

UC Berkeley Campus Lighting Master Planning Study

University of California, Berkeley

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LIGHTING DESIGN AND ENGINEERING

Prepared for:
University of California,
Berkeley

Berkeley
UNIVERSITY OF CALIFORNIA

Introduction

At night, lighting is the primary medium for experiencing the outdoor campus environment. Light defines space, form, texture and color of the buildings, walkways, plazas and landscape. Light guides pedestrians and extends visibility to create safer environments. Seeing and identifying destinations and surrounding buildings is equally as important as illuminating pathways to improve wayfinding at night.

Fiat Lux “Let there be light” is iconically emblemized on Sather Gate. Celebrating light on the UC Berkeley Campus is critical to the success of students, especially as the Campus expands its nighttime use facilities and programming.

Background

In coordination with the UC Berkeley 2020 Long Range Development Plan and Landscape Master Plan, outdoor lighting is a key component of campus night safety programs. Supported by student funding from the UC Berkeley Life Safety Committee, with support from the Presidents of the Associated Students of the University of California (ASUC) and the Graduate Assembly (GA), improved campus lighting for safety and security is of the highest priority. Additionally, as a world-class university and campus, outdoor lighting should enhance the character of the campus architecture and landscape.

This plan was developed using input about safety from students, UCPD, UC Fire Marshall, Parking and Transportation, as well as the various Real Estate and Construction and Design and Facilities Stakeholders. Input was sought in 2016 and included night time walking audits to inform stakeholders of conditions after dark.

The scope of this plan is limited to the central campus bounded by Hearst Avenue, Gayley Road, Bancroft Way, and Oxford Street. The street and pathway lighting at other campus facilities outside this scope is generally provided by City owned and maintained, on-street lights or project specific lighting.

Intent

This Campus Lighting Master Plan is intended to guide campus lighting improvements by:

- **Analyzing** existing lighting conditions
- **Prioritizing** areas for immediate and future improvement projects
- **Developing** conceptual lighting design strategies
- **Budgeting** high priority areas for immediate lighting improvements

Aspirations & Goals

- **Create** a Welcoming, Safe & Accessible Campus
- **Celebrate** Gateways & Ceremonial Spaces
- **Illuminate** Pathways, Transit Stops and Bike Racks
- **Reveal** Architectural Form & Texture
- **Promote** Gathering Spaces
- **Support** Sustainability, Health & Wellbeing

To improve the nighttime environment on the UC Berkeley Campus by achieving these goals, this Lighting Master Plan provides a holistic design approach and a practical framework that will guide future exterior lighting projects on the Campus.

The Lighting Guidelines & Concepts establish design considerations, intent, strategies and criteria for specific outdoor lighting applications to create a consistent approach for current and future campus improvement projects that include outdoor pathways and spaces.

Improving safety and a sense of security on campus is a multi-faceted issue. Quality lighting is only one of many factors that affect safety and security. The presence of other people, campus police and safety programs such as BearWALK have a greater effect on safety than lighting alone. However, quality lighting does make the nighttime environment more inviting and improves peoples’ sense of security.

Creating a network of primary nighttime pathways with high quality lighting throughout campus will help to encourage more students to utilize these pathways, thereby increasing the number of people using the same pathways to further improve nighttime safety.

A holistic lighting design approach considers how people experience the entire visual field, beyond the pathways, to celebrate the architecture, identify recognized landmarks, support wayfinding, and encourage spontaneous and planned gatherings at night. The UC Berkeley Campus has many outstanding features, including classical and contemporary architectural facades, natural landscape, plazas and gateways that provide opportunities for feature lighting at night.

This Campus Lighting Master Plan includes maps that identify the network of primary nighttime pathways and feature lighting opportunities based on workshops with student groups and input from campus staff, UC Berkeley Life Safety Committee, campus police, and other stakeholders. A phasing map, developed by evaluating existing lighting conditions, prioritizing accessible, high-use pathways and analyzing costs associated with proposed lighting solutions, provides guidance for current and future project funding.

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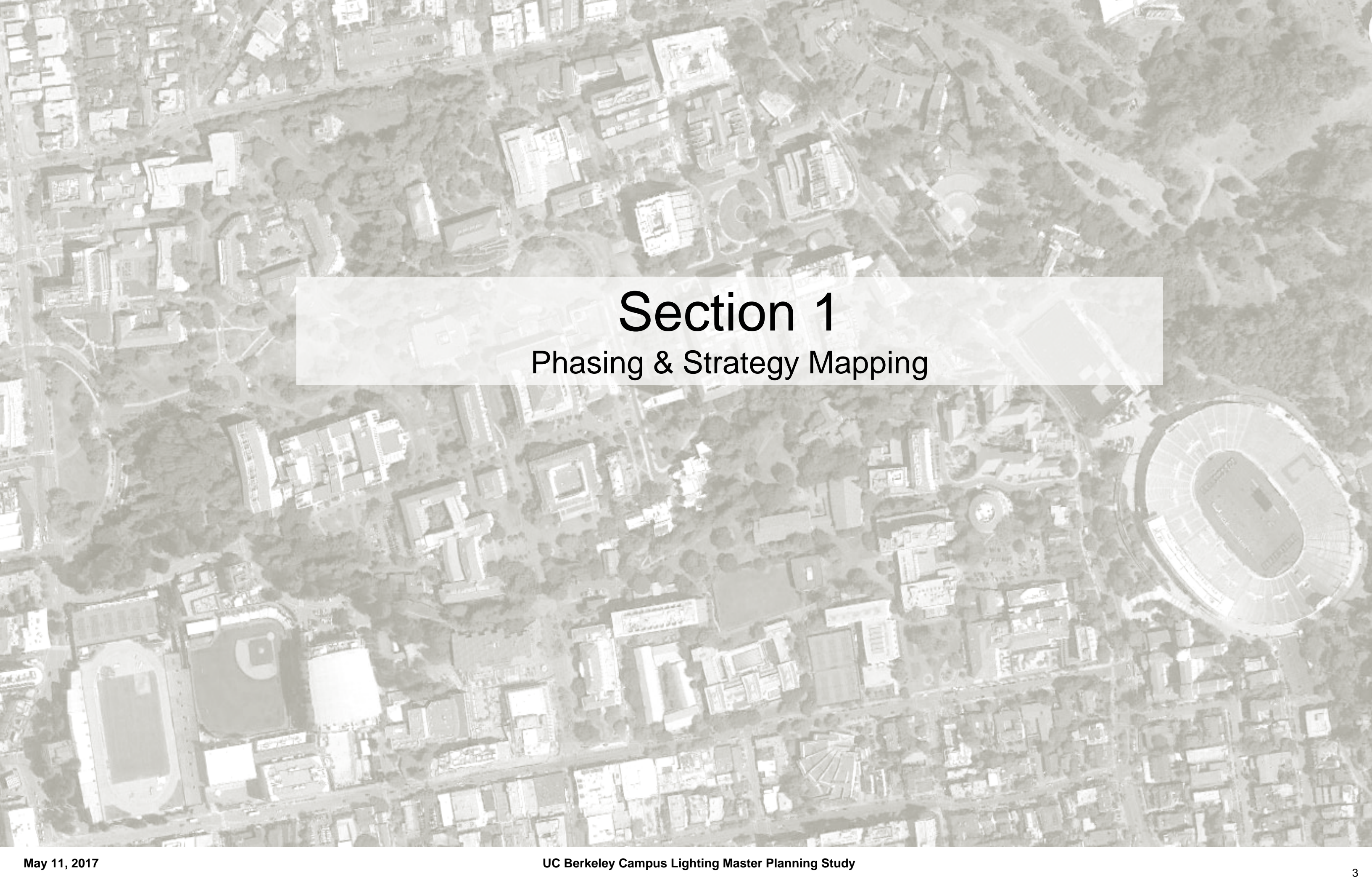
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Section 1

Phasing & Strategy Mapping

Campus Lighting Phasing Map

The primary and secondary nighttime pathways are based on discussions and nighttime walking tours with UC Berkeley students, faculty and staff members, BearWALK escorts, UCPD, Parking and Transportation. ADA accessible routes, buildings with frequent nighttime use, public transportation stops, bike routes and bike racks all inform the prioritizing of nighttime pathways. The pathways connect nighttime use facilities to transportation hubs and other key destinations and provide a network for traveling through campus at night. As new buildings come online, they would be expected to connect the lighting concept with this set of night paths.

Primary Paths:

- Continuous cross-campus routes that connect major facilities.
- Have highest volumes of pedestrian traffic.
- Bike routes where vehicle conflicts are higher.





Secondary Paths:

- Provide connections between primary routes.
- Have lower pedestrian volumes, particularly at night.

Feature Lighting:

This map identifies areas that provide excellent opportunities to reveal architectural form, celebrate gateways, campus design and art, or promote gathering spaces for both spontaneous and planned events.

Prioritizing Locations for Improvement

-  **Retrofit Only:** Coinciding with this Lighting Master Planning Study, the existing LED pedestrian lights on campus are undergoing a campus-wide warranty replacement. These pathways are priority locations for implementing the pedestrian light LED warranty retrofit project. Once the pedestrian lights along these pathways are replaced, the pathway lighting will be adequate.
-  **Phase A: Primary Pathways** are pathways identified as the highest priority where additional pedestrian lights are required to provide adequate lighting.
-  **Phase B: Primary Pathways** are the second highest priority that will require future funding to improve pedestrian lighting.
-  **Phase C: Secondary Pathways** are pathways that are currently darker, but are not as frequently used at night. While they are lower priority for funding purposes, these pathways would complete a comprehensive network of nighttime pathways for the UC Berkeley Campus.

Feature Lighting Strategies Map

Feature lighting is recommended to improve wayfinding on campus at night, providing distant views of significant buildings and creating more intimate lighting effects in ceremonial and gathering spaces. Careful integration of façade, landscape, and accent lighting in these locations will create a dynamic nighttime environment that accentuates UC Berkeley's architectural and historic character.

Proposed Lighting Strategies

Ceremonial Spaces:

The ceremonial spaces signify entry into the campus or emphasize significant locations. The lighting in these spaces should enhance the character of the space and exemplify UC Berkeley's historic and natural campus setting.

Gathering Spaces:

The plazas and glades throughout campus serve as casual gathering spaces. Additional lighting design should be considered throughout these outdoor spaces to provide the same sense of space during nighttime hours as experienced during the day.

Façade Lighting:

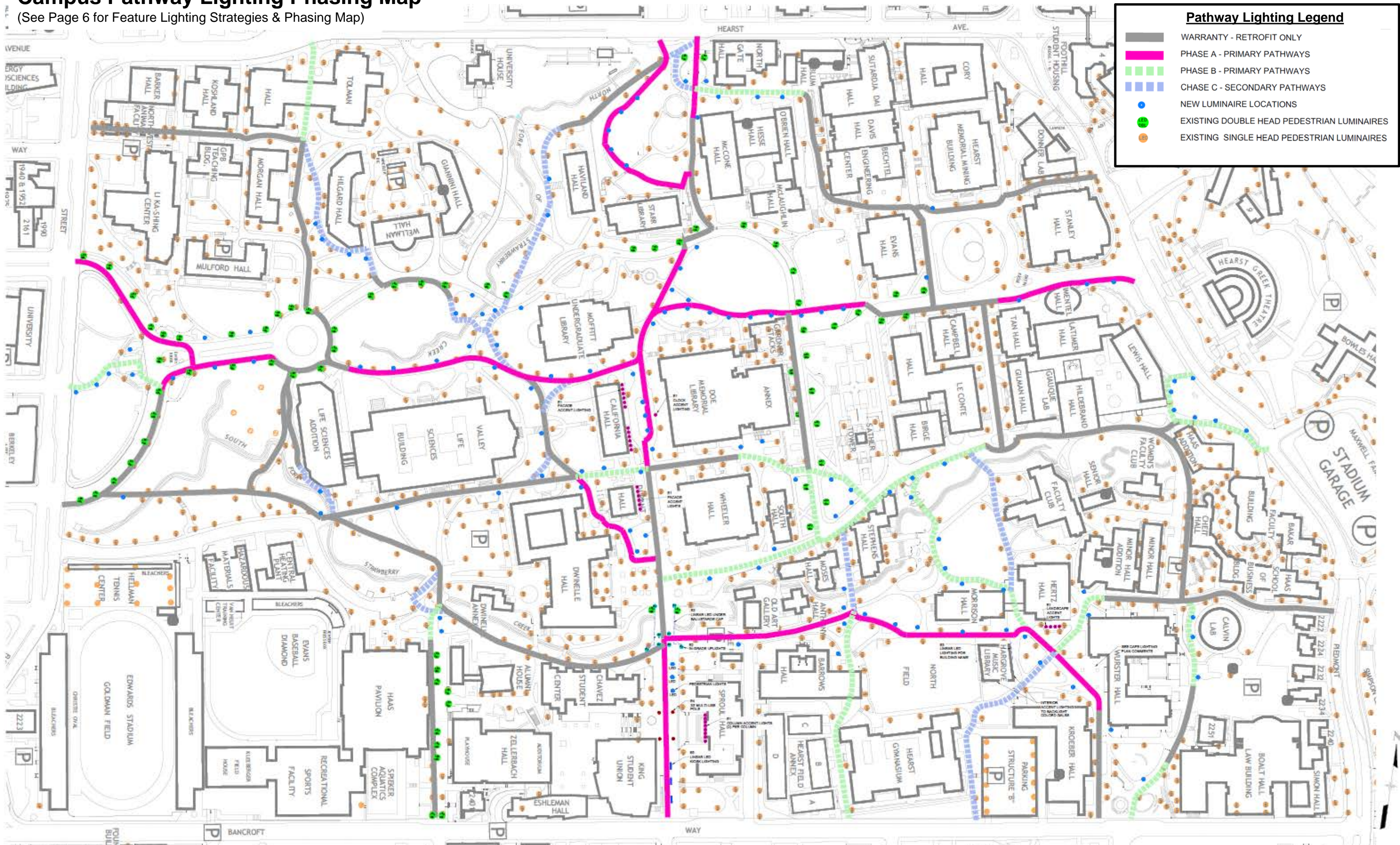
Improved entry lighting and façade lighting will emphasize the rich architectural expression found throughout the campus, highlighting both traditional and contemporary features. Lighting the distinctive facades along nighttime pathways will increase ambient light levels and enhance wayfinding.

Accent Lighting:

Accent lighting enhances the character and charm of the campus by highlighting interesting landscape, artwork, and other features that are often lost in the natural environment at night. Accent lighting improves wayfinding and helps provide scale and depth in the nighttime environment.

Campus Pathway Lighting Phasing Map

(See Page 6 for Feature Lighting Strategies & Phasing Map)

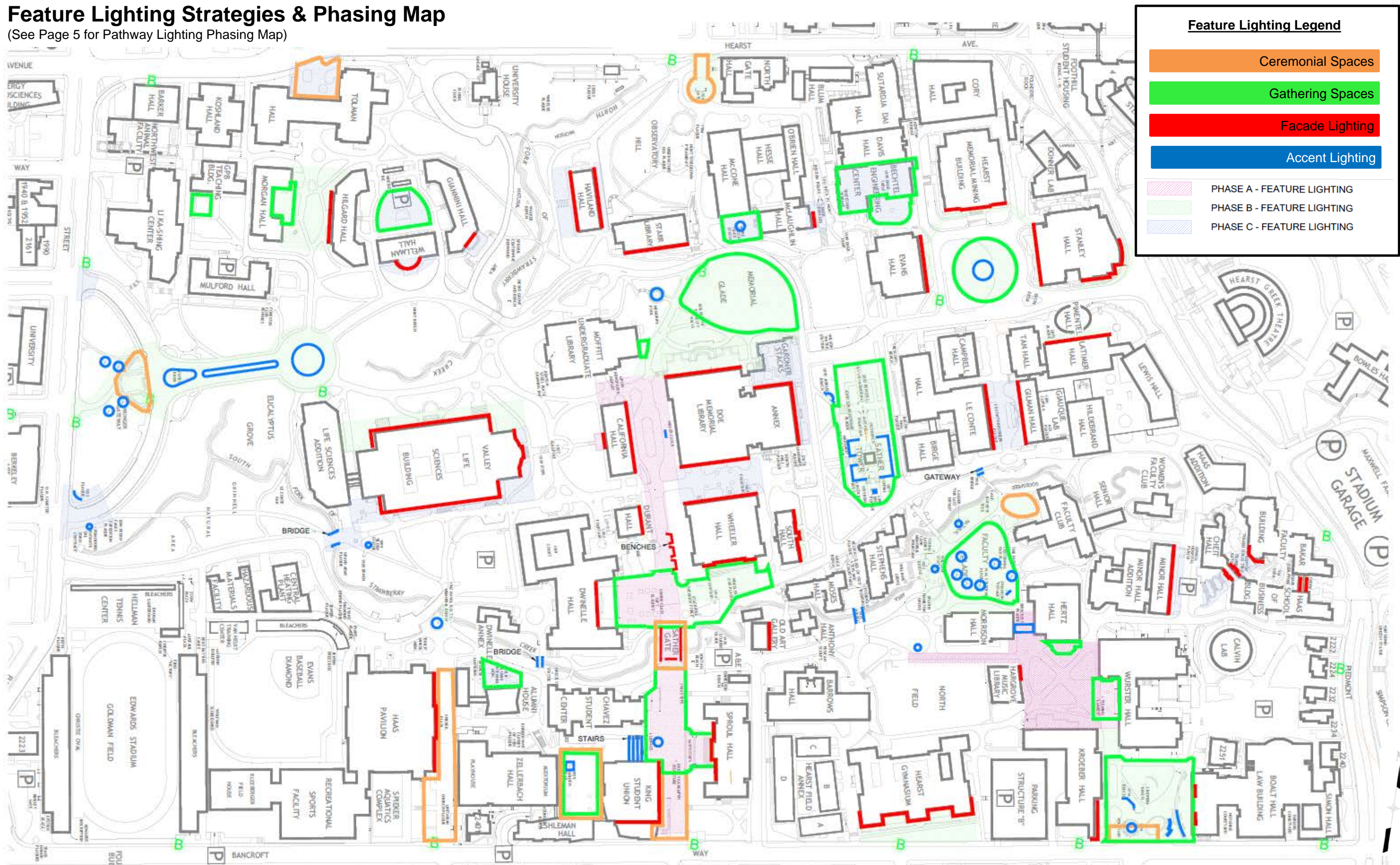


Pathway Lighting Legend

- WARRANTY - RETROFIT ONLY
- PHASE A - PRIMARY PATHWAYS
- PHASE B - PRIMARY PATHWAYS
- PHASE C - SECONDARY PATHWAYS
- NEW LUMINAIRE LOCATIONS
- EXISTING DOUBLE HEAD PEDESTRIAN LUMINAIRES
- EXISTING SINGLE HEAD PEDESTRIAN LUMINAIRES

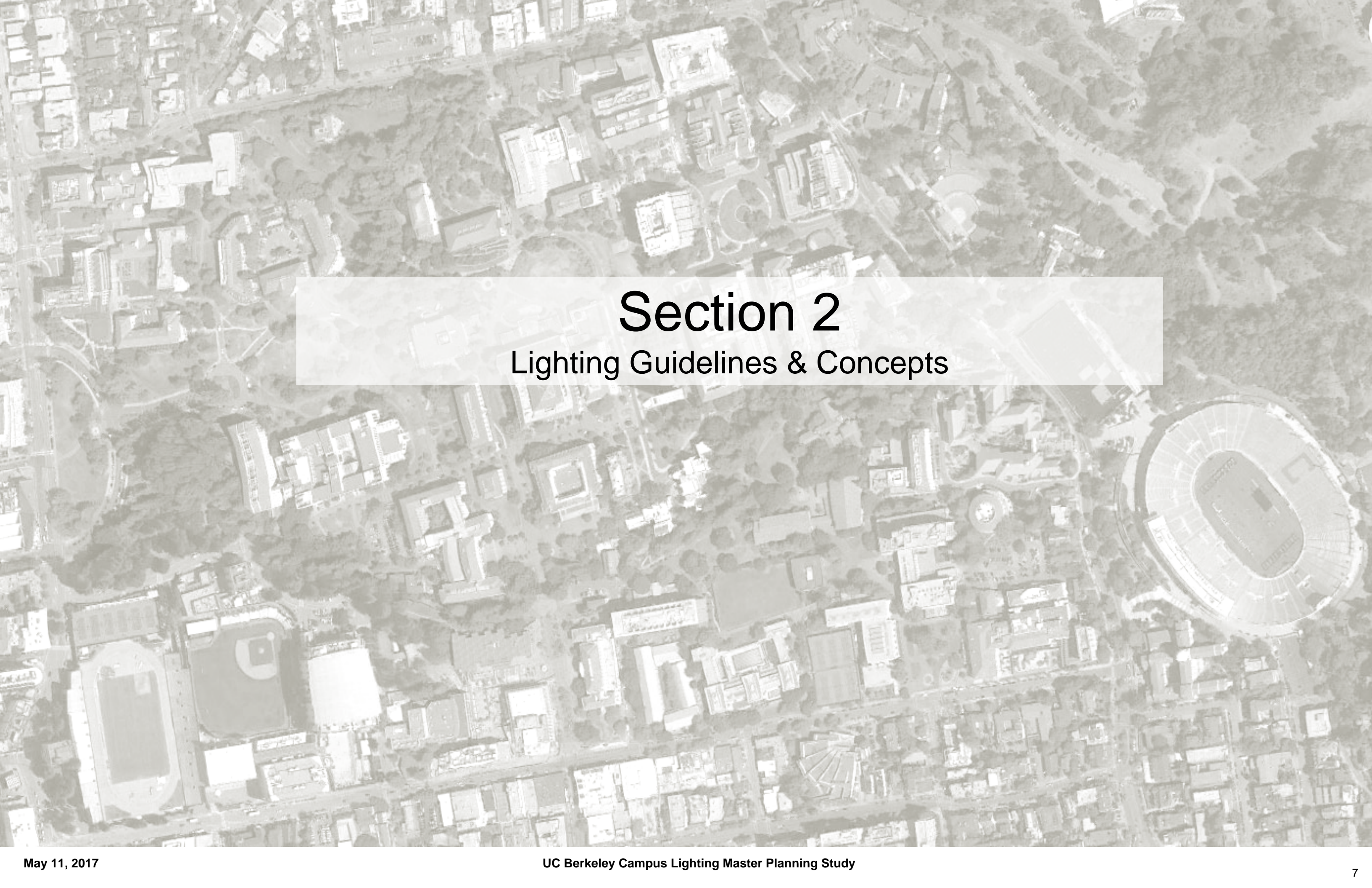
Feature Lighting Strategies & Phasing Map

(See Page 5 for Pathway Lighting Phasing Map)



Feature Lighting Legend

- Ceremonial Spaces
- Gathering Spaces
- Facade Lighting
- Accent Lighting
- PHASE A - FEATURE LIGHTING
- PHASE B - FEATURE LIGHTING
- PHASE C - FEATURE LIGHTING



Section 2

Lighting Guidelines & Concepts

Lighting Design Principles

The safety and security of an area is created by the combination of several layers of lighting elements. The visibility of the immediate pathway and surrounding surface brightness are necessary to enhance the nighttime environment. These design considerations are desired in new campus lighting projects.

Layers of Light

Providing layers of ambient, accent, and feature lighting improves the surface brightness and uniformity of the lighted environment. Lighted building surfaces improve visibility, brightness perception, comfort and security.



