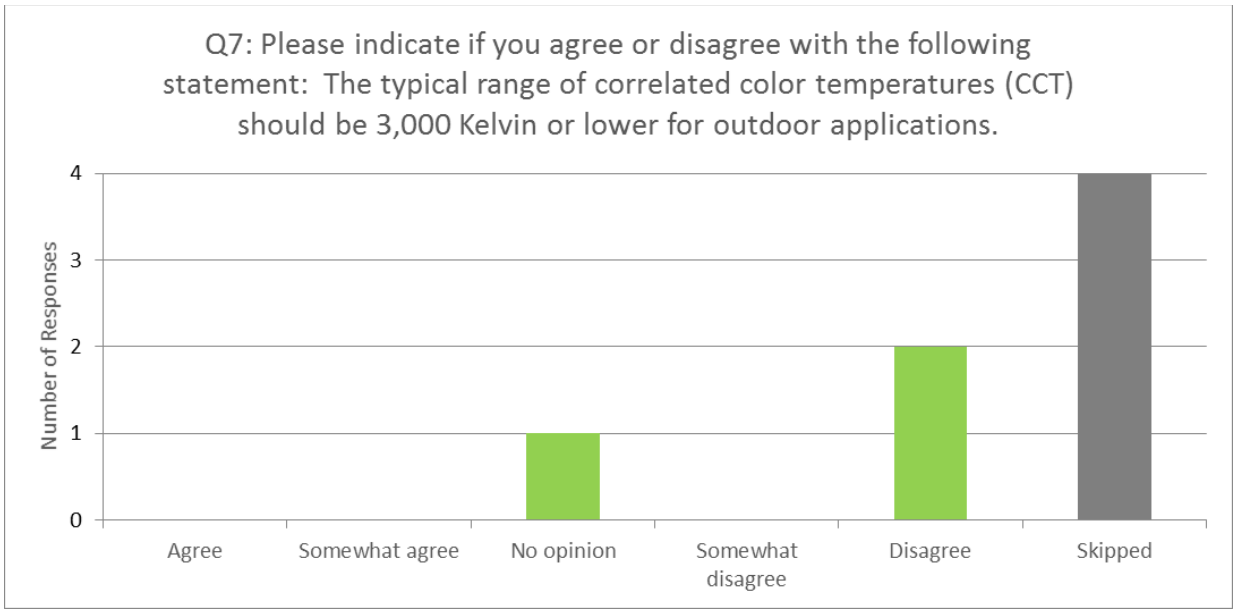

Figure 25: Range of CCT for outdoor applications.