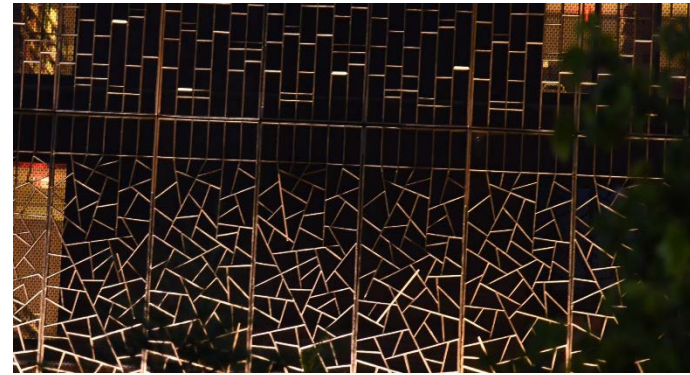
Subtle Contrast

Some variation of light levels provides definition to exterior spaces. Brighter entrances and pathways draw pedestrians between spaces while pedestrians feel less inclined to walk through dimmer spaces.



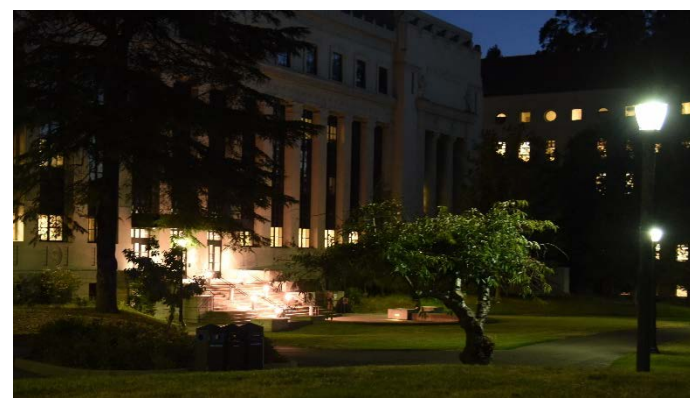
Accent & Feature Lighting

Accent lighting of building architectural features, entrances, water features, and sculptures can improve the pedestrian experience. Surrounding surfaces that are appropriately lighted improves visibility, security, and perception of brightness.



Color of Light

White light sources improve color rendering, by revealing rather than distorting colors. The warmth of the color of the light should be between a candle (1850K) and moonlight (4100K) to provide a comfortable nighttime environment. The standard color temperature for all Pedestrian and Area Lighting is 3000K. Color temperature for facade and feature lighting may vary from 2700K to 4100K, depending on the application.



Low Glare

Glare destroys nighttime visibility. Minimize glare to improve visibility.



Adaptation

Adapting from excessively bright interior spaces to non-lighted nighttime environments can take up to five minutes. Improving entry and immediate pathway nighttime light levels can improve adaptation.



Vertical Light Levels

Lighting vertical surfaces enhances facial and object detection. Facial detection allows pedestrians to identify the intent of approaching pedestrians, or see objects in the pathway, and respond accordingly.



Wayfinding

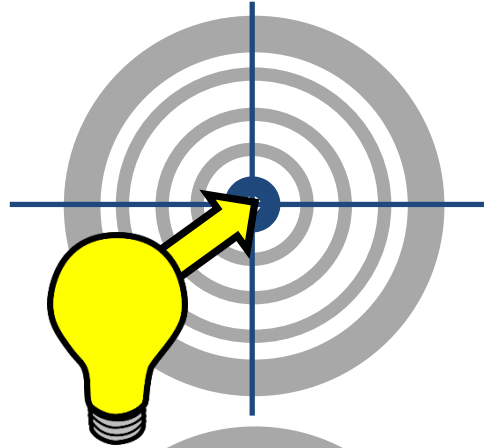
Illuminating focal points such as entrances, architectural features, and key pathways improves navigation. Lighting that improves wayfinding provides confidence to pedestrians who are unfamiliar with the area.

Sustainable Lighting Principles

Sustainable lighting design applies principles that are considerate of the potential adverse impacts that lighting, and the energy it consumes, can impose on the surrounding environment, including flora and fauna as well as human responses to light outdoors at night. When properly applied, these sustainable lighting principles benefit everyone by respecting nearby residents, reducing costs for the university, reducing wasted light and energy.

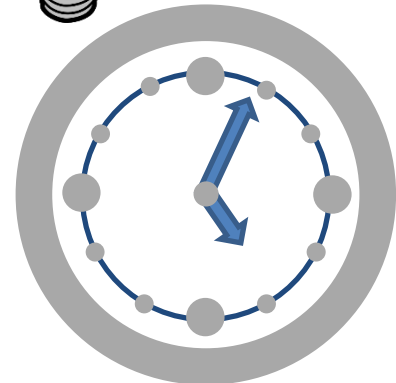
Light Only Where Needed

Lighting pathways, gathering areas, facades, structures or landscape is necessary for safety and security. However, large open areas may be left without light, minimizing energy use, maintenance costs, and impact on surrounding neighbors.



Light Only When Needed

Some accent and feature lighting performs an aesthetic function that does not need to be operating late at night. Lighting controls should be used to turn off non-essential lighting after a curfew, while pathway lighting, entry lighting, plaza and parking lot lighting remains on all night.



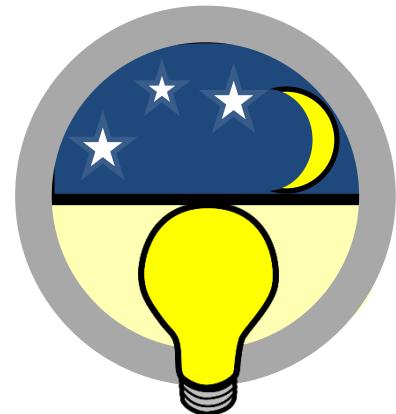
Minimize Light Trespass

Light trespass onto neighboring residences or adjacent properties shall be minimized with consideration for equipment selection, careful placement, luminaire shielding and proper aiming. With no dormitory buildings within the campus boundaries included in this study, light trespass shall only be a concern at the edges of the campus. With campus safety being a high priority, light spill into natural landscape areas within the campus is less of a concern since it improves visibility and safety.



Minimize Light Pollution

Light pollution is uncontrolled light that wastes energy, creates "sky glow" and reduces visibility of stars in the night sky. Unshielded luminaires and excessively high lighting levels cause light pollution. The lighting on campus must be well shielded, properly aimed and designed to appropriate light levels to help maintain dark skies.



Promote Health & Well-Being

The natural daily cycle of light and dark is directly linked to the suppression and production of melatonin in humans. Exposure to blue spectrum light after sunset can delay the nighttime production of melatonin. Lighting with warmer color (3000K or less) reduces the blue spectrum content of LED pedestrian and area lighting.



Minimize Energy Use

Reducing energy use on campus can be achieved by using energy efficient LED light sources, providing appropriate light levels without over-lighting, and reducing light levels after a curfew by dimming or turning off non-essential lighting.



Maintenance Considerations

For a large and dynamic campus with limited budgets for on-going maintenance, the durability, longevity and consistency of lighting equipment are high priorities and shall be considered when planning future project budgets.

Lighting Design Considerations

The safety and security of an area is created by the combination of several layers of lighting elements. The visibility of the immediate pathway and surrounding surface brightness are necessary to enhance the nighttime environment. These design considerations are desired in new campus lighting projects.

Space Size

The size of an area or pathway should be considered when determining the lighting design intent. Small spaces may have a more intimate or private feel, while larger spaces are more public and active. To create a more intimate space, smaller scale luminaires, lower light levels, subtle contrast and accent light can create a more subdued atmosphere, while larger spaces may have larger scale luminaires and more uniform light levels.



Surrounding Environment

Understanding the context of each project site affects the lighting design decisions. In Low Density areas surrounded by natural landscape, light should spill into the natural areas to improve visibility and safety for students at night. In Medium and High Density areas, the lighting design should consider lighting facades and features to improve wayfinding and reveal the Campus character at night.



Flexibility

Some areas of the UC Berkeley Campus are dynamic spaces that have multiple uses with different lighting and electrical needs. Campus lighting designs should consider the need for semi-permanent and/or temporary lighting that can provide flexibility for a variety of lighting needs.



Luminaire Style

The style of luminaire should consider both form and function of the specific location and application. The luminaire form should be influenced by the style of the surrounding buildings. There are three significant architectural styles on the UC Berkeley Campus – Historic, Contemporary and Rustic. The luminaire function should provide appropriate light levels and distribution for the specific application.



Architectural Features

Identifying and accentuating the key architectural and landscape features on Campus will celebrate and reveal the character and identity of the UC Berkeley Campus, improve the overall visual experience of the Campus at night, and improve wayfinding. Each building and outdoor space has its own unique features that should be identified and accented with light to compose the nighttime views and experiences throughout campus.



Mounting Locations

Luminaire mounting locations should consider the impact on the surrounding area. Ground mounted accent lights should be concealed from view wherever possible and shielded to avoid glare. Building mounted luminaires should consider the impact to the building and minimizing damage to building surfaces. Each location should consider the constructability and future maintenance of the project.



Additional Infrastructure

The Campus lighting establishes a network of electrical distribution and pole structures throughout Campus that often provides multiple uses, including power receptacles, security cameras, speakers and banners for advertising. Other emerging technologies that may also be considered in future projects include wireless lighting controls, WiFi, and other communications, analytic and asset management systems.



Lighting Strategies

A combination of lighting strategies shall be used to illuminate spaces. The six main lighting design strategies are outlined below.

Bollard Lighting

Bollard lights provide low-level illumination. They are typically 2-3 feet tall and come in a wide range of form factors. They are used to provide horizontal lighting on footpaths and plazas, but they do not provide facial illumination. Bollards are often associated with an intimate lighting mood.



Pedestrian Lighting

Pedestrian lights provide vertical and horizontal illumination at a human scale. These lights are typically 10 to 15 feet tall and are most commonly post-top luminaires or pole-mounted pendant luminaires. They are used to illuminate pathways, provide wayfinding, and provide facial illumination.



Area Lighting

Area lighting is used to provide general ambient lighting in larger areas. These luminaires are pole or building-mounted and can range from 20 to 30 feet tall when used in plazas. Area lights typically produce higher light output than pedestrian and bollard lighting.



Hardscape Accent Lighting

Hardscape accent lighting is lighting that illuminates surfaces and man-made features, particularly in plazas. This can be achieved by using a variety of different luminaires and technologies, such as small profile linear luminaires, or adjustable accent luminaires.

Landscape Accent Lighting

The landscape on UC Berkeley Campus is a unique asset for the University. Used sparingly, landscape accent lighting can exemplify the natural character of the Campus at night. Landscape accent lights include ground mounted, adjustable luminaires with glare shielding and vandal resistant features.



Façade Lighting

Façade lighting is any luminaire mounted on or near a building that is aimed at the building's façade. Typically, this is achieved by grazing the surface with a spot or linear luminaire. Both uplight and downlight can be used to illuminate a façade. Used correctly, façade lighting both compliments and celebrates the building's architecture, while providing perimeter lighting to the surrounding exterior spaces.



Lighting Guidelines: Pathways

Lighting Design Intent:

Pathways must be designed to provide safe and accessible walkways at all times of the night. Pathways link pedestrians to buildings, crosswalks, gathering spaces, transit stops, and bike racks. The lighting should be low-glare, while providing adequate light levels on walkways and pedestrians.

Lighting Design Considerations:

The following pathway characteristics will influence the lighting design strategies. These considerations are expanded upon on the right.

Space Size

Surrounding Environment

Flexibility

Luminaire Style

Lighting Goals:

- **Create excellent visibility** by providing low-glare lighting and adequate light levels.
- **Provide wayfinding** by using higher light levels at destination points such as building entries. Encourage pedestrians to use main pathways by providing adequate light levels along those walkways.
- **Establish continuity** of lighting quality and character along pathways to reinforce the character of the campus.
- **Enhance security** by providing vertical illumination to light pedestrians.

Sustainability and Energy Goals:

- **Control light trespass** at campus edges to:
 - 0.3 footcandles maximum at residential areas
 - 0.8 footcandles at commercial areas.
- **Limit light pollution** by limiting uplight and using fully shielded luminaires.
- **Promote health & well-being** by avoiding excessive light levels and providing warm colored light sources.

Lighting Design Considerations

Space Size



Small
Pathway Width: <7-ft (Minor Path)

Lighting Strategies:

- Bollard Lighting
- Typical Spacing: 25' – 35'



Medium
Pathway Width: 7-ft to 20-ft

Lighting Strategies:

- Pedestrian Lighting (1-Side)
- Typical Spacing: 60' – 80'



Large
Pathway Width: >20-ft

Lighting Strategies:

- Pedestrian Lighting (2-Sides)
- Typical Spacing: 60' – 80'

Surrounding Environment



Low Density

Lighting Strategies:

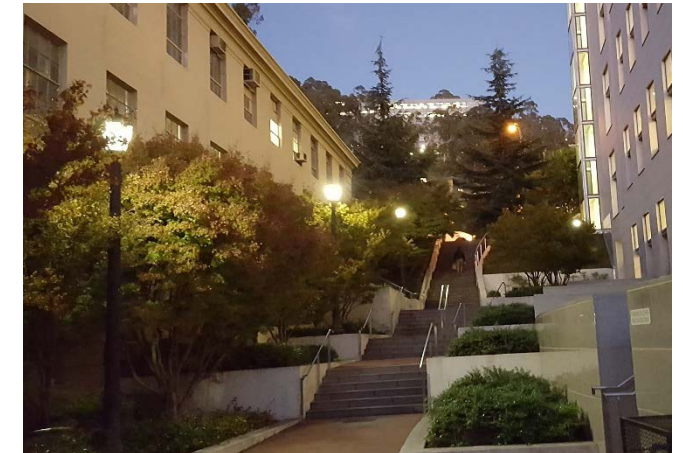
- Provide Type III Asymmetric Light Distribution or Type V Symmetric Light Distribution.
- Allow some spill light into surrounding areas.



Medium Density

Lighting Strategies:

- Provide Type II or III Asymmetric Light Distribution.
- Illuminate surrounding facades for wayfinding.



High Density

Lighting Strategies:

- Provide Type II or III Asymmetric Light Distribution.
- Apply backlight shields to prevent light trespass.
- Illuminate surrounding facades to provide a portion of the light levels on the pathways.

Lighting Guidelines: Pathways

UC Berkeley Lighting Criteria:

- **Limits of Criteria Application:** The Lighting Criteria shall apply to all Pathways:

Avg. Horizontal Illuminance	0.5 footcandle
Horizontal Uniformity	4.0 avg/min
Avg. Vertical Illuminance	0.2 footcandles
Maximum Glare Rating (IES TM-15-07)	G1
Color Temperature	3000 Kelvin

Other Strategies:

- Power for Event Tents, Temporary Stages, Holiday Lighting
- Communication Conduits for Speakers or Security Cameras

Lighting Design Considerations, Continued

Luminaire Style



Historic

Historic post top luminaires are located throughout the majority of campus. The decorative luminaire, pole, and pole base compliment the classical architecture of the original campus buildings.



Contemporary

Contemporary style pedestrian and bollard luminaires may be appropriate to compliment the adjacent architecture. Contemporary lighting should be selected to match existing contemporary style luminaires currently installed elsewhere on campus, unless otherwise approved by Campus Staff.



Rustic

Luminaires installed near rustic buildings such as the Faculty Club should promote the building's architectural form. Lights with craftsman style forms and rustic metal surfaces become an interesting architectural feature that complements the rustic building style.

Additional Infrastructure



Power Receptacles

In some locations, temporary power for events or maintenance may be desired. Coordinate with UC Berkeley Staff to determine where power receptacles should be located.



Security

Coordinate with UC Berkeley Staff and Campus Police to identify locations where spare conduit and in-grade splice boxes should be provided for future security camera power & communication.



Banner Arms

Consider where banner arms on pedestrian light poles should be used to provide event advertising and wayfinding.

Lighting Guidelines: Gathering Spaces

Lighting Design Intent:

Gathering Spaces must be designed to accommodate multiple functions, from daily use to larger planned events. Some gathering spaces are suitable for smaller gatherings while others may accommodate large events or groups of people. These spaces should incorporate layers of light to create a welcoming space that celebrates the unique characteristics of each gathering space.

Lighting Design Considerations:

The following characteristics of gathering spaces will influence the lighting design strategies. These considerations are expanded upon on the right.

Space Size

Surrounding Environment

Flexibility

Luminaire Style

Lighting Goals:

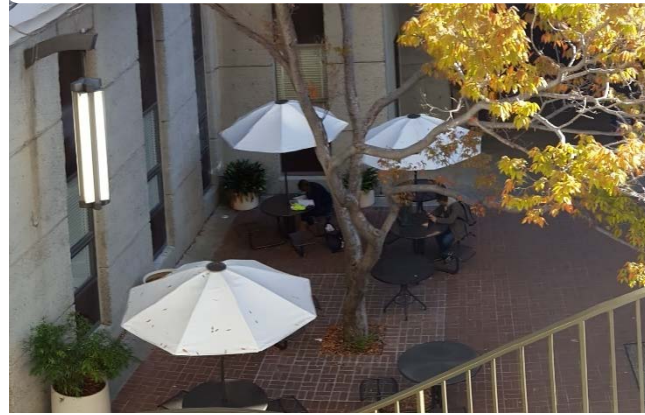
- **Create layers of light** that appropriately address the intended uses, character and features of each Gathering Space.
- **Encourage positive nighttime activities** by improving lighting quality in the campus's outdoor spaces.
- **Create excellent visibility** by providing low-glare lighting and adequate light levels.
- **Provide flexibility** with lighting controls and/or electrical power for temporary events.

Sustainability and Energy Goals:

- **Control light trespass** at campus edges to:
 - 0.3 footcandles maximum at residential areas
 - 0.8 footcandles at commercial areas.
- **Limit light pollution** by limiting uplight and using fully shielded luminaires.
- **Promote health & well-being** by avoiding excessive light levels and providing warm colored light sources.

Lighting Design Considerations

Space Size



Small

Lighting Intent:

Create an intimate lighting experience by enhancing features and facades, providing subtle contrast and minimizing pedestrian lighting.

Lighting Strategies:

- Hardscape Accent Lighting
- Landscape Accent Lighting
- Façade Lighting



Medium

Lighting Intent:

Provide pedestrian lighting on adjacent pathways and near building entries. Consider accent and façade lighting to provide definition to the surfaces surrounding the space.

Lighting Strategies:

- Pedestrian Lighting
- Façade Lighting
- Landscape Accent Lighting



Large

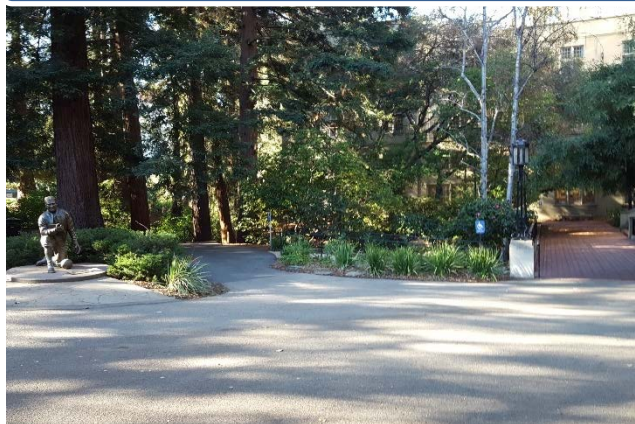
Lighting Intent:

Large Gathering Spaces may periodically host large events that require higher, uniform light levels. Taller light poles should be used to illuminate a larger area with fewer poles.

Lighting Strategies:

- Area Lighting
- Façade Lighting

Surrounding Environment



Low Density

Lighting Strategies:

- Provide Type III Asymmetric Light Distribution or Type V Symmetric Light Distribution.
- Allow spill light into surrounding areas.



Medium Density

Lighting Strategies:

- Provide Type II or III Asymmetric Light Distribution.
- Illuminate surrounding facades for wayfinding.



High Density

Lighting Strategies:

- Provide Type II or III Asymmetric Light Distribution.
- Apply backlight shields to prevent light trespass.
- Illuminate surrounding facades to provide a portion of the light levels on the pathways.

Lighting Guidelines: Gathering Spaces

UC Berkeley Lighting Criteria:

- **Limits of Criteria Application:** The Lighting Criteria shall apply to all hardscape Gathering Spaces and plazas. Gathering Spaces in softscape lawn or landscaped areas may include electrical power for temporary lighting of specific planned events. During a specific event in a softscape area, temporary lighting shall be provided to meet the appropriate Lighting Criteria, as follows.

Avg. Horizontal Illuminance	0.5 footcandle
• Normal Use, Small, or Medium Event	1.0 footcandle
• Large Event	
Horizontal Uniformity	4.0 avg/min
Avg. Vertical Illuminance	0.2 footcandles
Maximum Glare Rating (IES TM-15-07)	G1
Color Temperature	3000 Kelvin
Curfew	To be determined by University

Other Strategies:

- Infrastructure for Temporary Events
- Power for Event Tents, Temporary Stages, Holiday Lighting
- Communication Conduits for Speakers or Security Cameras

Lighting Design Considerations, Continued

Flexibility



Permanent

Pedestrian lighting, accent lighting, and façade lighting are permanent lighting installations that improve ambient light levels and wayfinding through each space. Layers of light create vibrant, inviting spaces that make visitors feel welcome during nighttime hours.



Semi-Permanent

Due to the dynamic nature of gathering spaces, the ability to change the ambient light levels and accessories is often desirable. Some light poles includes channels that pedestrian lights, area lights, accent lights, speakers, cameras, banners, etc. can be attached at varying heights. The pedestrian lights should remain “on” during normal nighttime hours, but additional area lights can be controlled as needed for larger functions.



Temporary

Several locations throughout campus serve as large event spaces. The campus may provide event power connections for temporary event lighting, stage sets and other temporary electrical loads. Poles located at key locations in a plaza can provide electrical hookups. Power outlets can be placed at strategic locations around large gathering spaces.

Luminaire Style



Historic

Historic post top luminaires are located throughout the majority of campus. The decorative luminaire, pole, and pole base compliment the classical architecture of the original campus buildings.



Contemporary

Contemporary style pedestrian and bollard luminaires may be appropriate to compliment the adjacent architecture. Contemporary lighting should be selected to match existing contemporary style luminaires currently installed elsewhere on campus, unless otherwise approved by Campus Staff.



Rustic

Luminaires installed near rustic buildings such as the Faculty Club should promote the building’s architectural form. Lights with craftsman style forms and rustic metal surfaces become an interesting architectural feature that complements the rustic building style.

Lighting Vignette Concept: Small Gathering Space – Memorial Pool

General Description

This common space on campus is heavily used by students, faculty, and visitors. It is host to many special events as it serves as a central gathering space near the student union building on campus.

1 Pedestrian lighting

Pedestrian lighting at the edge of a small space improves safety, visibility, and wayfinding along pathways. Post top luminaires will improve the ambient lighting in the space and can include banners for advertising opportunities and outlet receptacles.

2 Under Wall Lighting

The pool wall and seat wall are existing infrastructure that can serve as landscaping and functional furniture. Installing lights along the underside of the stone cap creates visual interest while defining the space and increasing ambient light levels.



1 Pedestrian Lighting



2 Under Wall Lighting

Lighting Vignette Concept: Medium Gathering Space – Law Library Plaza

General Description

This plaza is a major entrance to campus at College and Bancroft. Layering pedestrian lighting, pathway lighting and accent lighting will create a safe, intimate, and comfortable space.

1 Planter Walls & Step Lighting

Planters walls can serve as both landscaping and functional furniture. Installing lights along the underside of the wall cap creates visual interest while defining the space and increasing ambient light levels.

2 Art Lighting

Lighting interesting artistic elements defines and accentuates prominent features in a gathering space. Illuminating the wall art in this plaza will create a focal point for distant views while keeping an intimate experience within the plaza.

3 Tree Accent Lighting

Tree lighting is used to display the natural elements of the plaza. By reducing shadows and increasing ambient lighting the tree lighting will provide more spatial awareness. This heightened spatial awareness gives a perception of safety in a plaza such as this one.

4 Bollard Lighting

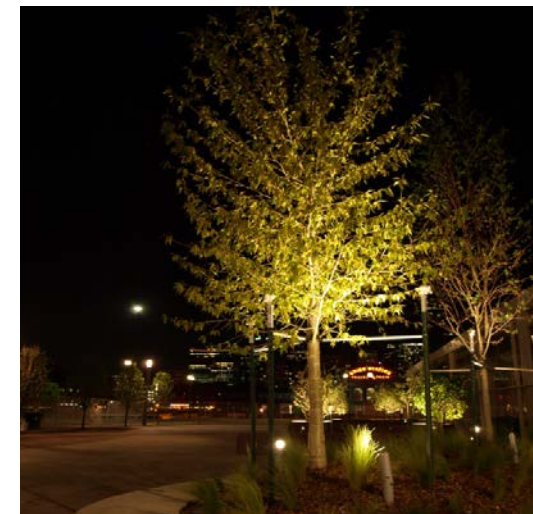
Bollards can be used to illuminate smaller paths at a more intimate level. This provides wayfinding and a general sense of safety for people moving through a plaza.



1 Planter Walls & Step Lighting



2 Wall Art Lighting



3 Tree Accent Lighting



4 Bollard Lighting

Lighting Vignette Concept: Large Gathering Space – Upper Sproul Plaza

General Description

This common space on campus is heavily used by students, faculty, and visitors. It is host to many special events as it serves as a central gathering space near the student union building on campus.

1 Column Lighting

Lighting columns on a façade provide interest without over lighting a space. The lighting accents improves wayfinding by enhancing the appearance of the building entry while accenting the existing architecture. Furthermore, this dramatic façade lighting creates prominence at night that echoes the building's prominence during daylight hours. Using in grade lighting, floodlights, or other luminaires would make this lighting effect successful.

2 Pedestrian Lighting

Pedestrian lighting improves visibility of paths, other people, and decorative features of a space. The trees along the Upper Sproul Plaza block the existing lighting coming from floodlights on the building, shown in the image on the right. Making use of string lights or pedestrian poles would help brighten the corridor to create a safe and inviting space.

3 Area Lighting & Additional Features

Area lights improve the lighting levels throughout the large gathering space. Installing lights on poles will increase the ambient lighting levels while providing the ability to accommodate advertising opportunities, speakers, receptacles, and other security features such as cameras.



1 Column Lighting



2 Corridor Lighting



3 Area Lighting & Additional Features

Lighting Guidelines: Façades

Lighting Design Intent:

Enhance the architectural form and character of Campus buildings at night with subtle façade lighting. Façade lighting contributes another layer of light to the outdoor environment, while simultaneously providing wayfinding and creating a sense of space.

Lighting Design Considerations:

The following characteristics of façade lighting will influence the lighting design strategies. These considerations are expanded upon on the right.

Architectural Features

Mounting Locations

Luminaire Style

Lighting Goals:

- **Create layers of light** that appropriately address the intended character and features of each Façade.
- **Create a sense of place and space** by accentuating building façade features, illuminating the edges of the outdoor spaces.
- **Improve Wayfinding** by illuminating facades that can be seen from distant viewpoints.
- **Reduce glare** by shielding light sources and aiming luminaires at the appropriate surfaces, away from pedestrians and traffic.

Sustainability and Energy Goals:

- **Control light trespass** at campus edges to:
 - 0.3 footcandles maximum at residential areas
 - 0.8 footcandles at commercial areas.
- **Limit light pollution** by minimizing uplight and using fully shielded, properly aimed luminaires that focus light on the intended surfaces with minimal spill light.
- **Save energy** by dimming or turning off non-essential lighting loads during curfew times.

Lighting Design Considerations

Architectural Features



Columns

Columns are enhanced by grazing the front or sides of the columns.

Lighting Strategies:

- Graze up or down the front of the column with narrow spot optics.
- Create depth by using multiple sources to light the sides of the columns.
- Use linear or wide optics to wash the surfaces behind the columns.



Materials & Textures

Grazing textured surfaces enhances the texture and provides drama by introducing shadows.

Lighting Strategies:

- Provide grazing distribution for linear luminaires.
- Mount luminaires close to the grazing surface; ideal distance depends on exact optics of the system.



Unique Lighting Opportunities

Façade lighting can be used to compliment atypical façades.

Lighting Strategies:

- Provide backlighting by illuminating the surfaces behind the unique feature.
- Use building features, such as windows, as alternative locations for lighting elements.
- Color filtering or color changing lighting may be used for special events at the discretion of the campus

Mounting Locations



Building Mounted

Grazing and backlighting may require luminaires to be building mounted. With many historic buildings on Campus, building mounted shall be carefully coordinated and approved by the Campus Architect.



Ground Mounted

Wall washing and other uniform lighting techniques can be achieved by lighting the surface from further away. In these instances, luminaires are likely to be ground mounted. Landscaping may be used to conceal luminaires from view without creating shadowing or blocking the light distribution. All floodlights shall be shielded to minimize glare, light pollution, and light trespass.



Constructability

Especially in a retrofit situation, it may not be possible to mount lighting in certain locations. Ease of construction and minimizing impacts to existing structures should inform which types of lighting strategies may be used for façade lighting.

Lighting Guidelines: Facades

UC Berkeley Lighting Criteria:

- **Limits of Criteria Application:** The Lighting Criteria shall apply to all façades. Façade lighting criteria is not based on a required illuminance level on the surface but instead specifies a maximum lumen output to reduce light pollution and over lighting.

Maximum Lumen Output	2000 lumens (lm) maximum
<ul style="list-style-type: none"> • Single Spot Accent • Linear Accent 	800 lm/ft maximum
Curfew	To be determined by University
Glare	Luminaires to be fully shielded Aimed to minimize spill light
Color Temperature	2700K-4100K

Lighting Design Considerations, Continued

Luminaire Style



Focused Accent

Spot accent luminaires with narrow optics create bold light patterns and more dramatic contrast.



Wall Wash

Luminaires with wider optics, set further back from the surface create a uniform wash on surfaces, typically creating less dramatic than focused grazing.



Linear Accent

Linear lighting is used when grazing or washing a façade when a large lighted surface area is desired. When grazing, narrow optics shall be used; when washing, wider optics and a further setback are required.



Direct View

Most façade luminaires should be hidden from view. However, direct view luminaires or translucent back-lit panels may be used to create unique lighting effects on façades.

Lighting Vignette Concept: Facades – Doe Memorial Library

General Description

The Memorial Glade along the north side of the Doe Memorial Library serves as a large common space used by students, faculty, and visitors. Increasing architectural lighting in this location improves the ambient light levels in the space while creating a visual boundary to define the surrounding space.

1 Façade Lighting

Façade lighting can bring out definition and detail in the architectural details of a building. This type of lighting can also be a tool for wayfinding on campus. Installing floodlights, ingrade luminaires, or other grazing luminaires improves the visibility of key facades.

2 Detail Lighting

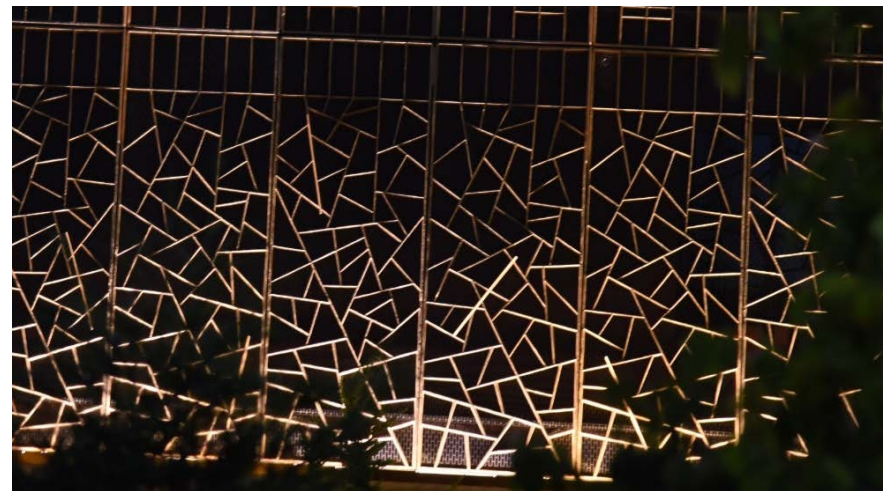
Detail lighting is a way to accent prominent architectural features. Lighting architectural details will give more dimension to a building. This type of lighting can be achieved in conjunction with façade lighting.

3 Pedestrian Lighting

Pedestrian lighting is important to illuminate the large walkways for safety and wayfinding. Post top luminaires help improve the ambient lighting in the space and can include advertising and outlet receptacles.



1 Façade Lighting



2 Detail Lighting



3 Pedestrian Lighting

Lighting Vignette Concept: Facades– California Hall

General Description

California Hall is within the campus's Historical Core at the center of campus along Sather Road, which is heavily used by students, faculty, and visitors. Visibility of this building at night will improve wayfinding and the aesthetic experience of the campus at night.

1 Façade Lighting

Façade lighting can bring out definition and detail in the architectural details of a building. This type of lighting can also be a tool for wayfinding on campus. Ground mounted or building mounted floodlights and accent lights create an opportunity to illuminate the façade of prominent buildings.

2 Detail Lighting

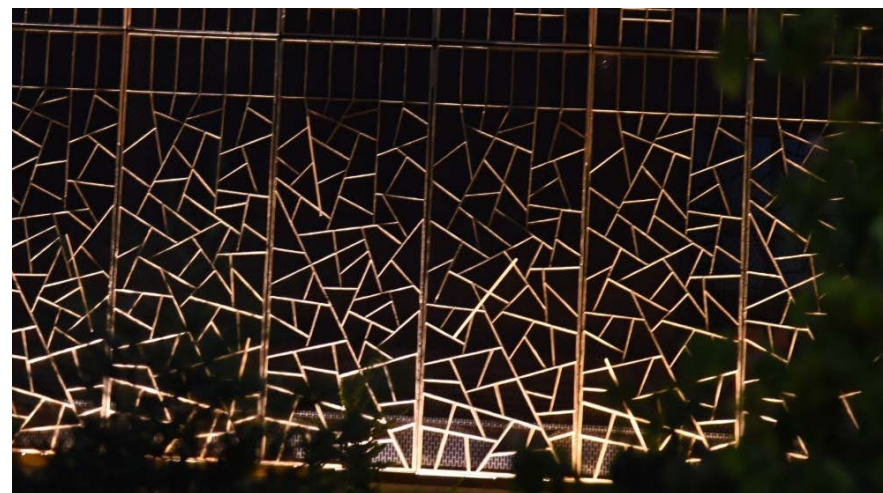
Detail lighting is a way to accent prominent architectural features or artwork. Lighting architectural details will give more dimension to a building. This type of lighting can be achieved in conjunction with façade lighting.

3 Pedestrian Lighting

Pedestrian lighting is important to illuminate the large walkways for safety and wayfinding. Post top luminaires help improve the ambient lighting in the space and may also include advertising and outlet receptacles.



1 Façade Lighting



2 Detail Lighting



3 Pedestrian Lighting

Lighting Guidelines: Ceremonial Spaces

Lighting Design Intent:

Lighting in Ceremonial Spaces should emphasize the architectural and/or landscape features of the space with serene, elegant and inspirational design. Lower ambient light levels allow accent lighting of features to create focal points for these spaces.

Lighting Design Considerations:

The following considerations should influence the lighting design strategies for Ceremonial Spaces. These considerations are expanded upon on the right.

Architectural Features

Luminaire Style

Additional Infrastructure

Lighting Goals:

- **Create layers of light** that appropriately address the intended uses, character and features of each Ceremonial Space.
- **Create wayfinding opportunities** by highlighting key destinations or ceremonial markers with light.
- **Create excellent visibility** by providing low-glare lighting and adequate light levels.
- **Provide flexibility** with lighting controls and/or electrical power for temporary events.

Sustainability and Energy Goals:

- **Control light trespass** at campus edges to:
0.3 footcandles maximum at residential areas
0.8 footcandles at commercial areas.
- **Limit light pollution** by limiting uplight and using fully shielded luminaires.
- **Promote health & well-being** by avoiding excessive light levels and providing warm colored light sources (3000K).

Lighting Strategies:

Pedestrian Lighting
Area Lighting
Hardscape Accent Lighting
Landscape Accent Lighting
Façade Lighting

Lighting Design Considerations

Architectural Features



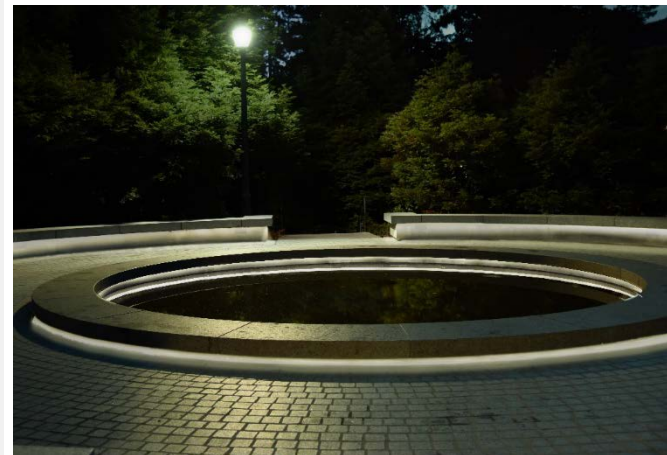
Focal Points

Lighting Intent:

Highlighting focal points within Ceremonial Spaces establishes a hierarchy of brightness and draws attention to important features.

Lighting Strategies

- Focused Accent Lighting
- Mount lights to the ground, trees, poles, or nearby buildings



Seat Walls

Lighting Intent:

Define the edges of a space while creating visual interest and by enhancing architectural features.

Lighting Strategies:

- Linear Accent Lighting
- Low output sources should be used to reduce glare and provide a low contrast scene.



Gateway Columns

Lighting Intent:

Grazing light onto column surfaces enhances the texture and form of gateways and improve wayfinding by improving visibility of distinct features from distant views.

Lighting Strategies

- Focused Accent Lighting
- In-grade uplights should be minimized, but may be necessary in hardscape areas.



Benches

Lighting Intent:

Create interest in an area by providing subtle lighting along the bottom of benches. Low levels of light improve visibility and safety.

Lighting Strategies:

- Linear Accent Lighting
- Uniform, low output sources should be used whenever possible



Direct View or Diffused Light Sources

Lighting Intent:

Visible or diffused light sources in limited, high-profile locations provide both ambient lighting for the Ceremonial Space and visibility from distant views.

Lighting Strategies:

- Architecturally significant, decorative luminaires.
- Architecturally integrated diffuse surfaces, back-lit to create internal glow.



Landscape

Lighting Intent:

Landscape lighting defines a space at night. Lighting along key pathways or around gathering spaces creates a sense of safety and distinguishes important areas.

Lighting Strategies

- Focused Accent Lighting
- Ground mounted lighting systems should have backlight shields to prevent glare

Lighting Guidelines: Ceremonial Spaces

UC Berkeley Lighting Criteria:

- **Limits of Criteria Application:** The Lighting Criteria shall apply to all hardscape Ceremonial Spaces. Ceremonial Spaces in softscape lawn or landscaped areas may include electrical power for temporary lighting of specific planned events. During a specific event in a softscape area, temporary lighting shall be provided to meet the appropriate Lighting Criteria, as follows.

Avg. Horizontal Illuminance	
• Normal Use	0.3 footcandle
• Small or Medium Event	0.5 footcandle
Horizontal Uniformity	4.0 avg/min
Avg. Vertical Illuminance	0.1 footcandle
Maximum Glare Rating (IES TM-15-07)	G1
Color Temperature	3000 Kelvin

Other Strategies:

- Infrastructure for Temporary Events
- Power for Event Tents, Temporary Stages, Holiday Lighting
- Communication Conduits for Speakers or Security Cameras

Lighting Design Considerations, Continued

Luminaire Style



Focused Accent

Spotlights and floodlights provide focused accent lighting. These lights are the most versatile in lighting effect, distribution, and mounting location.

Lighting Effect:

- Narrow distribution spotlights provide high contrast lighting that can emphasize artwork.
- Wide distribution floodlights provide uniform lighting for landscape lighting and subtle sculptural lighting.



Linear Accent

Linear accent lighting provides uniform lighting that can be used to create dramatic or intimate settings.

Lighting Effect:

- Low output linear lights underneath benches, and along seat walls provides uniform lighting.



Bollards

Bollard lights create a more intimate scale of lighting for smaller spaces.

Lighting Effect:

- Illuminate smaller spaces with bollard luminaires that don't overwhelm the space or compete with other focal points.

Additional Infrastructure



Power Receptacles

In some locations, temporary power for events or maintenance may be desired. Coordinate with UC Berkeley Staff to determine where power receptacles should be located.



Temporary & Holiday Lighting

Additional power at structures or near trees provide opportunities for temporary or holiday lighting to celebrate specific events.

Lighting Vignette Concept: Ceremonial Space – North Gate

General Description

North Gate is adjacent to Hearst Avenue and serves as a primary entrance to the Northside of campus. This gate creates an initial impression that will be impactful to visitors passing through the space.

1 Lantern Lighting

Existing lantern lighting is what makes North Gate a recognizable and important point of entry. Factors such as: color temperature, using an LED source, and reliable electrical equipment provides an opportunity to improve energy efficiency, light levels, and overall success of the lantern lighting.

2 Column Accent Lighting

The columns at the North Gate are architectural features that present an opportunity for accent lighting. Locating an in-grade luminaire at the base of the structure would light the column face and further increase light levels in the ceremonial space.

3 Bollard Lighting

Bollards can be used to illuminate key paths at a more intimate level because they create smaller pools of light. This provides wayfinding and a general sense of safety for people moving through a plaza.



1 Lantern Lighting



2 Column Accent Lighting



3 Bollard Lighting

Lighting Vignette Concept: Ceremonial Space – Sather Gate

General Description

The crown of Sather Gate reads “fiat lux” which means “let there be light.” This gate is a prominent and well known element of UC Berkeley that serves as a major entrance into campus.

1 Lantern Lighting

Existing lantern lighting is a notable feature of Sather gate. It makes it recognizable and prominent for the entryway for campus. Factors such as color temperature, using an LED source, and reliable electrical equipment provides an opportunity to improve energy efficiency, light levels, and overall success of the lantern lighting.

2 Column Accent Lighting

The base of the gate is the supporting column which should not be overlooked. Using an in-grade luminaire can help highlight the column and add definition to the gate’s architectural elements.

3 Focal Point Lighting

The focal point of this ceremonial space is Sather Gate itself. Illuminating the crown of the gate is an important addition to make this entrance stand out.

4 Balustrade Lighting

Adding in lighting under the top portion of these walls can serve as a way to guide people into campus. Accenting the underside of the walls will brighten balustrades and features along the walls. Furthermore, this lighting strategy will illuminate this pathway for a greater sense of safety and wayfinding.



1 Lantern Lighting



2 Column Accent Lighting



3 Focal Point Lighting



4 Balustrade Lighting

Lighting Guidelines: Accent

Lighting Design Intent:

Accent Lighting creates interest in a space by including layers of light, wayfinding, improving illuminance levels and defining the edges of the space. Low lumen output luminaires or shielding should be installed to prevent unwanted glare into surrounding areas. The lighting should be carefully selected to complement the feature being emphasized.

Lighting Design Considerations:

The following characteristics of accent lighting will influence the lighting design strategies. These considerations are expanded upon on the right.

Architectural Features

Mounting Locations

Luminaire Style

Lighting Goals:

- **Improve the sense of safety** by increasing the perception of brightness in areas next to pathways and gathering spaces.
- **Provide interest and wayfinding** by emphasizing key elements that are unique to the campus
- **Create layers of light** that appropriately address the intended uses, character and features of each space.
- **Create excellent visibility** by providing low-glare lighting and appropriate lighting contrast.

Sustainability and Energy Goals:

- **Limit light pollution** by limiting uplight and using fully shielded luminaires.
- **Promote health & well-being** by avoiding excessive light levels and providing warm colored light sources.
- **Consider maintenance** cost by selecting a family of luminaires that meet the lighting requirements for a variety of situations.

Lighting Strategies:

- Focused Accent Lighting
- Linear Accent Lighting
- Integrate focused and linear lighting into architectural elements

Lighting Design Considerations

Architectural Features



Sculptures

Lighting Intent:

Create interest and improve nighttime visibility by highlighting interesting sculptures and other pieces of art.

Lighting Strategies

- Focused Accent Lighting
- Mount lights to the ground, trees, poles, or nearby buildings



Landscape

Lighting Intent:

Landscape lighting defines a space at night. Lighting along key pathways or around gathering spaces creates a sense of safety and distinguishes important areas.

Lighting Strategies

- Focused Accent Lighting
- Ground mounted lighting systems should have backlight shields to prevent glare



Benches

Lighting Intent:

Create interest in an area by providing subtle lighting along the bottom of benches. Low levels of light improve visibility and safety.

Lighting Strategies:

- Linear Accent Lighting
- Uniform, low output sources should be used whenever possible



Seat Walls

Lighting Intent:

Define the edges of a space while creating visual interest and by enhancing architectural features.

Lighting Strategies:

- Linear Accent Lighting
- Low output sources should be used to avoid excessive contrast.



Bridges

Lighting Intent:

Installing lighting elements on the edges of bridges improves visibility and safety while accentuating a place of interest.

Lighting Strategies:

- Linear Accent Lighting installed at low levels
- Decorative lights become pieces of art
- Minimize backlight to prevent spill into the natural environment



Stairs

Lighting Intent:

The play of light and shadow on stairs at night is necessary to distinguish each step. The treads should be well lit to contrast darker risers

Lighting Strategies:

- Integrated Lighting (handrails or steps)
- Area lights
- Edges of stair treads should be well lit

Lighting Guidelines: Accent

UC Berkeley Lighting Criteria:

- Limits of Criteria Application:** Contrast and glare should be carefully considered for all accent lighting. Linear accent lighting may be installed along linear features. Focused lighting is recommended for lighting organic shapes and sculptures. Consider the following contrast ratios to when designing accent lighting, these contrast ratios are determined based on the luminance differences between the accent feature and the surrounding area (accent element-to-surrounding environment):

Dramatic Contrast: creates a focal point	20:1
Feature Lighting: highlights element	10:1
Destination Lighting: subtly emphasizes element for wayfinding	5:1
Visual Edge: creates subtle differentiation between elements	2:1
No Contrast: feature is not differentiated from background	1:1

Other Strategies:

- Minimize equipment by mounting focused accent lights on area poles.
- Install linear accent lighting underneath decorative elements to conceal the light source.

Lighting Design Considerations, Continued

Mounting Locations



Integrated

Luminaires integrated into architectural features, wall caps, handrails, provide dramatic accent lighting.



Ground Mounted

Luminaires for lighting artwork, landscape, and façades may be ground mounted for easy installation and maintenance. The luminaires should be shielded to prevent glare near pathways, and uplight should be minimized to reduce light pollution.



Pole or Building Mounted

Mounting a light to a pole, wall or other vertical surface reduces uplight and light trespass into surrounding areas, while accentuating interesting elements. Internal or external shields and louvers should be included when the light source is visible.

Luminaire Style



Focused Accent

Spotlights and floodlights provide focused accent lighting. These lights are the most versatile in lighting effect, distribution, and mounting location.

Lighting Effect:

- Narrow distribution spotlights provide high contrast lighting that can emphasize artwork.
- Wide distribution floodlights provide uniform lighting for landscape lighting and subtle sculptural lighting.



Linear Accent

Linear accent lighting provides uniform lighting that can be used to create dramatic or intimate settings.

Lighting Effect:

- Low output linear lights underneath benches, along seat walls, and bridges provides uniform lighting.

Lighting Vignette Concept: Accent Lighting – West Gate

General Description

Serving as the West Gateway to the UC Berkeley campus, students and faculty should feel welcome and safe to walk through.