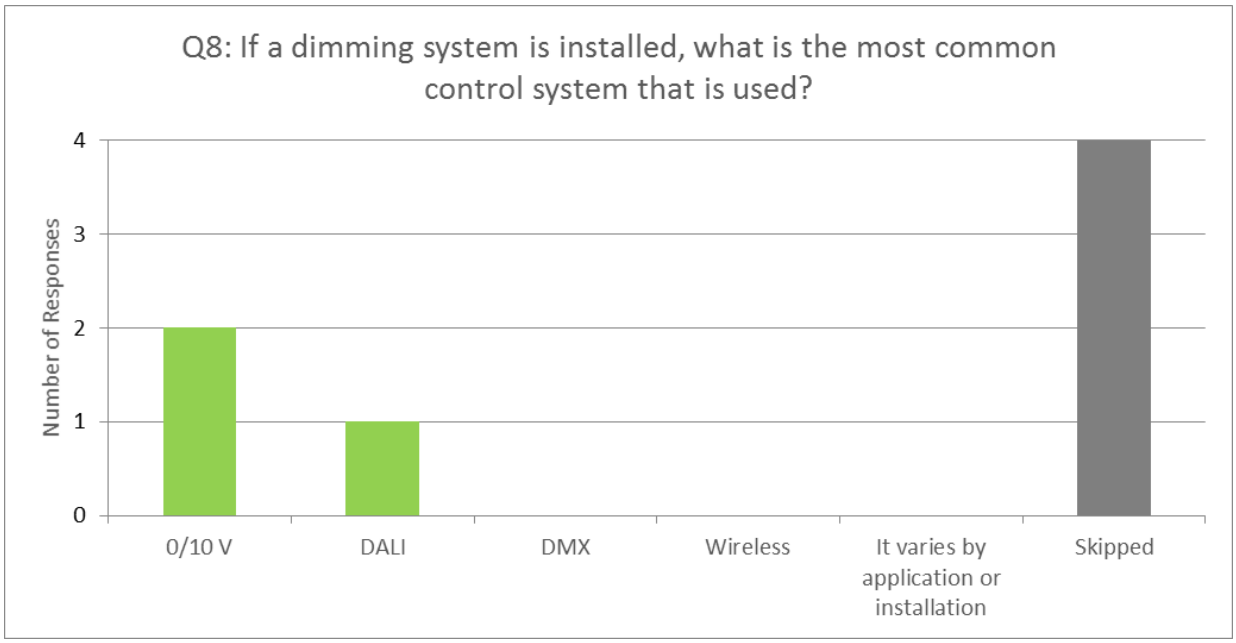

Figure 26: Common types of dimming control systems used.

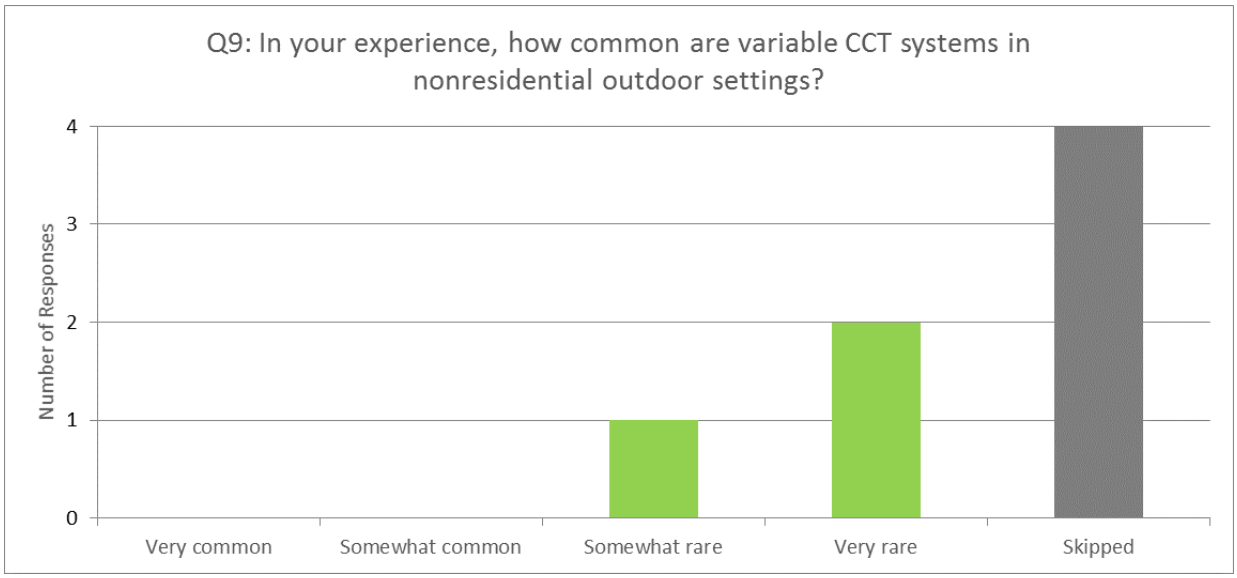

Figure 27: Frequency of variable CCT system usage in outdoor settings.