1 Tree Accent Lighting

Tree lighting is used to display the natural elements of the plaza. By reducing shadows and increasing ambient lighting the tree lighting will provide more spatial awareness. This heightened spatial awareness gives a perception of safety in a plaza such as this one.

2 Pedestrian lighting

Pedestrian lighting improves safety, visibility, and wayfinding along pathways. Post top luminaires will improve the ambient lighting in the space and can include banners for advertising opportunities and outlet receptacles.



1 Tree Accent Lighting



2 Pedestrian Lighting

Lighting Guidelines: Transit Stops & Bike Racks

Lighting Design Intent:

Transit Stops and Bike Racks must be designed to provide safe stopping points at all times of the night. Students will spend time waiting at these locations, so higher light levels are warranted for safety. The lighting should be low-glare, while providing adequate light levels on horizontal walkways and on faces of pedestrians. It is also important to locate luminaires in front of Transit Stops, instead of behind, to better illuminate the faces of riders for bus drivers.

Lighting Design Considerations:

The following features of Transit Stops and Bike Racks will influence the lighting design strategies. These considerations are expanded upon to the right.

Space Size

Surrounding Environment

Luminaire Style

Lighting Goals:

- **Create excellent visibility** by providing low-glare lighting and adequate light levels.
- **Enhance security** by providing vertical illumination to light faces of pedestrians.

Sustainability and Energy Goals:

- **Control light trespass** at campus edges to:
0.3 footcandles maximum at residential areas
0.8 footcandles at commercial areas.
- **Limit light pollution** by limiting uplight and using fully shielded luminaires.
- **Promote health & well-being** by avoiding excessive light levels and providing warm colored light sources (3000K).

Lighting Design Considerations

Space Size



Large – Covered

Lighting Strategies:

- Pedestrian luminaire to be located in front of transit stop, on the approach side of the stop.
- Additional lighting in the covered transit stop may be used.
- At large bike parking areas, provide pedestrian lights at 40-ft to 60-ft spacing



Small – Uncovered

Lighting Strategies:

- Pedestrian luminaire to be located in front of transit stop, on the approach side of the stop.

Surrounding Environment



Low Density

Lighting Strategies:

- Provide Type V Symmetric Light Distribution
- Allow spill light into natural areas.
- Provide additional pedestrian luminaires as needed as there is no spill light from surrounding buildings.



Medium Density

Lighting Strategies:

- Provide Type III Light Distribution.
- Illuminate surrounding facades for wayfinding.



High Density

Lighting Strategies:

- Apply backlight shields to prevent light trespass.
- Illuminate surrounding facades to provide a portion of the light levels on the pathways.

Lighting Guidelines: Transit Stops & Bike Racks

UC Berkeley Lighting Criteria:

- **Limits of Criteria Application:** The Lighting Criteria shall apply to all Transit Stops and Bike Paths:

Avg. Horizontal Illuminance	1 footcandle
Horizontal Uniformity	4.0 avg/min
Avg. Vertical Illuminance	0.3 footcandles
Maximum Glare Rating (IES TM-15-07)	G1
Color Temperature	3000 Kelvin
Luminaire Location	Located in front of Transit Stops

Other Strategies:

- Power for Holiday Lighting
- Communication Conduits for Speakers or Security Cameras

Lighting Design Considerations, Continued

Luminaire Style



Historic

Historic post top luminaires are located throughout the majority of campus. The decorative luminaire, pole, and pole base compliment the classical architecture of the original campus buildings.



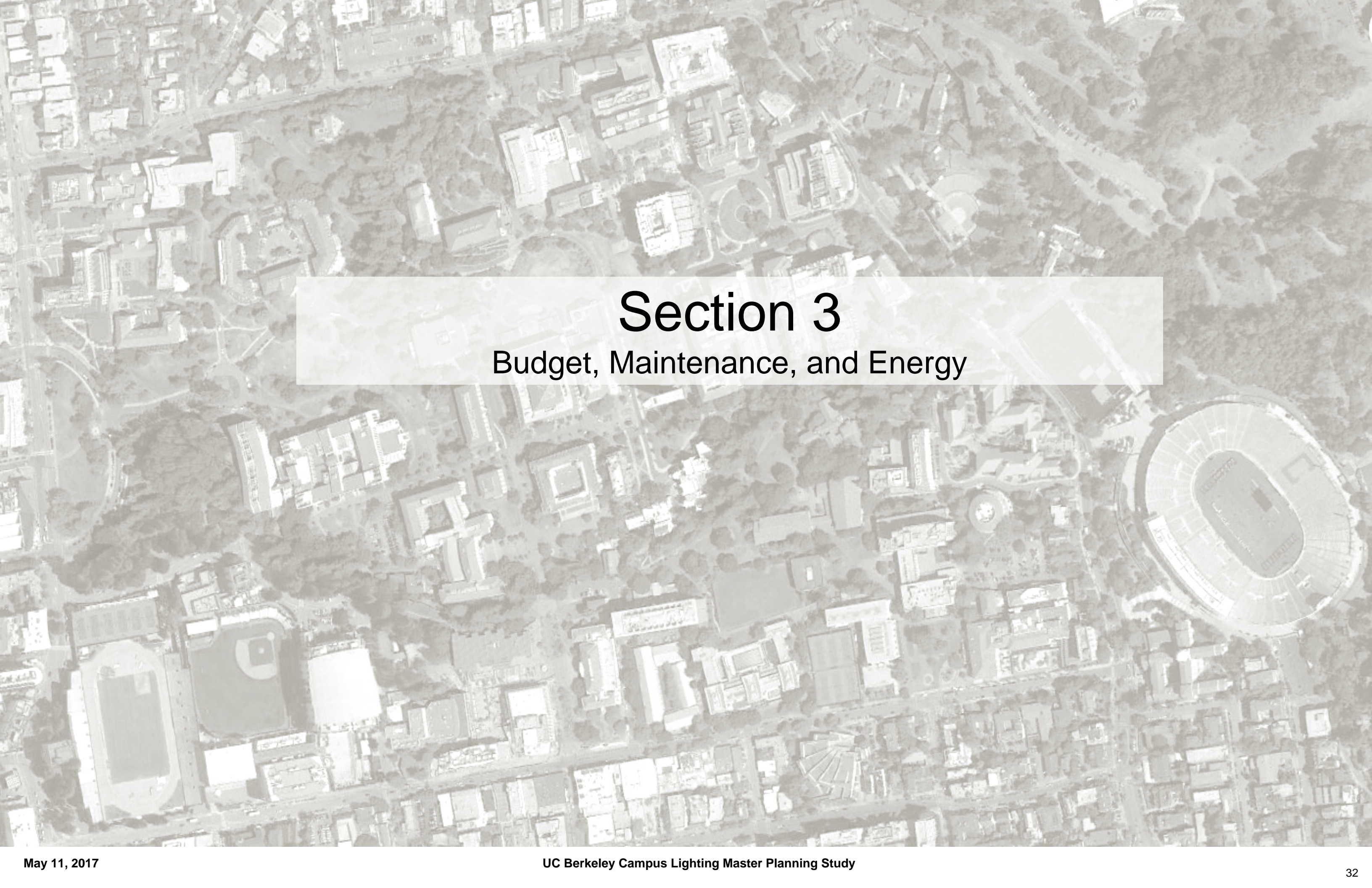
Contemporary

Contemporary style pedestrian and bollard luminaires may be appropriate to compliment the adjacent architecture. Contemporary lighting should be selected to match existing contemporary style luminaires currently installed elsewhere on campus, unless otherwise approved by Campus Staff.



Rustic

Luminaires installed near rustic buildings such as the Faculty Club should promote the building's architectural form. Lights with craftsman style forms and rustic metal surfaces become an interesting architectural feature that complements the rustic building style.



Section 3

Budget, Maintenance, and Energy



Budget

Funding

The UC Berkeley Life Safety Committee has currently allocated approximately \$2 million for the Phase 1 lighting improvements as recommended in this Lighting Master Planning Study. Future funding allocation will be needed to complete Phase 2 and Phase 3 lighting improvement recommendations.

Budgeting, Prioritizing & Phasing

The budgeting, prioritizing and phasing proposed in this Lighting Master Planning Study involved collaboration and input from various stakeholders, including the UC Berkeley Life Safety Committee, student representatives from the Associated Students of the University of California (ASUC), UC Berkeley Real Estate, Physical & Environmental Planning, Construction & Design and the University of California Police Department (UCPD).

This collaboration included interviews, group discussions and nighttime campus walks, resulting in three options for campus pathway prioritizing and phasing. Cost budgets were developed for each of these three options by a third-party cost estimator who is familiar with the UC Berkeley Campus, and University project costs were included. The final phasing map in this Lighting Master Planning Study was selected by the various stakeholders to provide a network of well illuminated nighttime pathways throughout the Campus, while also providing some funding for façade and accent lighting that will enrich the nighttime experience on campus.



Maintenance

Long Life, Durable Products

LED lighting technology has now surpassed all other light source technologies in terms of product life and durability. Current LED products report expected lifetimes of 100,000+ hours, based on industry standard L70 performance, at which the light output of the product has reduced to 70% of the initial light output. Dispersion of heat away from LED circuit boards through luminaire thermal management is the most significant factor in the lifetime expectancy of LED light sources.

LED drivers often have a shorter life expectancy than the LED light source. Thermal separation between the LED circuit board and the LED driver is important to maintaining the life of both components. Accessible drivers and serviceable LED light sources are key features that should be considered when selecting luminaires.

Manufacturers shall provide a minimum of 10-year warranties for LED luminaires.

Controlling Inventory

New lighting projects on the UC Berkeley Campus should utilize luminaires that are already used elsewhere on Campus to keep the inventory of luminaires and number of lighting manufacturers to a reasonable and manageable level.



Energy

Energy Efficient Luminaires

LED lighting technology is now more efficient than all other light source technologies. LED light source continue to improve in efficacy, meaning they provide more lumens per watt of energy used. These light sources are also becoming very common and an industry standard. Many current LED luminaires exceed 90 – 100 lumens per watt.

Energy Efficient Design

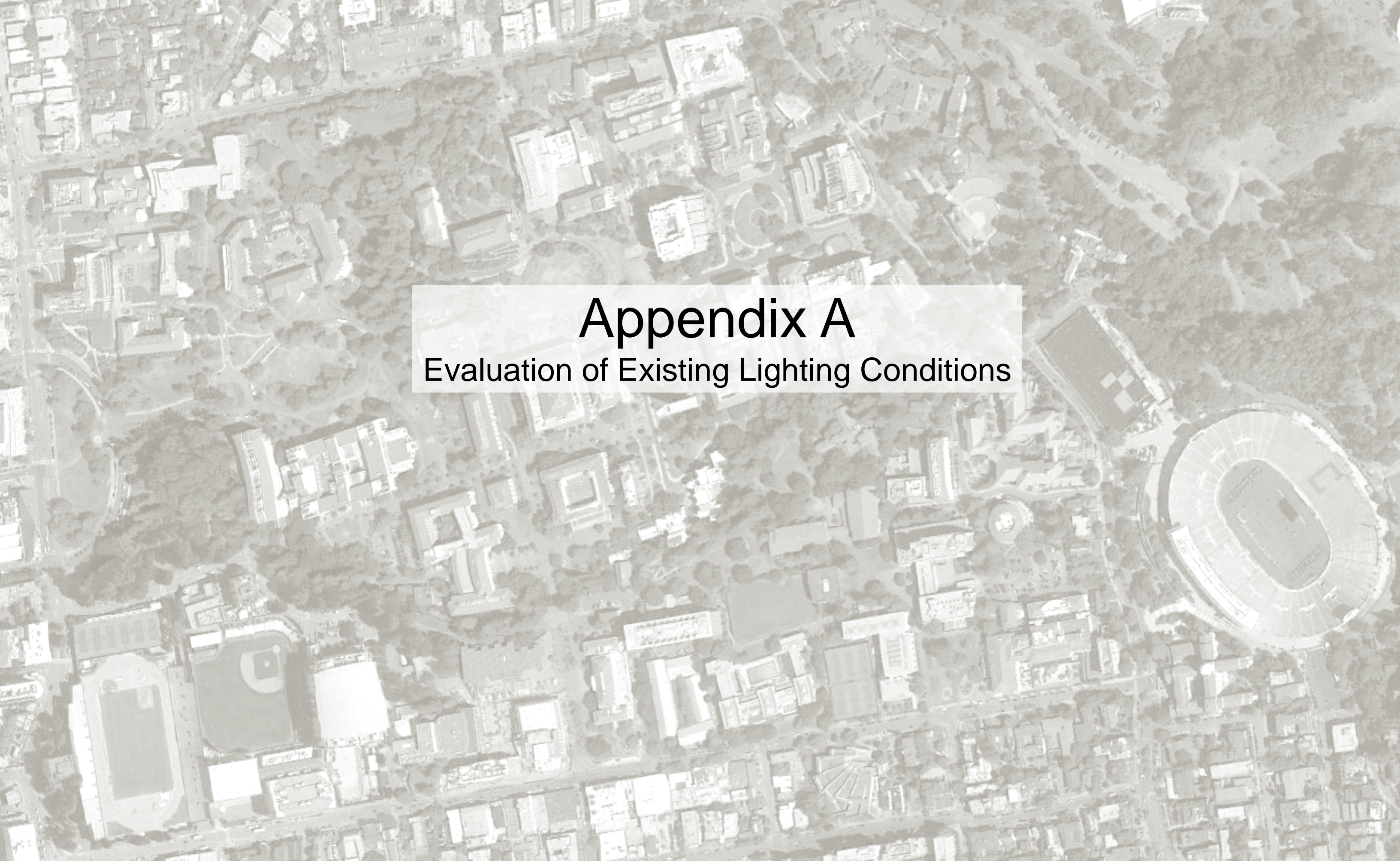
Energy efficient design will mean something different for each project. Good design must find the balance between safety, budget, energy efficiency, and aesthetics. The key feature of energy efficient design is intentional placement of luminaires. It is important to avoid over-lighting, or putting lumens where they are not wanted, such as a bedroom window or the night sky. Using the correct luminaire style and distribution type for each application will mitigate these issues, along with aiming any adjustable luminaire.

A good, energy efficient design will prioritize quality over quantity. Employing different layers of light for the application will create an environment that feels well lit while using fewer lumens and watts.

Lighting Controls

An energy efficient design focuses both on where and when the light is used. Controlling exterior lighting is incredibly important in employing strategies such as dimming or turning off luminaires during curfew hours, providing only the light that is needed, when it is needed.

Currently, the pedestrian lighting on Campus is controlled by remote photocells for dusk to dawn operation with no dimming and no time-switch control. As new lighting is installed, additional time-switch and dimming control should be considered and discussed with Campus Staff and Maintenance to determine which lights may be turned off or dimmed during curfew hours.



Appendix A

Evaluation of Existing Lighting Conditions

Existing Conditions Summary

The University of California, Berkeley Student Life Safety Committee requested an evaluation of the existing pathway nighttime light levels and proposed pathway lighting improvements to enhance nighttime safety and security. To obtain a comprehensive understanding of the existing lighting, Clanton & Associates surveyed ten locations on campus, conducted nighttime surveys, and calculated the light levels along all the primary and secondary nighttime paths. By enhancing the lighting on these key paths students will be able to safely move between event spaces, 24/7 facilities, and transit stops at night.

Evaluation of existing lighting conditions

In June 2016, Clanton & Associates evaluated the current campus lighting conditions at ten sites around campus that provided an understanding of the diversity of lighting conditions. The selected sites included natural environments, new lighting conditions, and primary pathways. Both horizontal and vertical illuminance (the amount of light reaching a surface, expressed in units of footcandles [fc]) measurements were taken along the pathways at each site. Luminance (the amount of light reflected from a surface that the eye perceives, expressed in units of candela per square meter [cd/m²]) measurements were also taken to understand the surrounding surface brightness. These measured light levels were used to compare the existing light levels to the light level requirements established by the campus. Clanton & Associates also took high-dynamic-range (HDR) images as a visual representation of the perceived nighttime experience. Simultaneously to the lighting measurements being taken, Campus stakeholders completed a subjective survey assessing the lighted environment at each site. The survey results and lighting measurements can be found in Appendix B.

Campus lighting levels

To understand the pathway lighting throughout the entire campus, Clanton & Associates calculated the primary and secondary pathways light levels. These calculations were based on the new Sentry LED retrofit luminaire, which will be installed within the school year. Each section of the campus pathways is categorized into three levels of acceptability based on the calculations, survey results, and by comparing measured lighting levels to the campus lighting standards.

Acceptable: Sections of pathways that meet campus lighting standards, with the new Sentry LED retrofit, and received high survey scores, are acceptable. These areas will not require any lighting improvements beyond the LED retrofit, which will be installed in a project separate from these lighting improvements.

Marginally Acceptable: Sections of pathways that do not meet campus lighting standards and received medium to low survey scores, are marginally acceptable. Typically, these pathways have relatively small areas that are darker between poles, and would require minor improvements to meet campus lighting standards.

Unacceptable: Sections of pathways that have very low light levels and scored lowest on surveys are unacceptable. These areas typically do not have enough pedestrian lights, and will most likely require significant investment in new lighting and electrical infrastructure to meet campus lighting standards.

Lighting improvements

The primary pathways should be the focus of future lighting improvements. This will provide well lighted pathways between transportation, 24/7 facilities, retail venues, and other key destinations throughout the Campus. Care will be taken to incorporate the lighting into the surrounding pathway environment to improve the sense of safety and security.

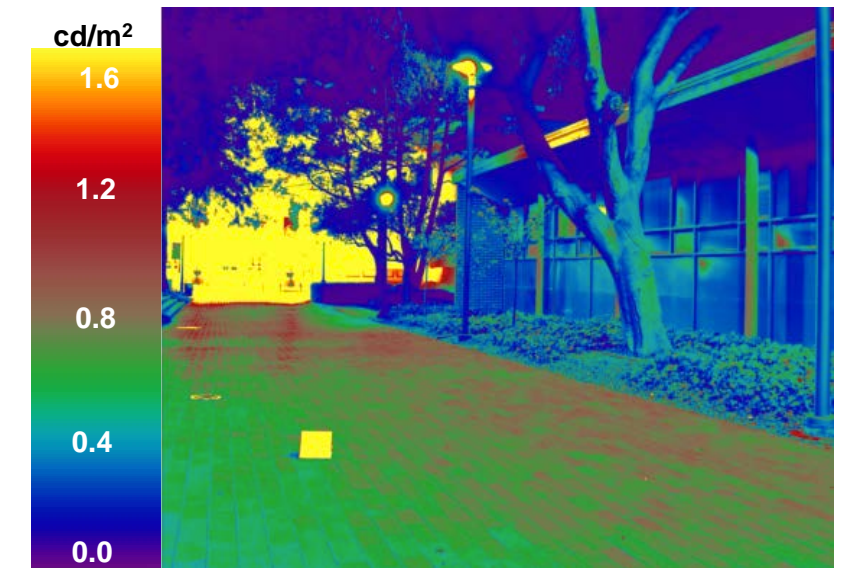
Additionally, well lighted entries will provide wayfinding when approaching the building and improve light to dark adaptation when leaving. Subtle façade lighting on key buildings throughout campus will improve the ambient lighting in a space, wayfinding, and visibility. Vertical light levels will also be increased, which enhances facial and object detection. Low glare luminaires with warm colored light will draw people toward their final destinations.

Existing Conditions Example

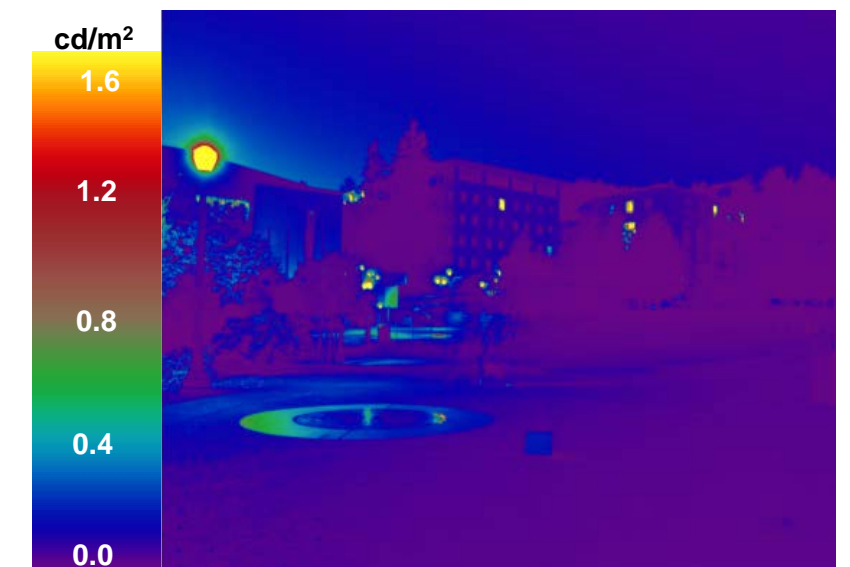
The following High Dynamic Range images (HDR) and measured illuminance levels were taken during the June 2016 site visit. An analysis of the ten sites surveyed can be found in Appendix B.

Measured Illuminance Levels

Criteria	Acceptance Level	Illuminance Type (fc)	Horizontal Illuminance	Vertical Illuminance
Criteria	Acceptable	Average	0.5	0.25
Lower Sproul/ Alumni Walk	Acceptable	Average	0.7	0.36
Moffitt Library/ Sather Road	Unacceptable	Average	0.2	0.13



Lower Sproul/ Alumni Walk – Acceptable (0.7 average illuminance)



Moffitt Library along Sather Road – Unacceptable (0.2 average illuminance)

EXISTING CONDITIONS SUMMARY

Exterior lighting LED retrofit

The current LED pathway luminaires are failing, thus providing very little useful light at night. To rectify this, new Sentry LED retrofit luminaires will be installed in place of the current LEDs, within the 2016-2017 school year. The Sentry retrofit will replace the luminaire cap on the existing pathways poles, as shown on the right. The luminaire lens may also be retrofitted with new sandblasted lenses to improve the light distribution along the path.

While Sentry provides multiple retrofit options, Clanton & Associates recommends purchasing a 3000K LED. White light improves color rendering of objects and the warm color temperature creates a welcoming nighttime environment. The 700mA operating current option is recommended for glare reduction. Minimizing glare will reduce the contrast between illuminated areas and darker natural environments, thus increasing visibility.

The primary and secondary pathway lighting calculations were based on the Sentry LED retrofit. The calculation assumptions are listed below:

- Luminaire: Sentry LED retrofit kit
- Catalogue Number: 24LEDV29-0.7A-830-BRT2-[sand blasted lens]-BK
- Color Temperature (CCT): 3000K
- Luminaire Operating Current: 700mA
- Light Distribution: Type III (Asymmetric, forward throw)
- Pole Height: 14 feet

The resulting illuminance levels, calculated in AGi32, are shown on the next page. Each pathway is prioritized by the calculated lighting level.

Label	Illuminance Level (fc)	Uniformity (Avg/Min)
Low Priority	≥ 0.5 fc (UCB lighting standard)	≤ 8.0
Medium Priority	0.3 – 0.5	≤ 8.0
	< 0.3	> 8.0

Exterior lighting improvements

To improve the safety and security of the nighttime pathways, Clanton & Associates recommends prioritizing the retrofits along the acceptable pathways. This will focus the lighting improvements to under lighted pathways. After the LED retrofits are installed, and the pathways have been relighted, all the primary pathways will be well lighted. These pathways will provide access to 24/7 facilities, event spaces, and transportation stops at night.

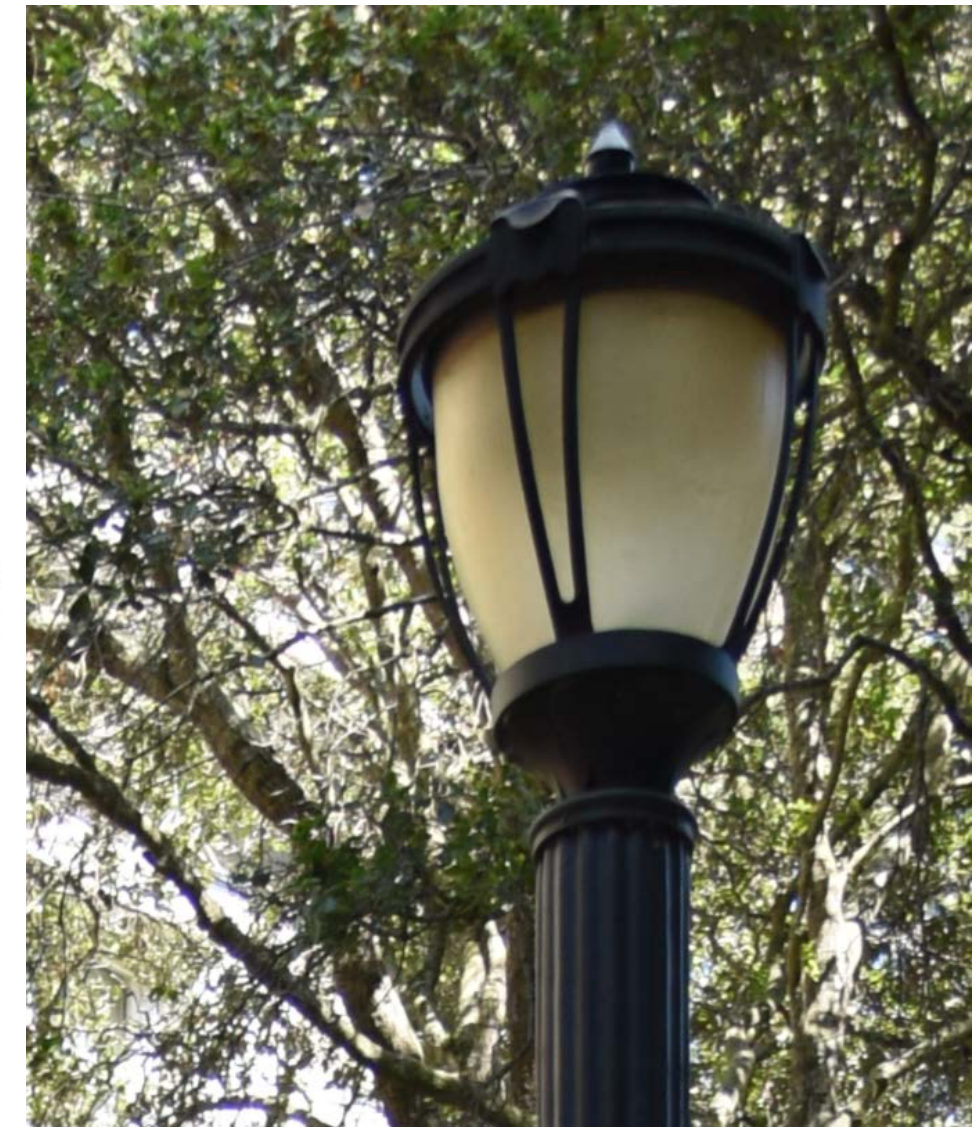
Further analysis of newly improved building lighting should be performed to confirm that these newly lighted pathways meet the campus lighting standards of 0.5 footcandles (fc). The lighting acceptability level of pathways near these buildings might be altered if ambient light levels are higher than calculated.

Electrical improvements

The existing electrical infrastructure around UC Berkeley appears to be in good shape and adequate for reuse wherever possible. The level of new electrical infrastructure need along each pathways has been

Label	Electrical Improvements
Tier I	No new circuits or power sources are expected for retrofit of current lighting
Tier II	Extend existing circuits to incorporate new lighting installation
Tier III	New electrical circuits required to provide power to new lighting installation

Sentry LED retrofit



Ambient Temperature	-40° C minimum to 35° C maximum (Luminaire not to operate at maximum temperature for a period of time longer than 15% of total operating hours.)
CRI	80
Color Temperature	2700K, 3000K, 3500K, 4000K
Rated Life (L70B50) @ 25° C Ambient Temperature	50,000 Hours at 70% lumen maintenance
Surge Protection	Surge current rating of 20 kA using standard 8/20 μSec wave. Protected line-neutral, line-ground, and neutral-ground in accordance with ANSI/IEEE 62.41, Category C3.
Driver Specifications	<ul style="list-style-type: none"> • 120-277V power supply • Compatible with 0-10V and step dimming lighting control systems • Complies with the requirements of UL and CSA

EXTERIOR LIGHTING

Electrical Improvement Tiers

The key nighttime pathways have been separated into tiers based on the complexity of the electrical design and construction required to improve the lighting levels.

Tier I

The lighting levels along Tier I pathways will be adequate after the Sentry LED retrofit occurs. Existing electrical equipment and lighting poles can be reused.

Electrical Improvements: No new circuits or power sources are expected for retrofit of current lighting

Tier II

The Tier II pathways require additional lighting installations which can be connected to the existing power sources.

Electrical Improvements: Extend existing circuits to incorporate new lighting installation

Tier III

Additional luminaires are necessary to increase the lighting levels along Tier III pathways. Additional electrical design is required to provide power to these locations.

Electrical Improvements: New electrical circuits are required to provide power to new lighting installation



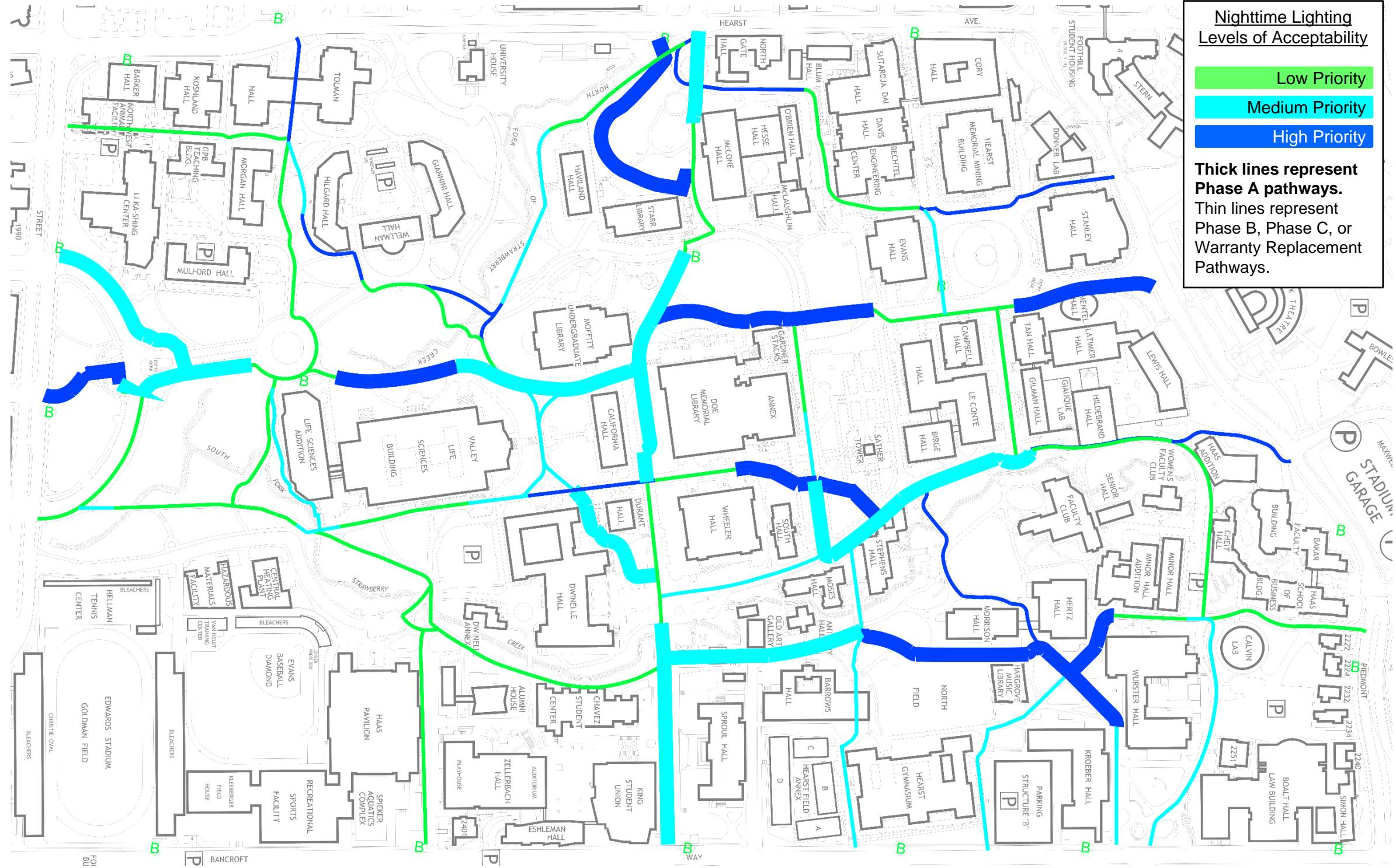
Nighttime Levels of Acceptability

To understand the existing lighting levels ten locations on campus were studied, nighttime surveys were conducted, and the light levels along the primary and secondary nighttime paths were calculated. These lighting calculations and existing conditions can be found on the next page. The site surveys and measured lighting levels can be found in Appendix B.

The nighttime pathways were prioritized by comparing the lighting level to the preferred campus lighting standard of 0.5 footcandles (fc). The colors on the map to the right represent levels of acceptability.

The lighting improvements have been broken into three staging recommendations, listed below. These stages will ensure that several pathways throughout the campus will be well lit while improvements are made to secondary pathways (Phase B and Phase C pathways). The staging is determined from the prioritized pathways shown in the image to the right. The primary pathways recommended for improvements are represented by thick lines. The secondary or low priority pathways, represented by thin lines, can be relighted at UC Berkeley's convenience.

1. **Sentry LED retrofit (Warranty Replacements)**
Sentry LED retrofits should be installed along the nighttime pathways, since the pedestrian LEDs throughout the campus are of diminished quality. Several pathways will be under lighted until the LED retrofits are installed.
2. **Improve primary pathways**
Additional lighting should be installed along primary pathways that are considered medium or high priority. These areas are indicated by a thicker, dark blue line on the map to the right.
3. **Improve secondary pathways**
Providing additional lighting along the secondary pathways is a lower priority, but necessary to ensure that the campus is well lighted. These paths are shown as thin lines.



Nighttime Lighting Levels of Acceptability

- Low Priority
- Medium Priority
- High Priority

Thick lines represent Phase A pathways.
Thin lines represent Phase B, Phase C, or Warranty Replacement Pathways.

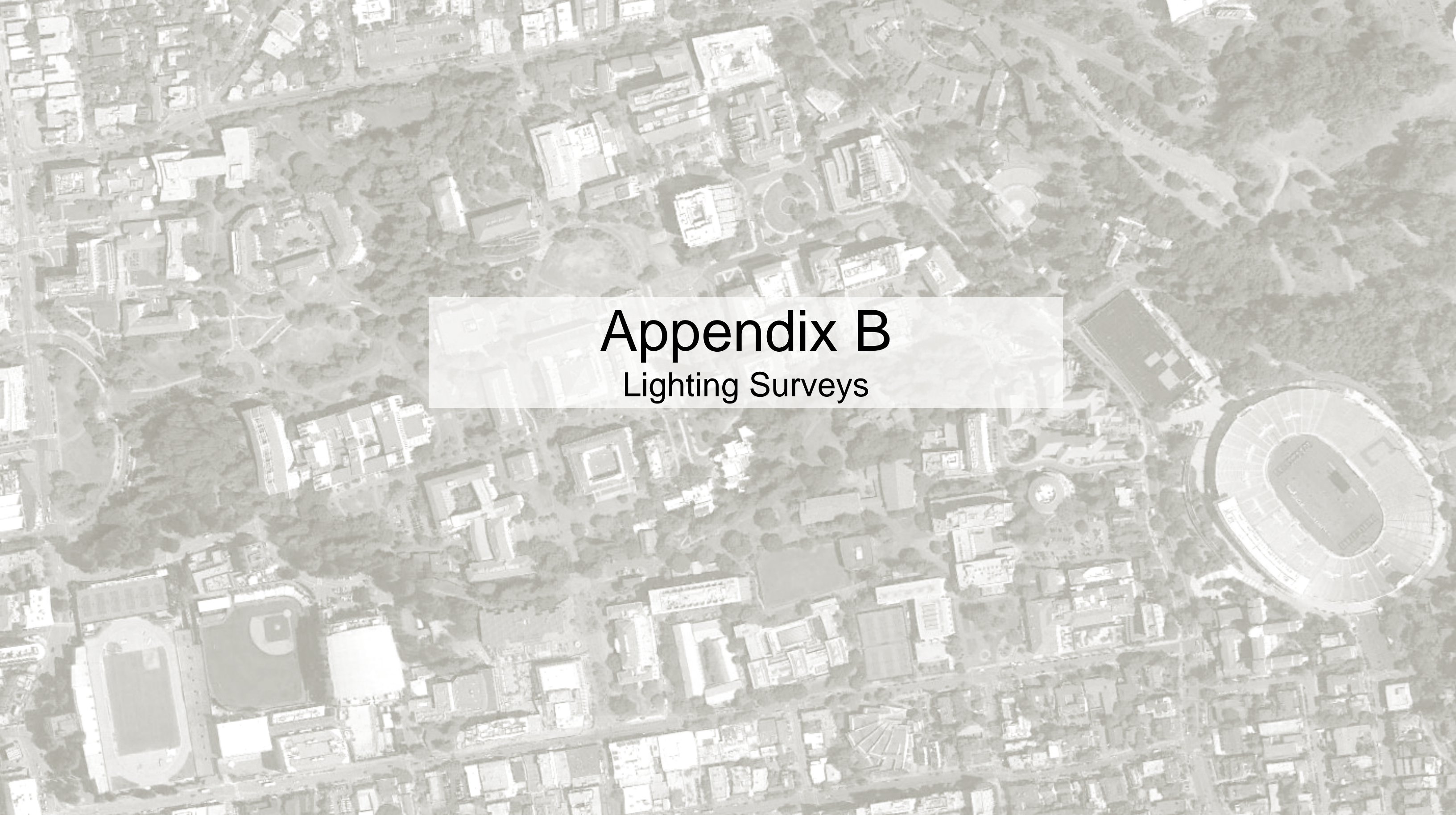


Illuminance Values Color Scale

█	0.9 – 2.0 FC
█	0.7 – 0.9 FC
█	0.5 – 0.7 FC
█	0.3 – 0.5 FC
█	< 0.3 FC

- Note:**
1. Building mounted lights are not included in the calculated light levels.
 2. Light level calculations assume Sentry LED retrofit is complete.

CALCULATED EXISTING CONDITIONS



Appendix B

Lighting Surveys

Site Observations

The UC Berkeley Campus Lighting Study provides an understanding of the current nighttime lighted environment in ten different locations throughout the central UC Berkeley campus. The sites were selected based on student comments, the Fiat Lux from prior years, natural environments, and new lighting solutions. The selected survey sights provide a collective understanding of the lighting and environmental conditions found throughout the campus. The ten nighttime sites are:

- Sproul Plaza;
- The Alumni Walk, also labeled as Lower Sproul;
- The Spieker-Grinnell-FSW Intersection;
- Grinnell Glade;
- Springer Gateway;
- Tolman Gateway at Morgan Hall;
- Wickson Glade along Euclid Drive at Haviland Hall;
- Moffitt East Terrace along Sather Road;
- South Drive at Hildebrand Hall;
- Peppertree Way at Morrison Hall, also called Morrison Road.

After the Campus and Clanton & Associates documented the initial site observations, lighting measurements were taken. Both horizontal and vertical illuminance (the amount of light reaching a surface) measurements were taken along each pathway. Luminance (the amount of light on a surface that the eye perceives) measurements were also taken to provide an understanding of surface brightness at each site. These measured light levels are used to compare the existing light levels to the light level requirements established by the Campus. Clanton & Associates also took high-dynamic-range (HDR) images as a visual representation of the perceived nighttime experience. An example, of the images taken, is shown to the right.

Simultaneously to the lighting measurements being taken, ten Campus stakeholders were taken on a nighttime tour of the selected sites and asked to complete a survey assessing the lighted environment. The survey was comprised of several subjective questions regarding the safety and aesthetics of each site. The survey includes, but is not limited to, the following questions:

- It would be safe to walk here, alone, during daylight hours.
- It would be safe to walk here, alone, during darkness hours.
- The light is uneven (patchy).
- The light sources are glaring.
- The lighting is poorly matched to the campus.

Participants answered each question with a ranking between Strongly Agree and Strongly Disagree. The answers to each question were combined to provide an understanding of each site. Participants surveyed ten different sites featuring natural areas, plazas, bike paths, and roadways.

Establishing Levels of Acceptability

The site observations and study results are used to create four levels of acceptability: high, medium, low and lowest.

A high acceptability is obtained by meeting the Campus lighting standard of 0.5 fc (horizontal illuminance level in footcandles) with adequate vertical illumination to allow facial detection. The lighting in this location is relatively uniform, provided by warm (3000K) light sources that are not glaring.

A medium acceptability indicates that the lighting in the area feels comfortable. In some cases, such as Tolman Gateway, the light level might be lower than the Campus standard but the lack of glare and shadowing from surrounding landscaping, along with some surrounding surface brightness, creates a comfortable nighttime environment. In other locations such as Grinnell Glade, the light levels are adequate but the luminaires are glaring.

A low level of acceptance is often seen in locations with a large contrast

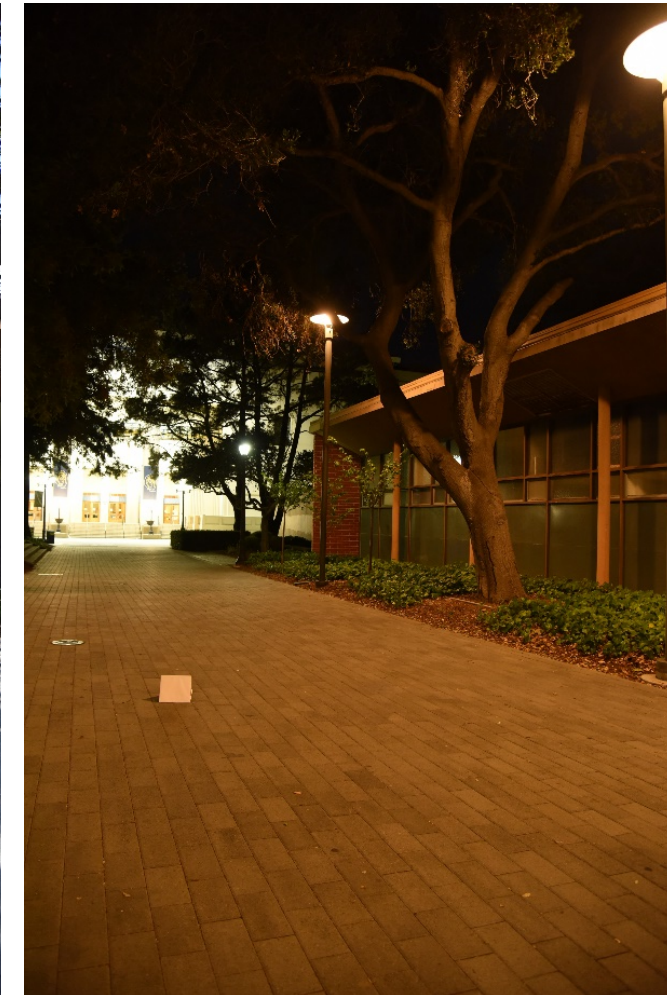
along the main pathway, such as Sproul Plaza and the Spieker-Grinnell-FSW intersection. Although the light level or uniformity in these two locations is only slightly lower than Campus standards, the high uniformity contrast makes the space feel uncomfortable.

The lowest level of acceptance occurs when the luminaires are spaced too far apart to provide adequate light levels and uniformity. These spaces are often characterized by a lack of ambient light provided by illuminated windows in buildings, façade lighting, or natural environments with lower light levels.

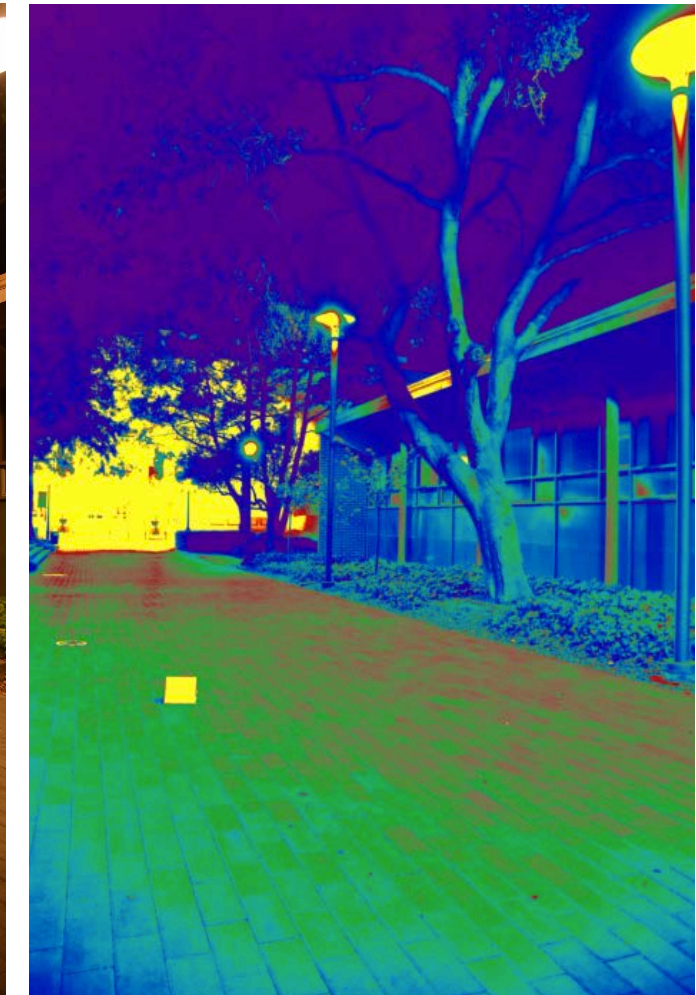
These four levels of acceptable are applied to the ten sites studied to provide an understanding of the nighttime environments found throughout the Campus. This allows a variety of lighting improvement options to be developed. These future lighting options will enhance the nighttime safety and security around campus. Each option will focus on improving light levels, uniformity, and wayfinding while reducing glare.