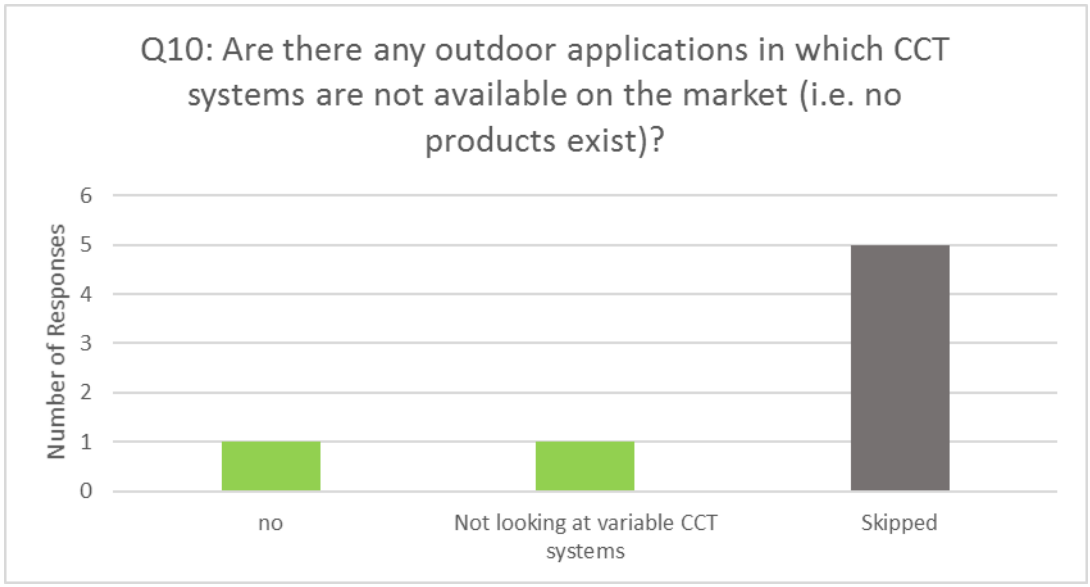

Figure 28: Outdoor applications where CCT systems are not available.

Q11: Please indicate how strongly you agree or disagree with all the following statements:	Strongly Agree	Somewhat Agree	Neutral	Somewhat Disagree	Strongly Disagree
Variable CCT systems will be common in outdoor applications in the next 3 years.	0	0	2	0	1
Variable CCT systems are less efficient than non-tunable luminaires. Example: variable CCT system set 3000K vs non-tunable 3000K luminaire.	0	1	2	0	0
Variable CCT systems are significantly more expensive than non-tunable luminaires.	0	2	1	0	0
The cost of variable CCT systems prevents their widespread use.	0	1	2	0	0
Skipped	4				

Figure 29: Variable CCT system assumptions.

Q12: How frequently are the following CCT techniques used in nonresidential outdoor lighting applications?	
Answer Choices	Responses
Dim to Warm tuning: ___% of fixtures.	2
White color tuning: ___% of fixtures.	2
Full color tuning: ___% of fixtures.	2
Skipped	5

Figure 30: Frequency of variable CCT system techniques.