Alumni Walk Daytime Environment



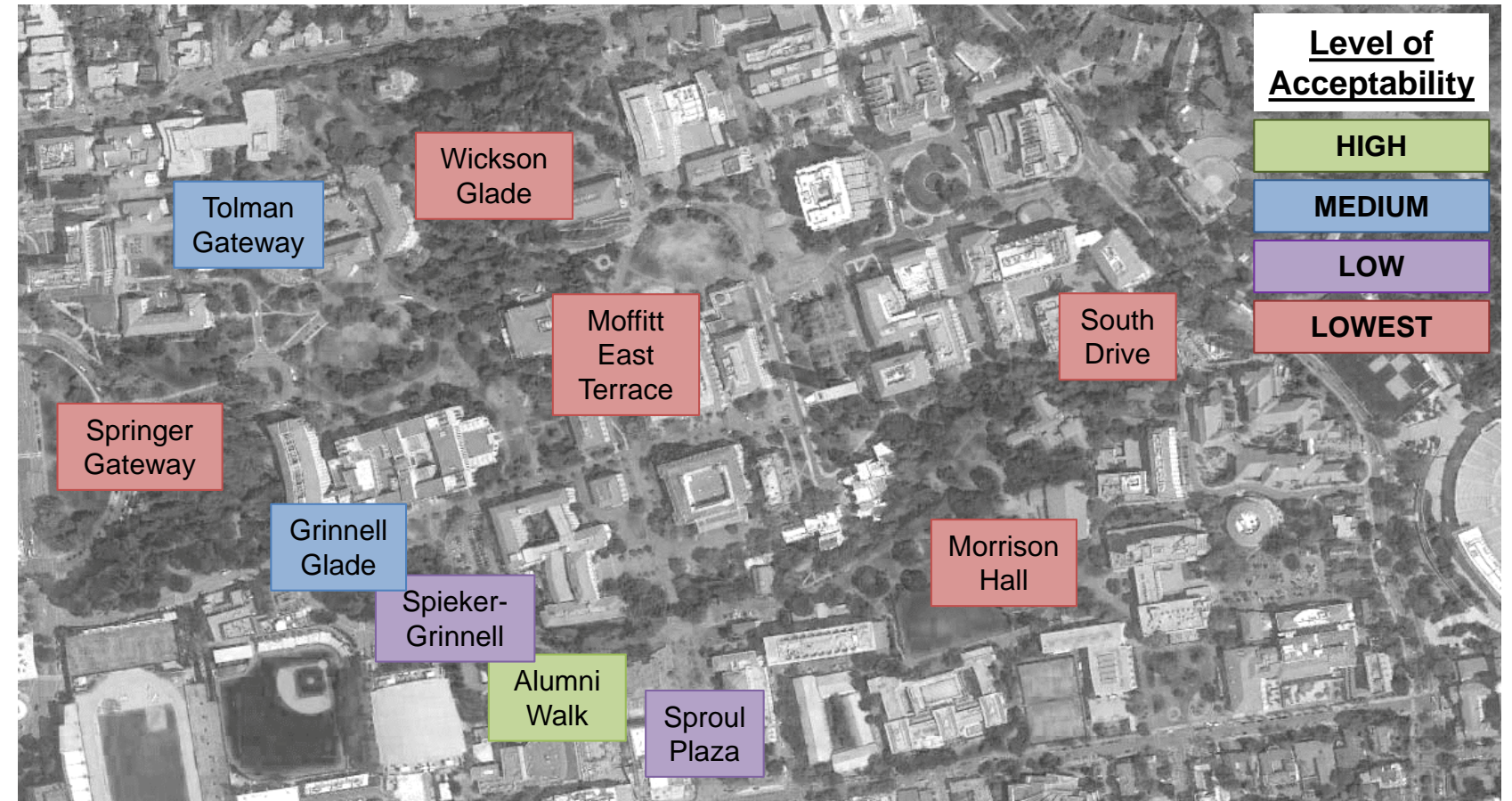
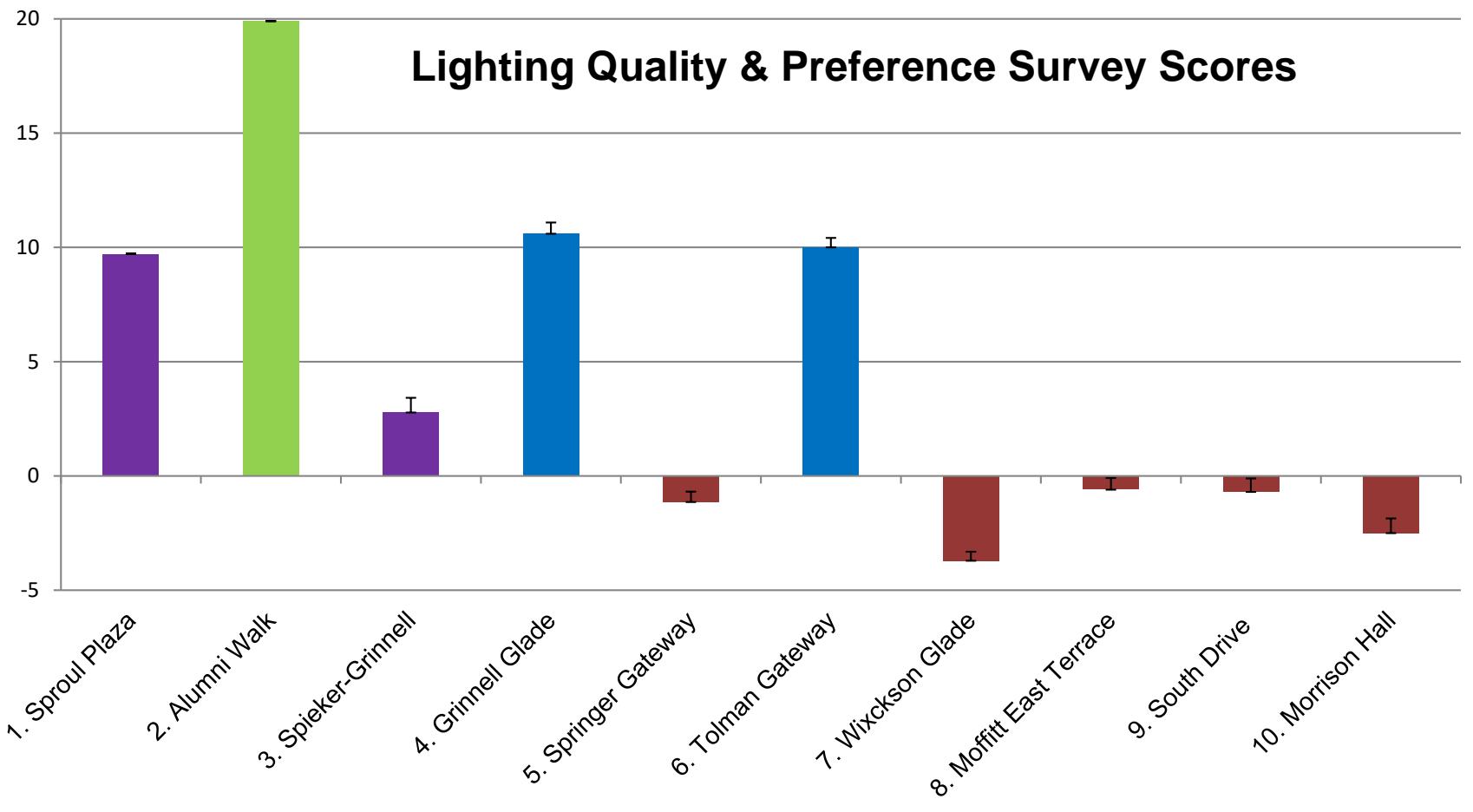
Alumni Walk Nighttime Environment



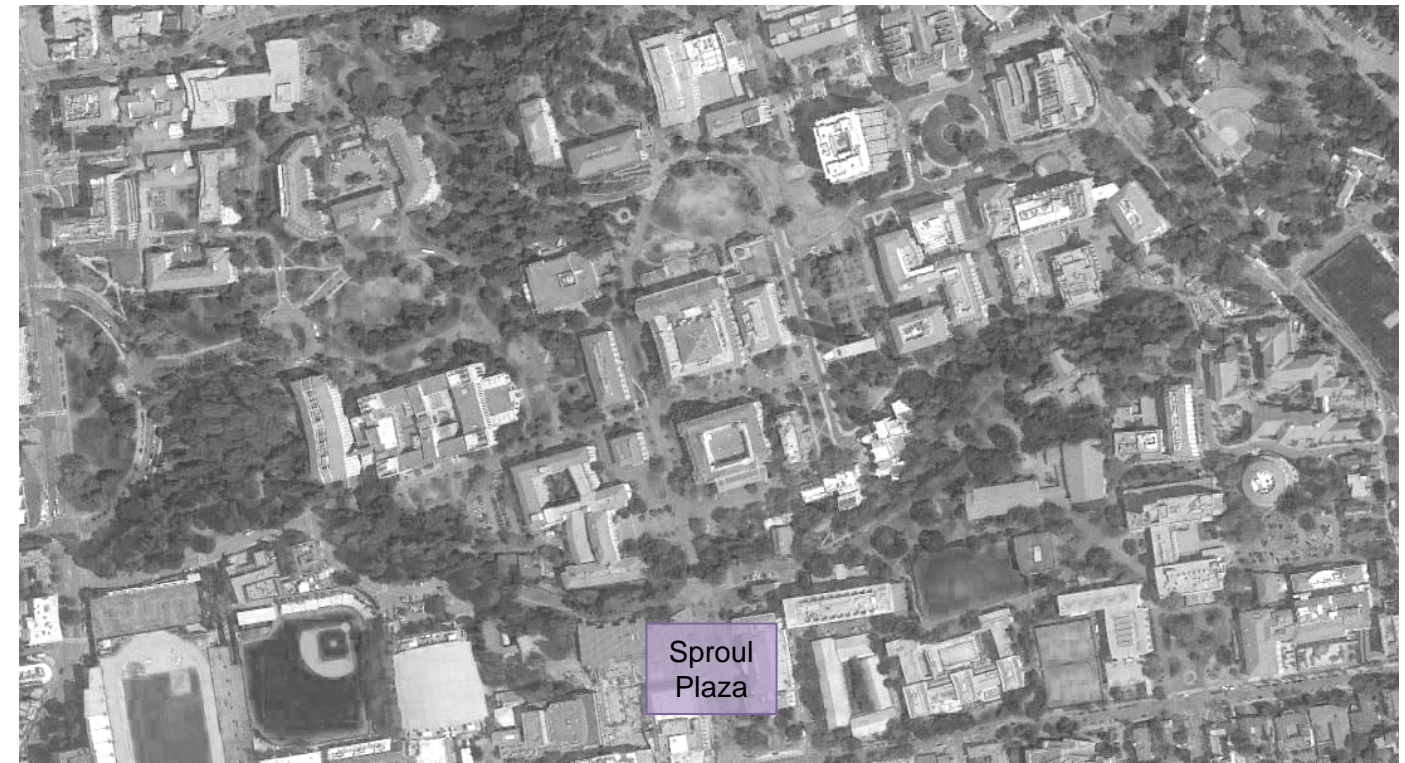
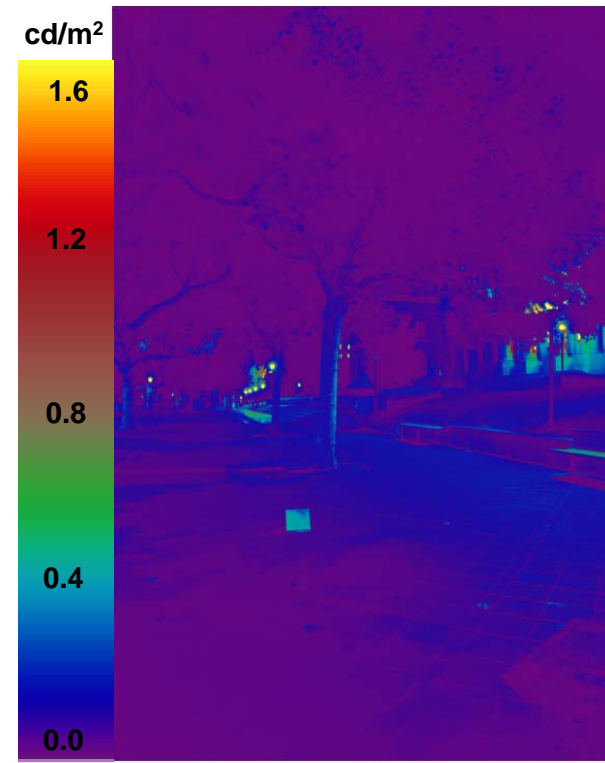
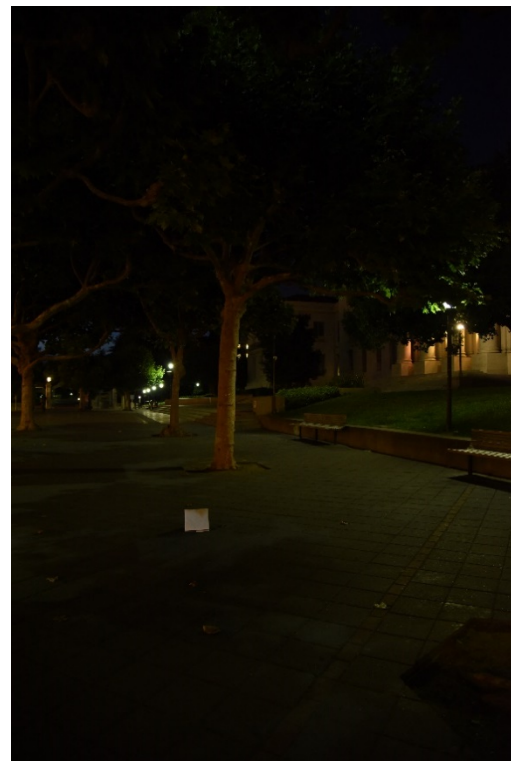
Alumni Walk High-Dynamic Range Images

INTRODUCTION

	Acceptance Level (High - Lowest)		Illuminance (fc)		Correlated Color Temperature (K)
			Horizontal	Vertical	
Criteria	High	Average	0.5	0.25	3000K (Recommended)
		Avg/Min	4	--	
Sproul Plaza	Low: high edge lighting and low lighting in the Plaza center	Average	1.4	0.68	4500K
		Avg/Min	22	14	
Lower Sproul/ Alumni Walk	High: vertical surface brightness	Average	0.7	0.36	2700K & 4500K
		Avg/Min	2	3	
Spieker-Grinnell- FSW Intersection	Low: large contrast between lighted and unlighted areas	Average	0.3	0.24	5000K
		Avg/Min	2	4	
Grinnell Glade	Medium: adequate light levels and glare lights	Average	0.9	0.63	4000K
		Avg/Min	3	19	
Springer Gateway	Lowest: dark crosswalks and roadway	Average	0.2	0.14	5000K
		Avg/Min	6	6	
Tolman Gateway	Medium: low light levels and surrounding surface brightness	Average	0.2	0.15	5600K
		Avg/Min	1	3	
Wickson Glade/ Haviland	Lowest: luminaires spaced too far apart	Average	0.2	0.13	4000K
		Avg/Min	15	12	
Moffitt East Terrace/ Sather Road	Lowest: low light levels and minimal vertical lighting	Average	0.1	0.10	4500K
		Avg/Min	6	8	
South Drive	Lowest: low vertical lighting in the Faculty Glade	Average	0.4	0.17	4000K
		Avg/Min	7	19	
Morrison Road	Lowest: little ambient lighting	Average	0.2	0.13	5000K
		Avg/Min	10	32	

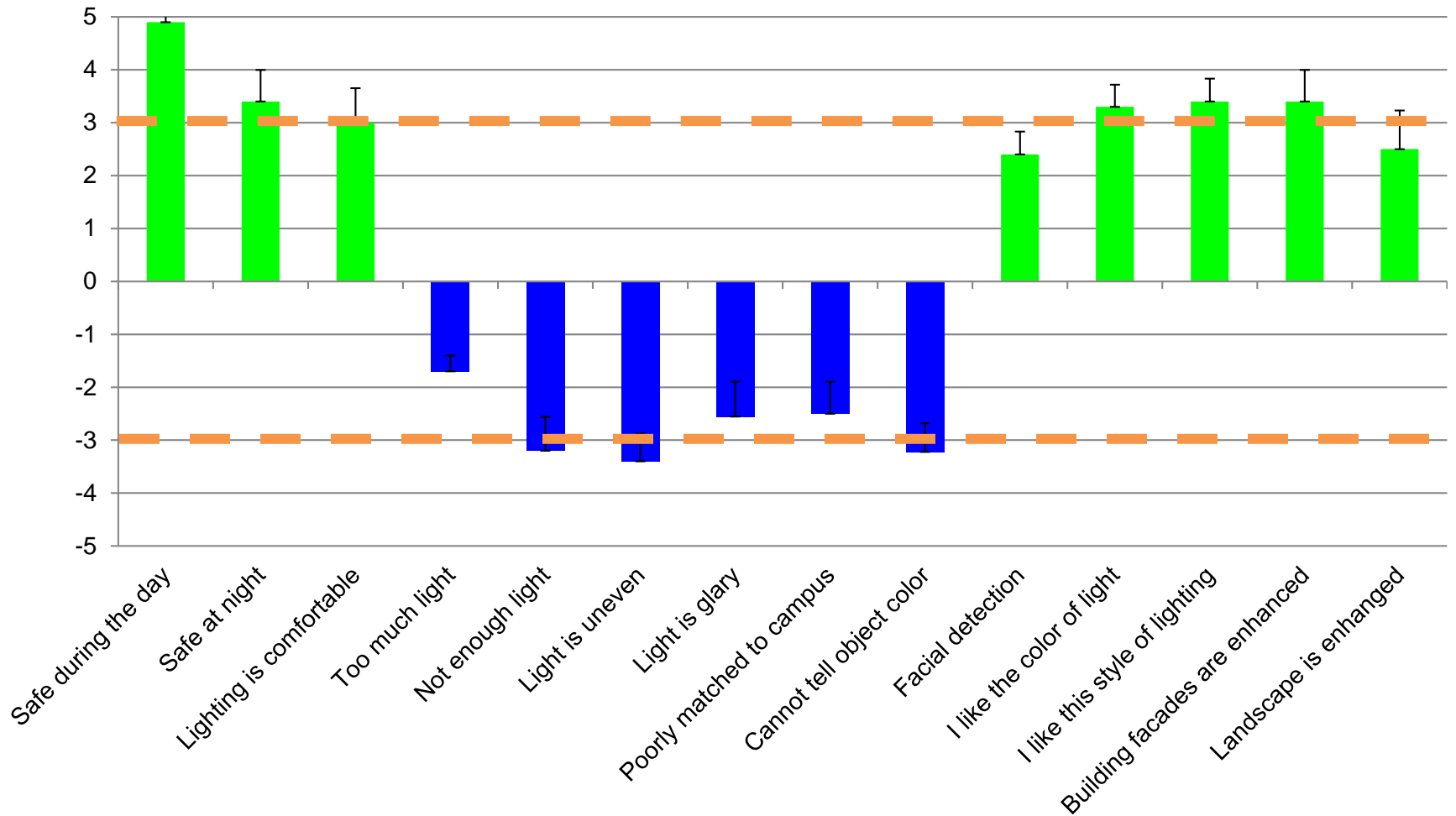


LIGHTING MEASUREMENTS AND SUBJECTIVE SURVEY SUMMARY



Green Bars are Positive Questions (High Values are Preferred)
Blue Bars are Negative Questions (Low Values are Preferred)
Orange Lines are Neutral Responses

Sproul Plaza



Level of Acceptability: Low

The edge of the Plaza is well lit with minimal light levels in the center of the Plaza.

Initial Site Observations

- Students identified this as a dark space.
- This location is a major campus gateway, ceremonial space, and pedestrian corridor.
- The tree canopy shadows the pathway. The tree canopy is trimmed every spring.
- There is a variety of light sources and lamp types in this location.

Lighting Measurements

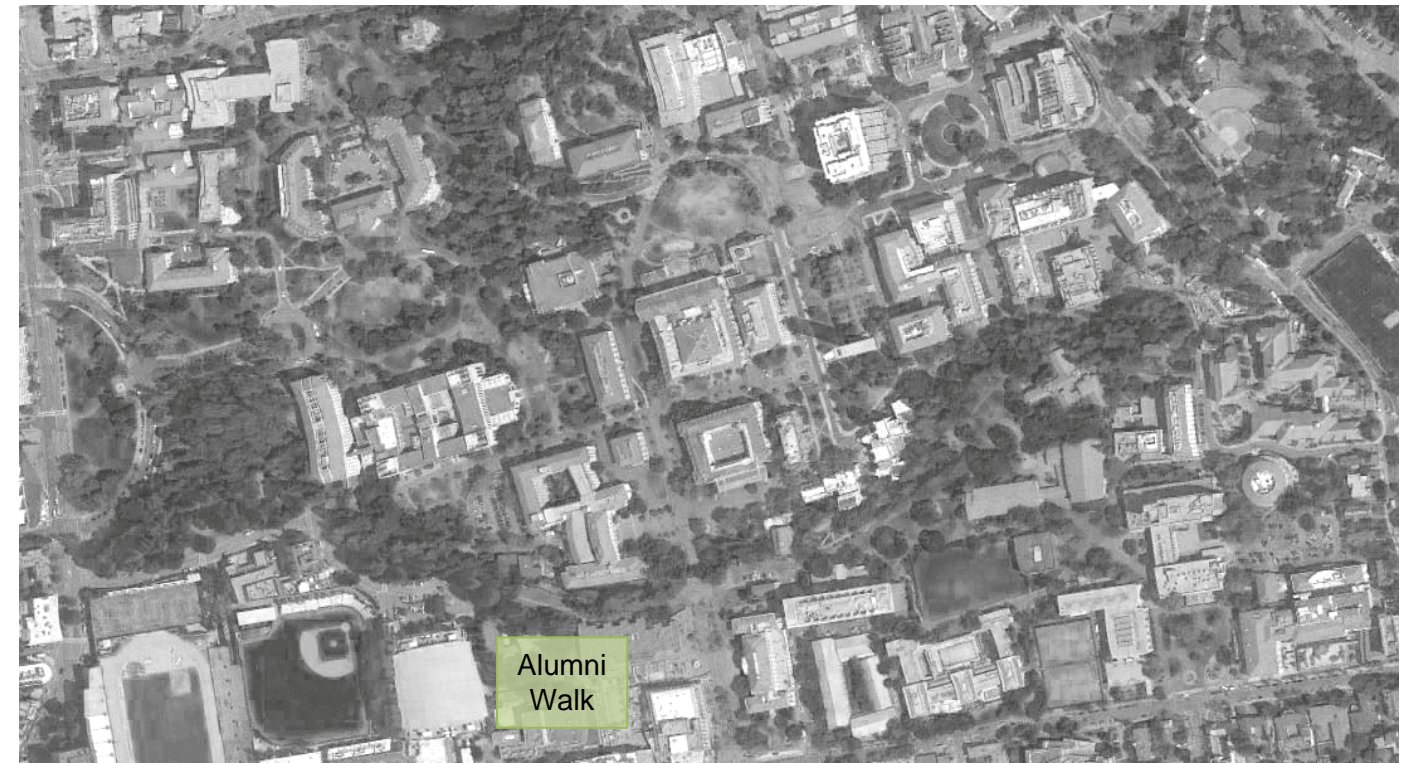
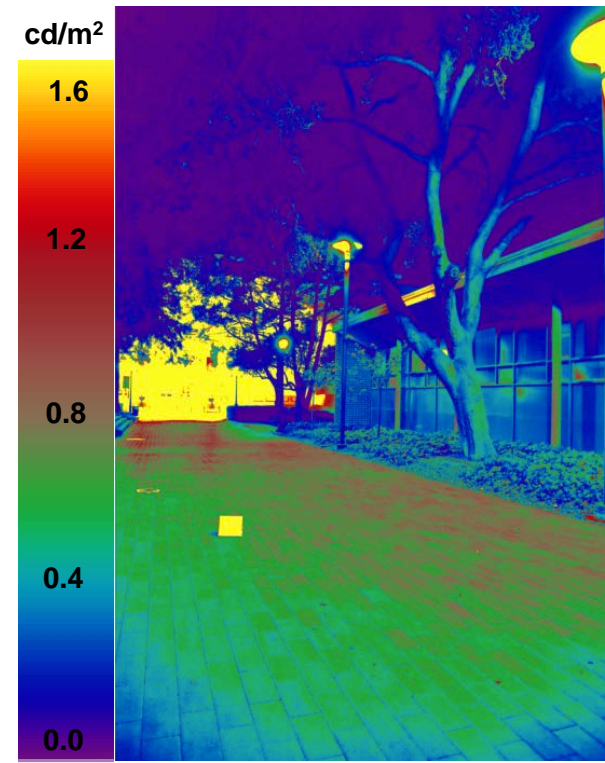
- Plaza center is dark without any central lighting system, this creates poor lighting uniformity.
- Light is provided by pedestrian luminaires on the edge of the plaza and spotlights mounted on MLK.

Participant Survey

- Participants felt neutral about the lighting in this location.
- The light is uneven with low lighting levels along the pathway.
- Facial detection and identification was difficult in the center of the pathway (under the tree canopy).

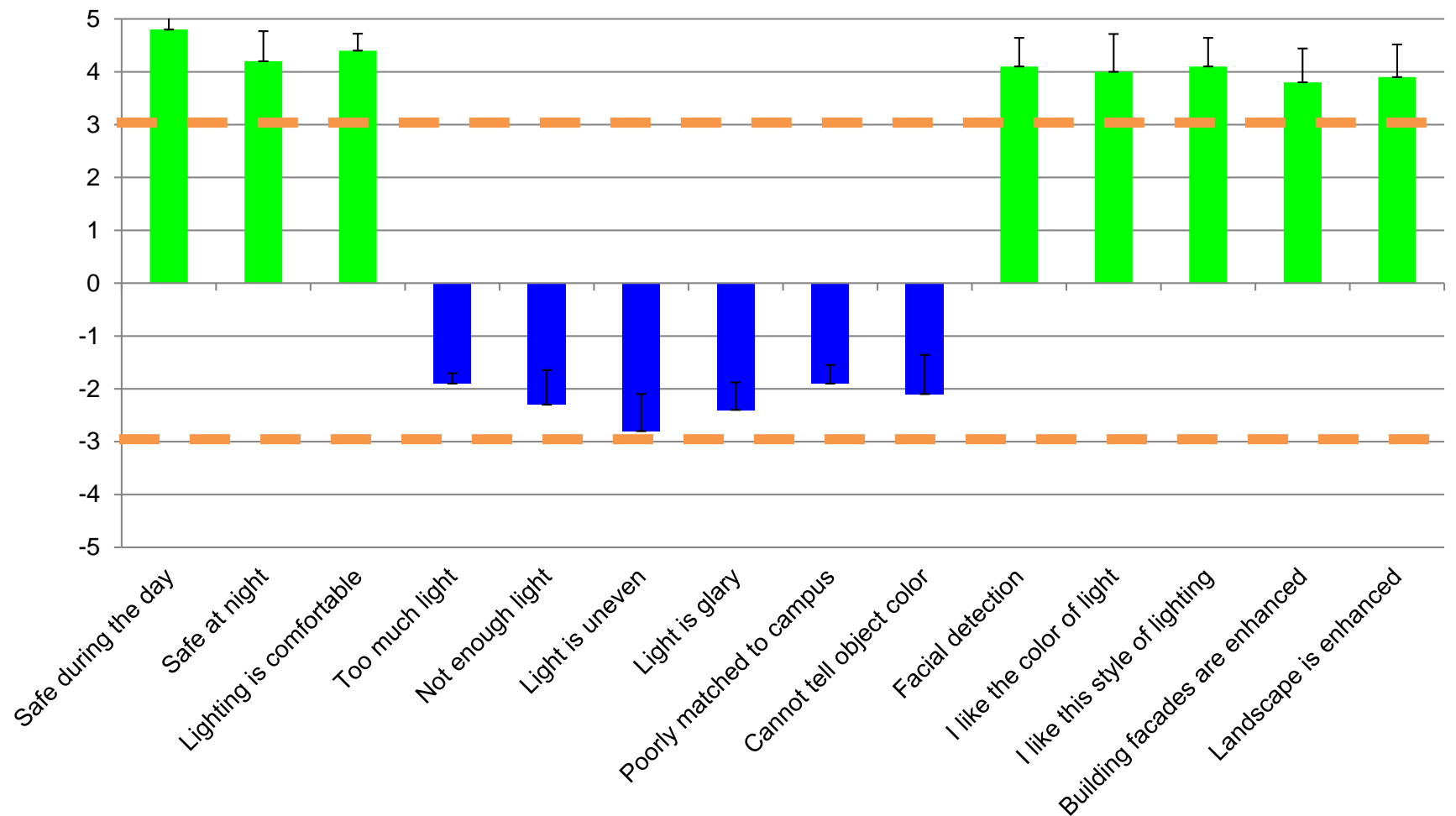
Criteria	Average	Illuminance (fc)		CCT (K)
		Horizontal	Vertical	
	Avg/Min	0.5	0.25	3000K (Recommended)
Sproul Plaza	Average	1.4	0.68	4500K
	Avg/Min	22	14	

SPROUL PLAZA



Green Bars are Positive Questions (High Values are Preferred)
Blue Bars are Negative Questions (Low Values are Preferred)
Orange Lines are Neutral Responses

Alumni Walk



Level of Acceptability: High

High vertical surface brightness improves visibility and comfort.

Initial Site Observations

- New indirect Bega metal halide luminaires have been installed along the walk.
- Lighting feels inviting and comfortable.

Lighting Measurements

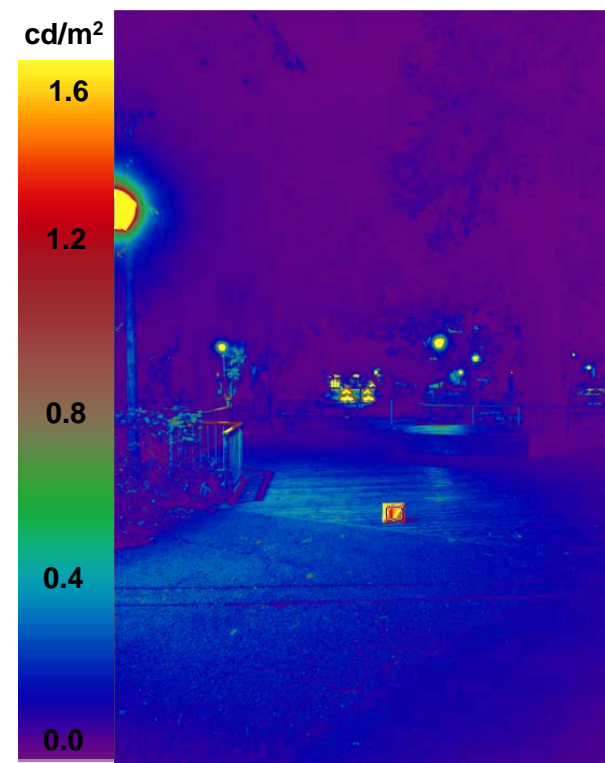
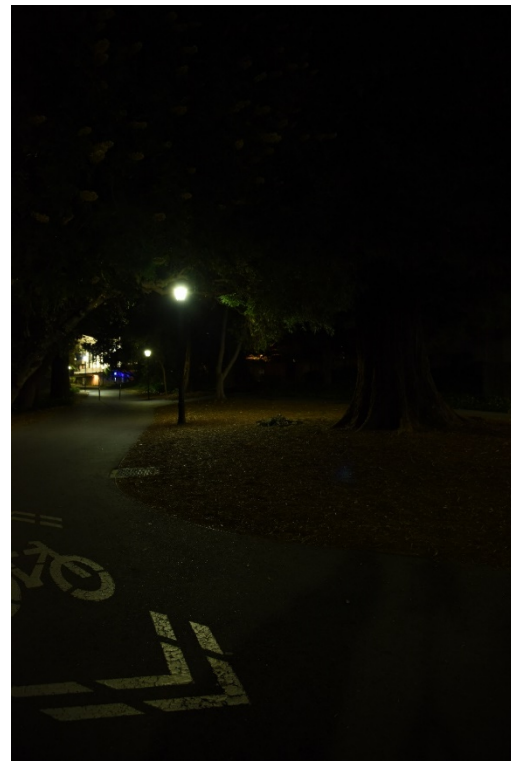
- Walkway is well lit with an indirect system.
- The uniformity of the light is even with bright, surrounding surface lighting.
- The warm lamp color temperature creates an inviting space.
- This site meets the Campus lighting criteria.

Participant Survey

- Participants felt safe and comfortable in this location.
- Participants would like this style of indirect lighting in other campus locations.
- The vertical illuminance enhanced facial recognition and object detection.

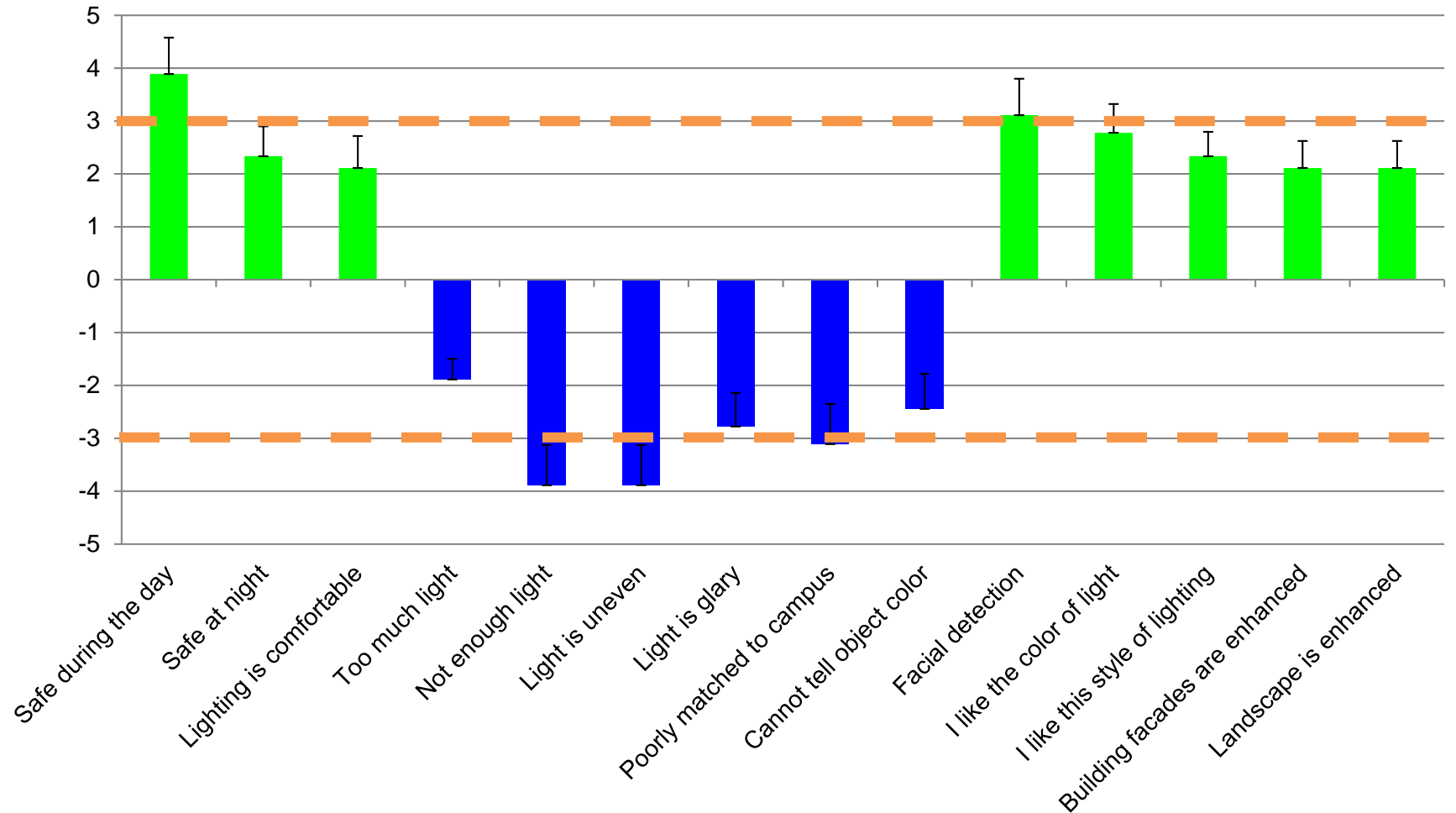
Criteria	Average	Illuminance (fc)		CCT (K)
		Horizontal	Vertical	
	Avg/Min	0.5	0.25	3000K (Recommended)
Lower Sproul/ Alumni Walk	Average	0.7	0.36	2700K & 4500K
	Avg/Min	2	3	

ALUMNI WALK



Green Bars are Positive Questions (High Values are Preferred)
Blue Bars are Negative Questions (Low Values are Preferred)
Orange Lines are Neutral Responses

Speiker-Grinnell-FSW Intersection



Level of Acceptability: Low

There is a large contrast between lighted and unlighted areas.

Initial Site Observations

- The roadway and several pathways converge over the creek.
- Dark areas were noted on 2015 Fiat Lux.
- Surrounding trees cause shadowing along the path.

Lighting Measurements

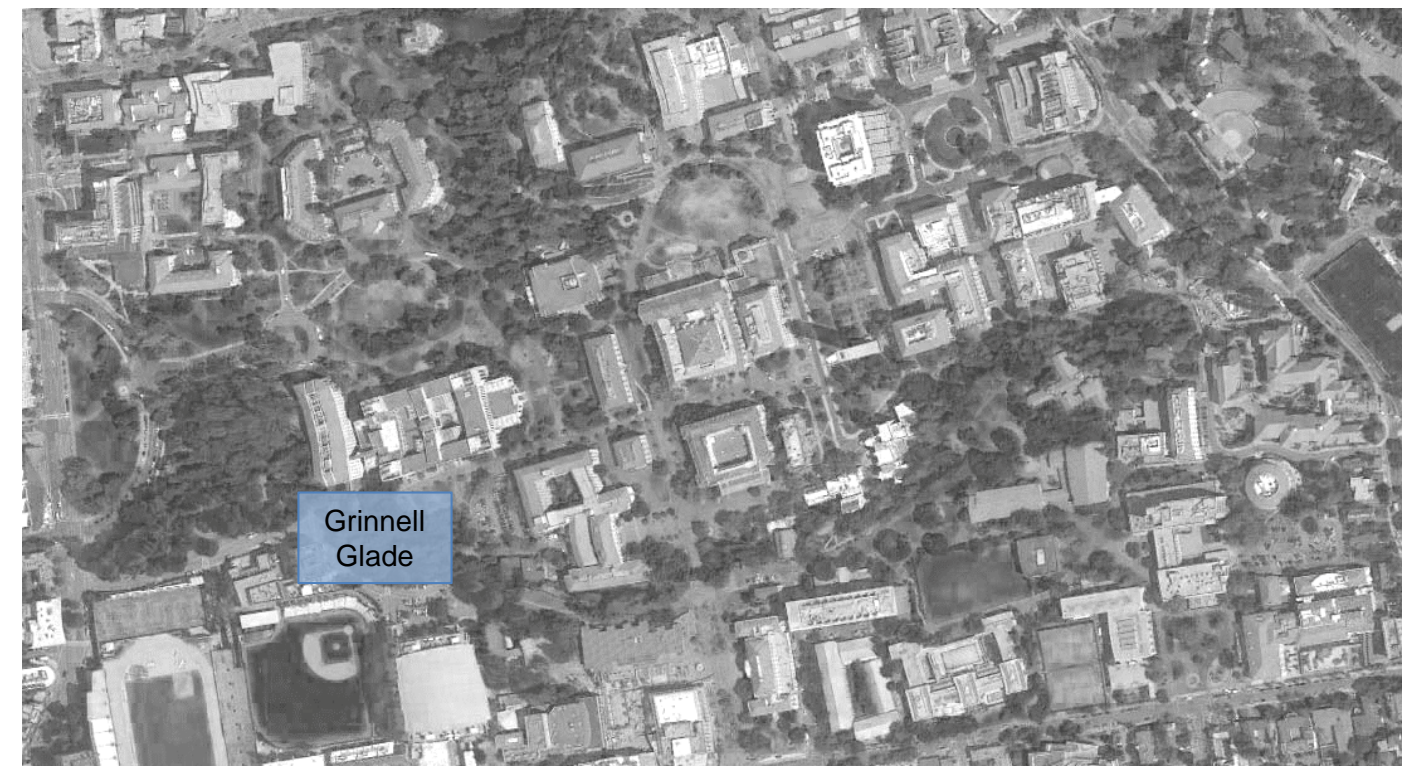
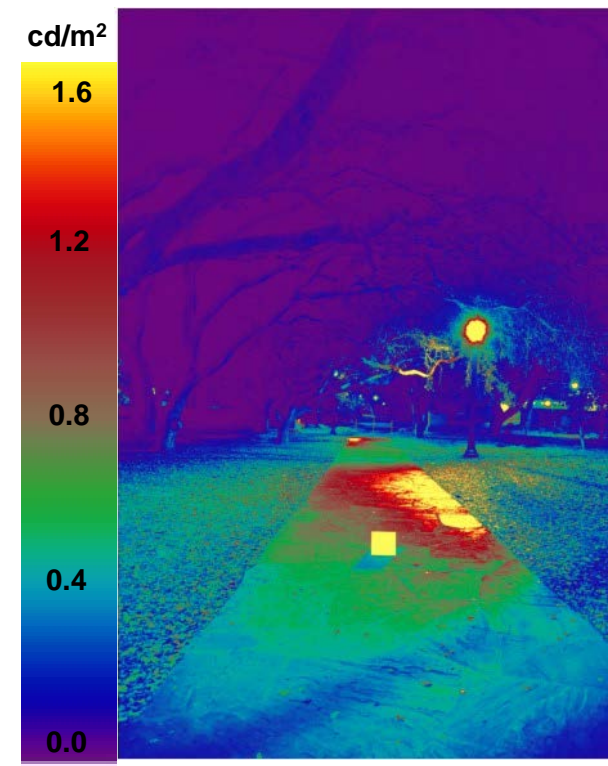
- The surrounding trees cause intense shadows during the daytime.
- The bridge could be enhanced by accent lighting along features of the bridge.
- The contrast between the bright Speiker Plaza and nighttime pathways make the space visually darker than the lighting measurements indicate.

Participant Survey

- Participants did not feel comfortable in this location.
- Participants agree that there is not enough light in this location.
- Facial detection and identification is possible along the pathway.

Criteria	Average	Illuminance (fc)		CCT (K)
		Horizontal	Vertical	
Speiker-Grinnell-FSW Intersection	Average	0.3	0.24	5000K
	Avg/Min	4	--	
				3000K (Recommended)

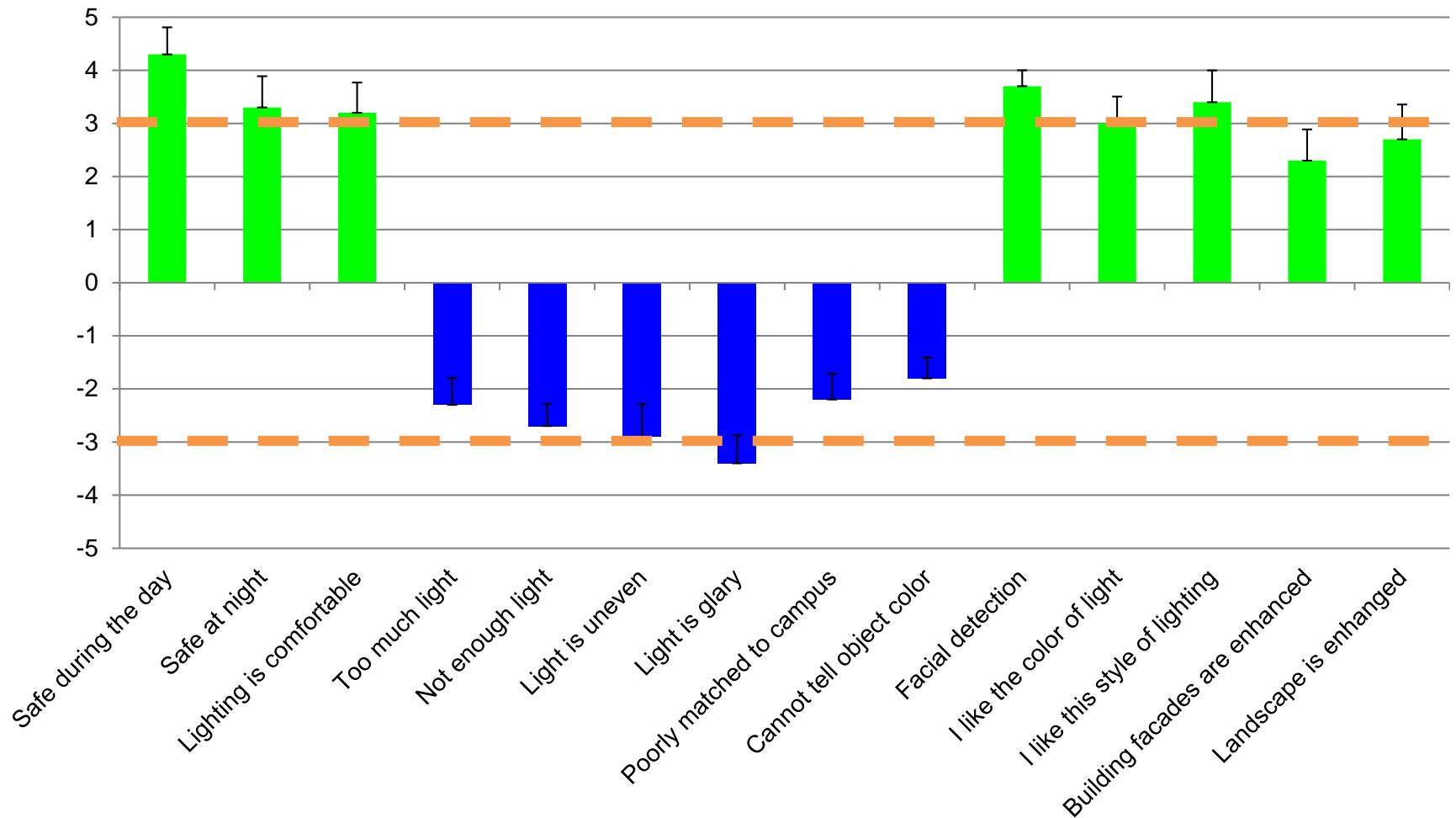
SPIEKER – GRINNELL - FSW INTERSECTION



Green Bars are Positive Questions (High Values are Preferred)
Blue Bars are Negative Questions (Low Values are Preferred)
Orange Lines are Neutral Responses

Level of Acceptability: Medium
 Light levels are adequate yet glary luminaires decrease visibility into darker locations.

Grinnell Glade



Initial Site Observations

- New sample LED retrofits have been installed to provide an example of color, brightness, etc. for other retrofit sites.
- Various wattages of 2700K, 3000K, and 4000K LED chip on boards were installed.

Lighting Measurements

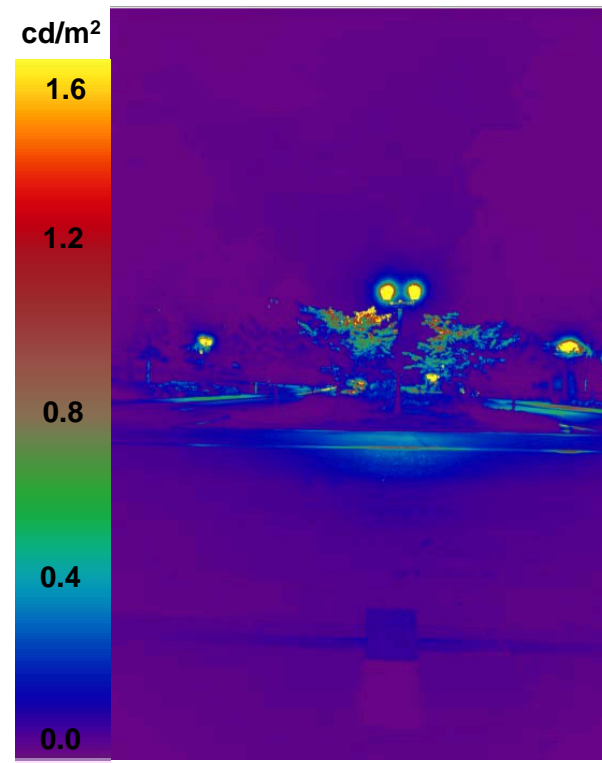
- Light levels are adequate,
- Luminaires are glary. This hinders visibility into natural areas adjacent to the path.
- The contrast between luminaires and dark locations, such as the creek, is uncomfortable.