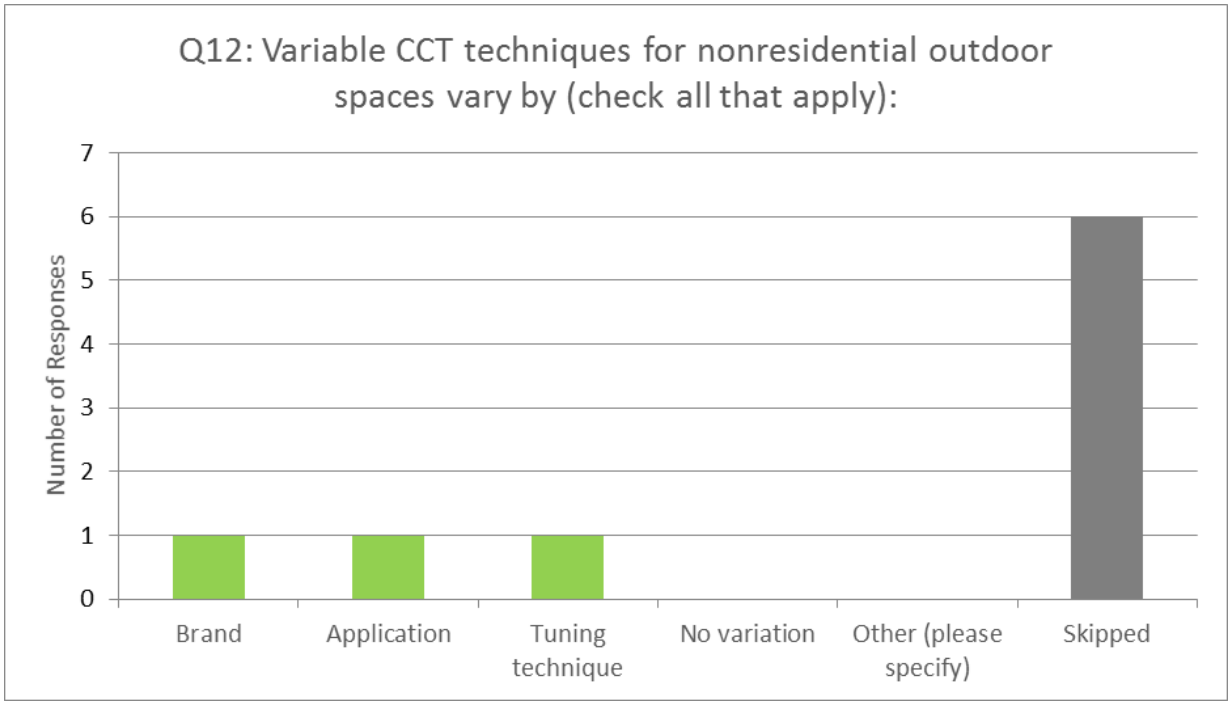

Figure 31: How variable CCT system techniques differ.

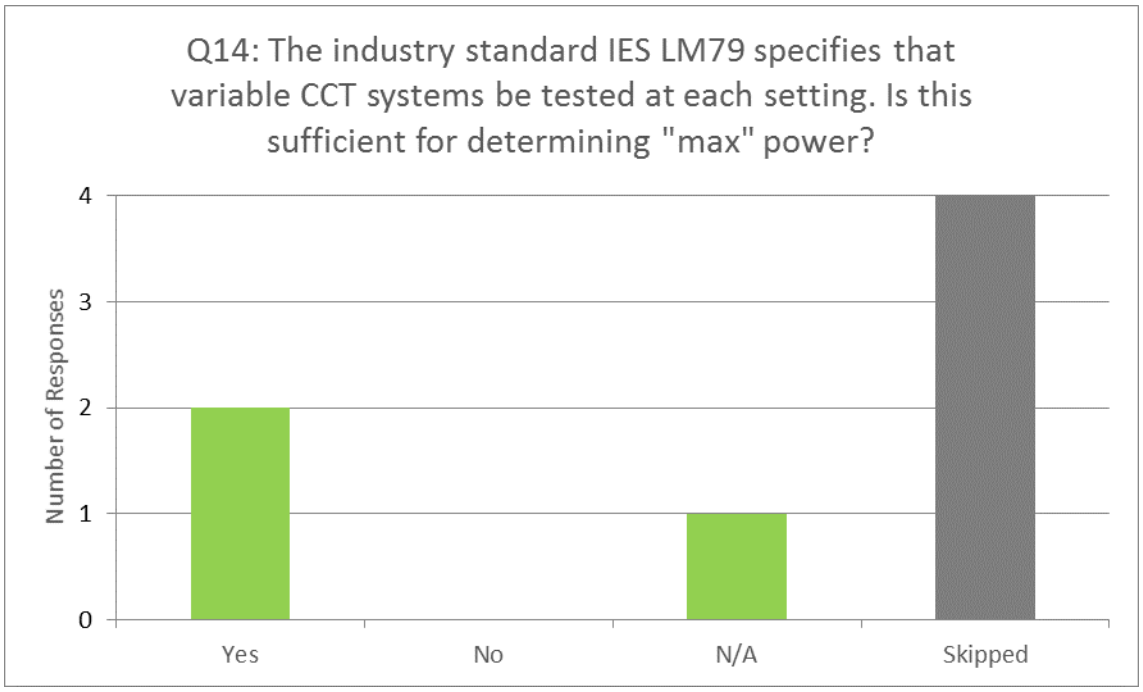

Figure 32: Assumptions on rating "max" power for variable CCT systems.

Q15: In your experience, do you consider variable CCT systems to be a unique system of lighting or system of controls? Please explain.	
Answer Choices	Responses
yes	2
No. Plenty of interior applications for it. Just not exterior. It's not like the moon changes color...	2
no opinion	2
Skipped	5

Figure 33: Assumptions on how to classify variable CCT systems.

Figure 34: Willingness to have follow up conversations.