Participant Survey

- Participants liked this style of light and the level of lighting
- The higher wattage LED retrofit luminaires are glary.
- The luminaires provide high vertical illumination, enhancing facial detection and identification.

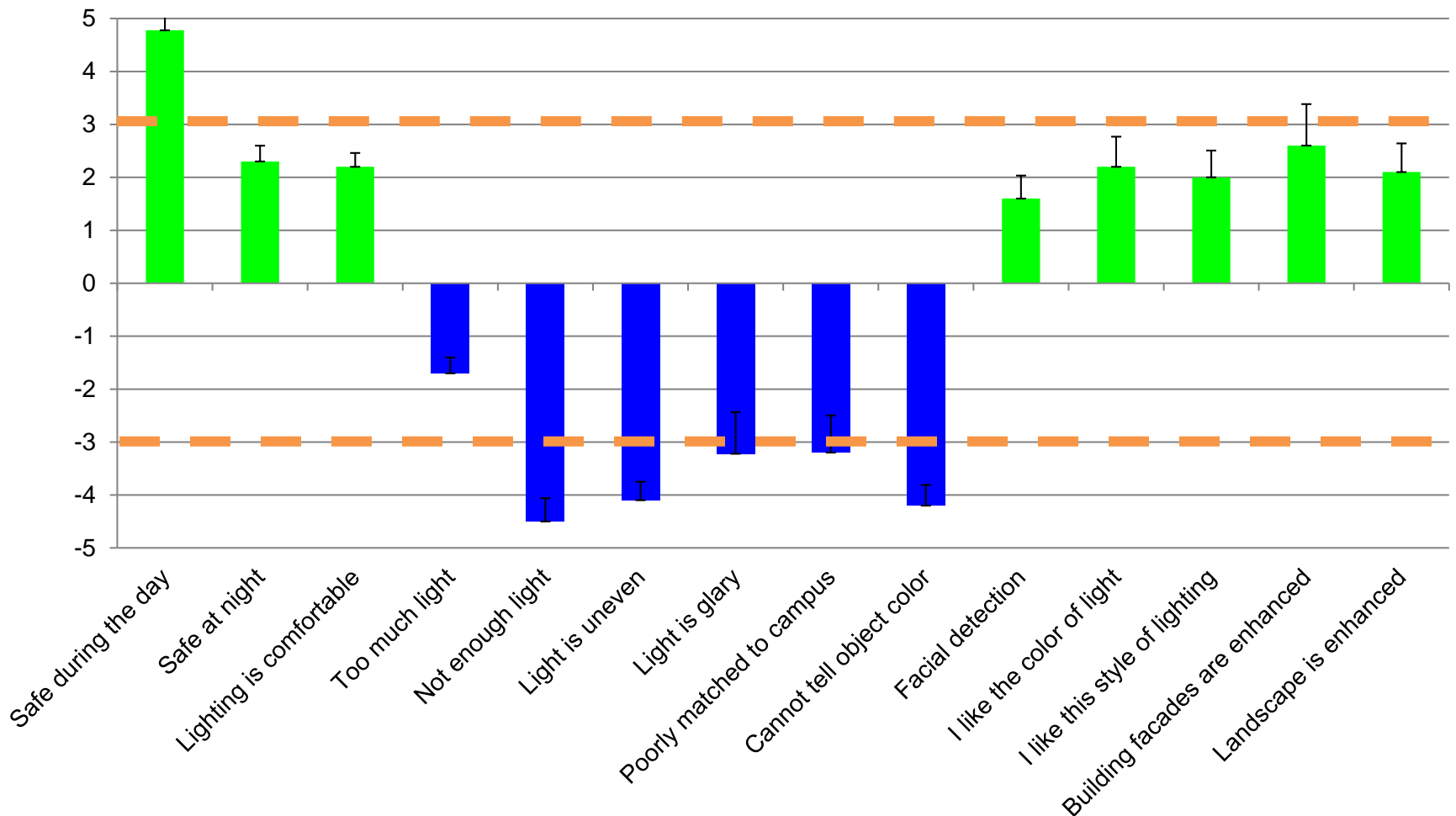
Criteria	Average	Illuminance (fc)		CCT (K)
		Horizontal	Vertical	
	Avg/Min	0.5	0.25	3000K (Recommended)
Grinnell Glade	Average	0.9	0.63	4000K
	Avg/Min	3	19	

GRINNELL GLADE



Green Bars are Positive Questions (High Values are Preferred)
Blue Bars are Negative Questions (Low Values are Preferred)
Orange Lines are Neutral Responses

Springer Gateway



Level of Acceptability: Lowest

The roadway, crosswalk, and surrounding sidewalks are under lighted with little vertical illuminance.

Initial Site Observations

- This site is a major campus entrance for vehicles and pedestrians.
- This is primarily a roadway plaza at night with less pedestrian traffic.
- Street is illuminated by a few pedestrian luminaires. There are no street lights along the roadway.

Lighting Measurements

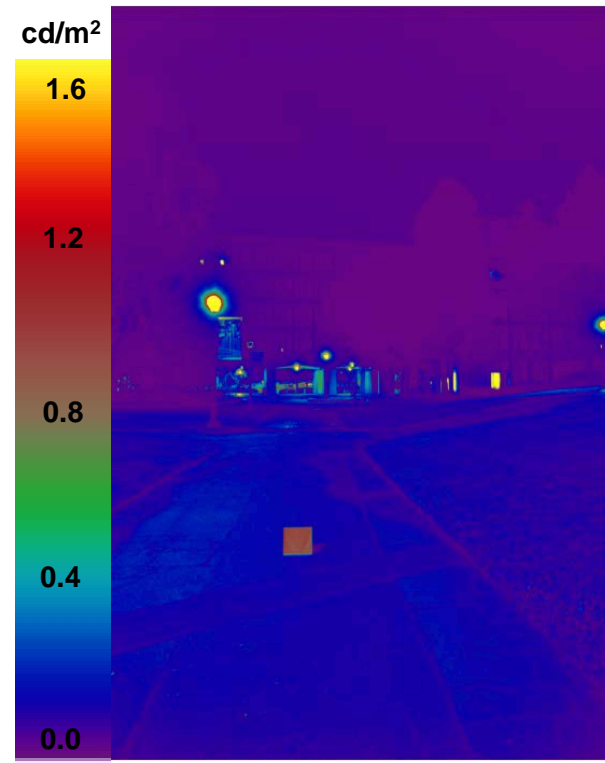
- Low levels of vertical light do not properly light pedestrians in crosswalk.
- The west steps are under lighted.

Participant Survey

- Participants did not feel safe in this location at night.
- The space felt incredibly dark.
- Facial detection and identification was difficult due to the lack of vertical illumination.

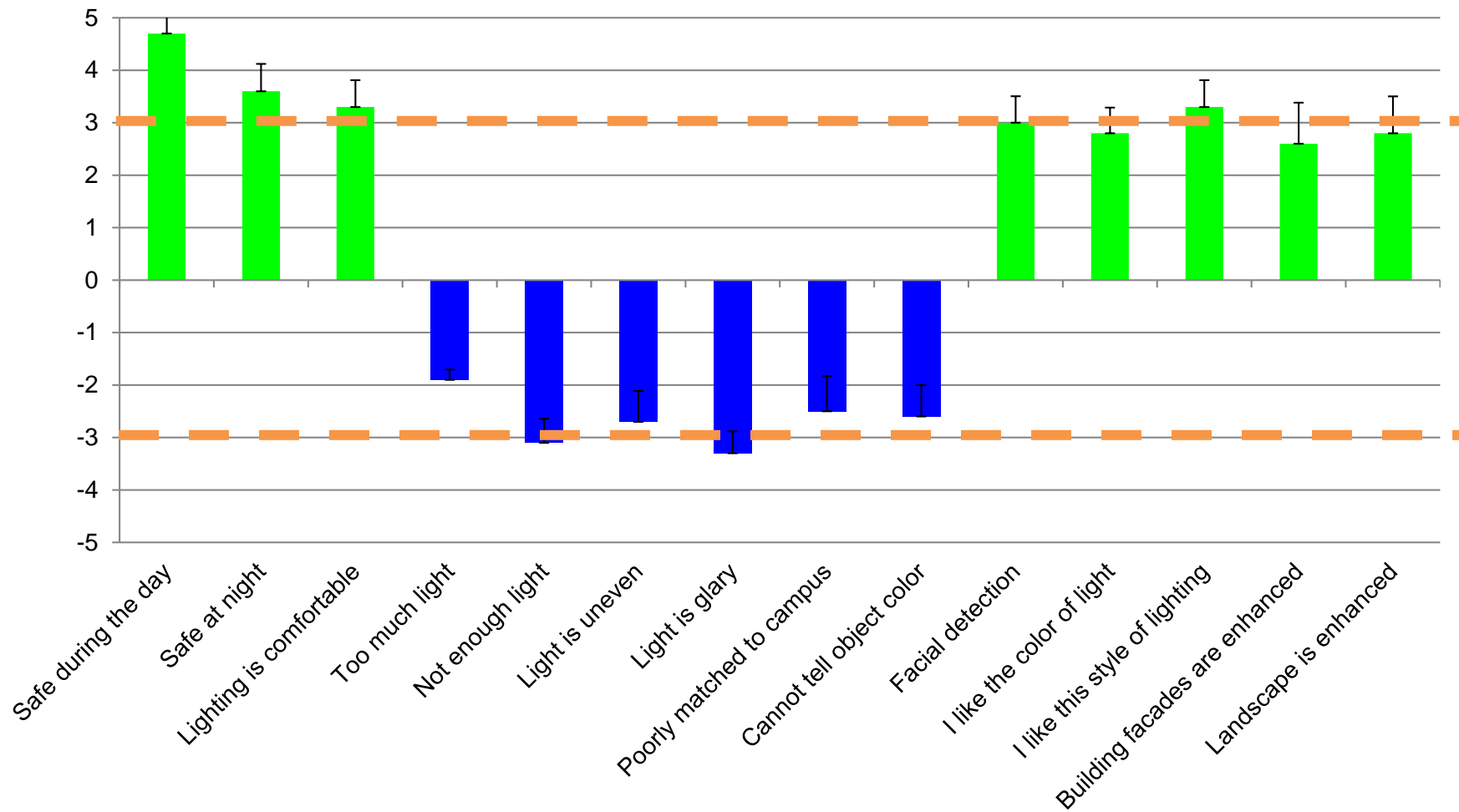
Criteria	Average	Illuminance (fc)		CCT (K)
		Horizontal	Vertical	
	Avg/Min	0.5	0.25	3000K (Recommended)
Springer Gateway	Average	0.2	0.14	5000K
	Avg/Min	6	6	

SPRINGER GATEWAY



Green Bars are Positive Questions (High Values are Preferred)
Blue Bars are Negative Questions (Low Values are Preferred)
Orange Lines are Neutral Responses

Tolman Gateway/Morgan Hall



Level of Acceptability: Medium

While light levels are low, surrounding surface brightness creates a comfortable space.

Initial Site Observations

- This is a major pedestrian campus entrance and bike path.
- Tolman Hall will be demolished within the next few years.
- The lighting distribution is even and uniform with low lighting levels
- There are few trees in the area to create shadows.

Lighting Measurements

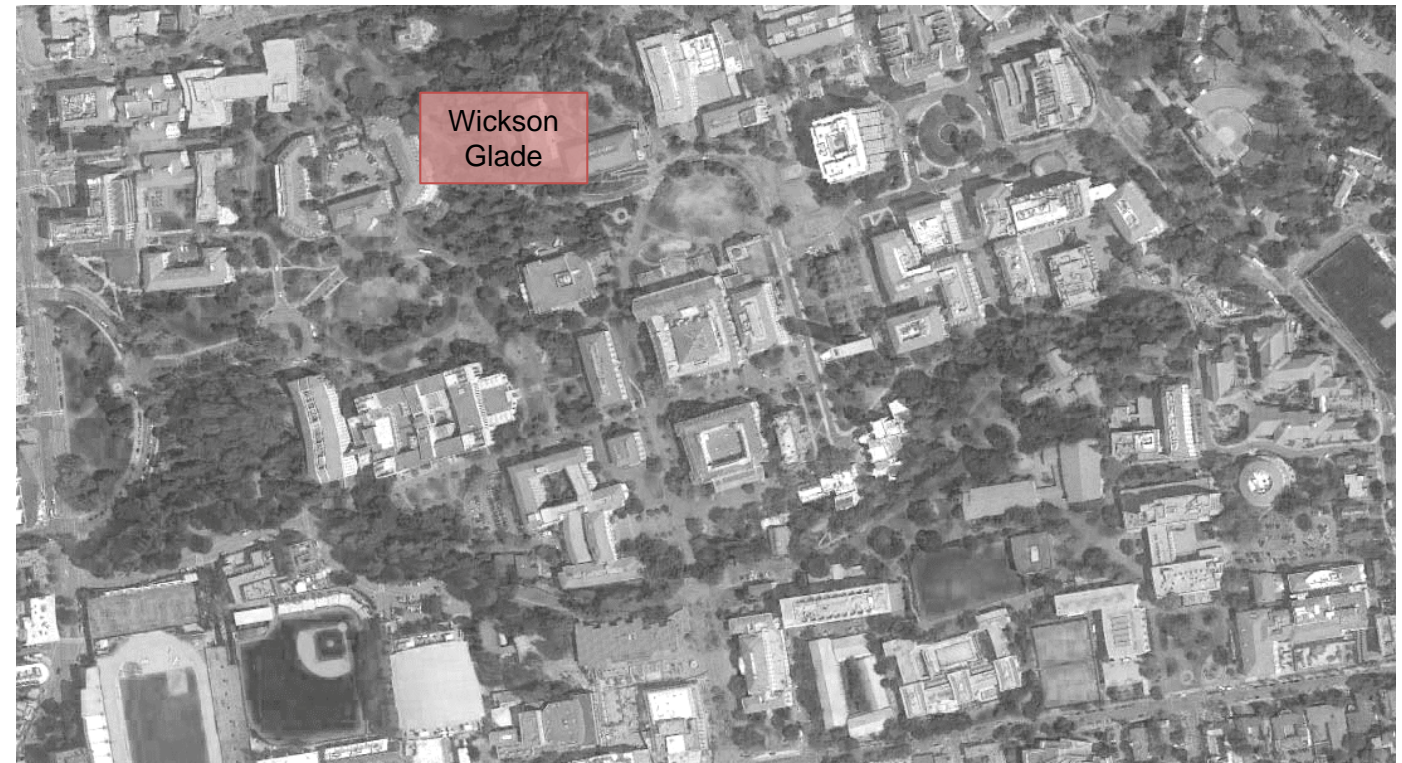
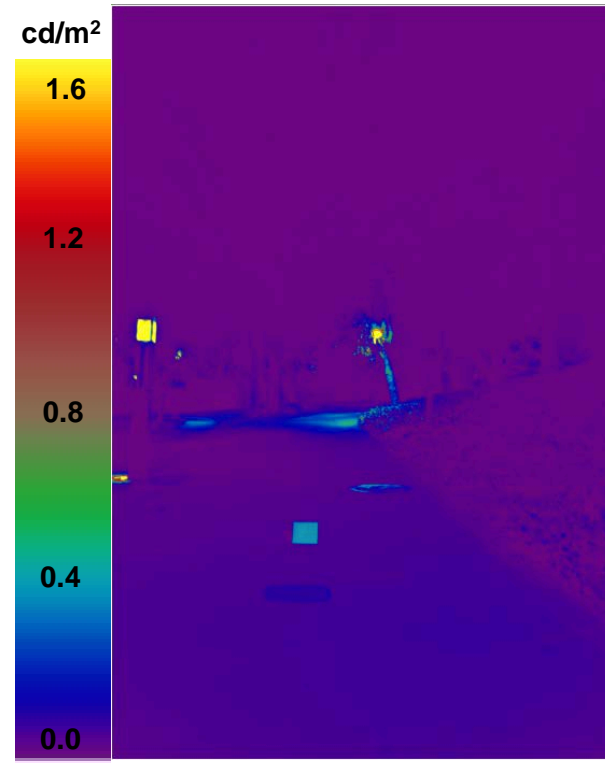
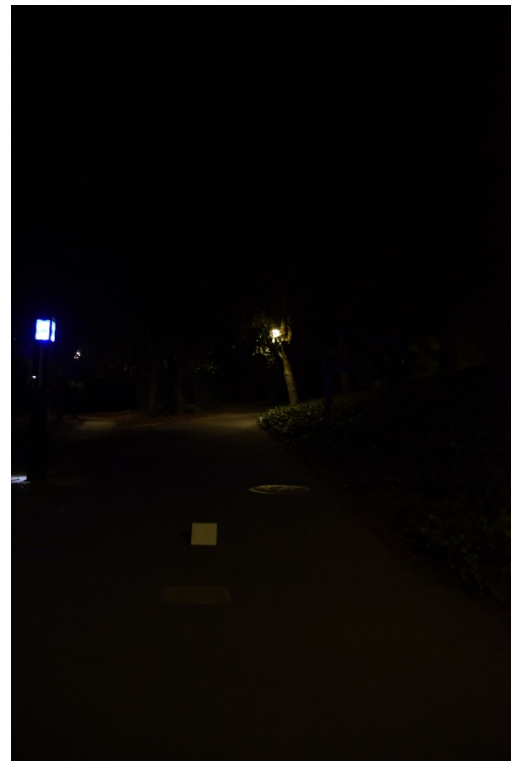
- The lack of trees improves the perception of safety.
- Surrounding surface brightness creates a comfortable space.
- Light levels are low.

Participant Survey

- Participants felt comfortable during nighttime hours.
- Participants felt neutral towards the light level and uniformity.
- Facial detection and identification was adequate.

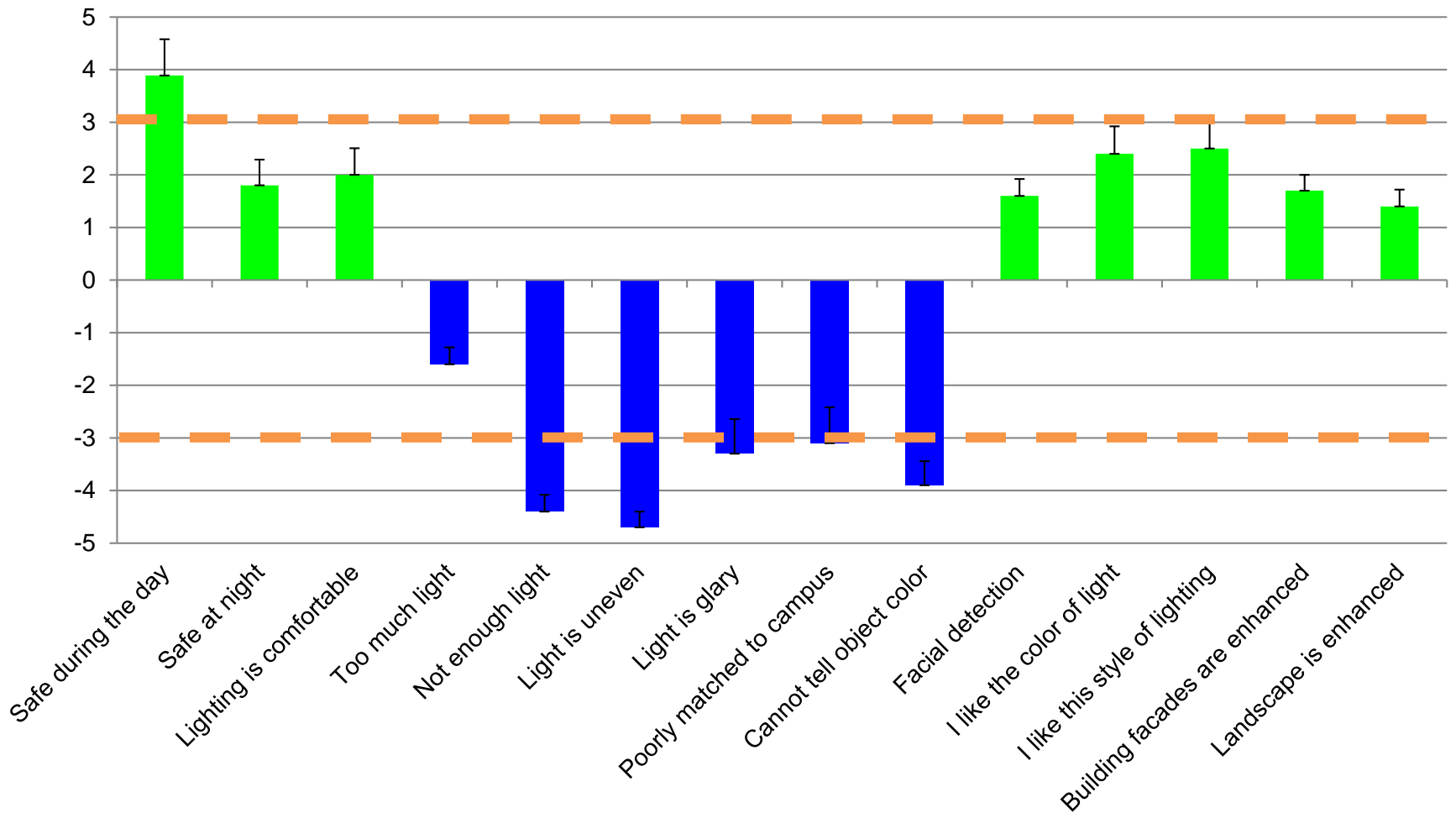
Criteria	Average	Illuminance (fc)		CCT (K)
		Horizontal	Vertical	
	Avg/Min	0.5	0.25	3000K (Recommended)
Tolman Gateway	Average	0.2	0.15	5600K
	Avg/Min	1	3	

TOLMAN GATEWAY/ MORGAN HALL



Green Bars are Positive Questions (High Values are Preferred)
Blue Bars are Negative Questions (Low Values are Preferred)
Orange Lines are Neutral Responses

Wickson Glade/Haviland



Level of Acceptability: Lowest

Luminaires are spaced too far apart to provide adequate light levels.

Initial Site Observations

- This is a natural zone with some nighttime pedestrian traffic.
- There have been criminal issues in the past.
- The luminaire spacing does not provide adequate lighting levels.

Lighting Measurements

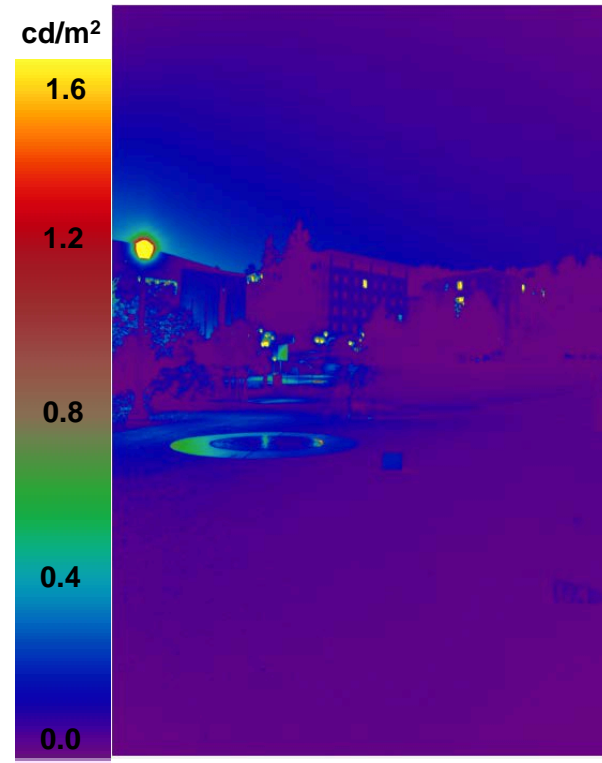
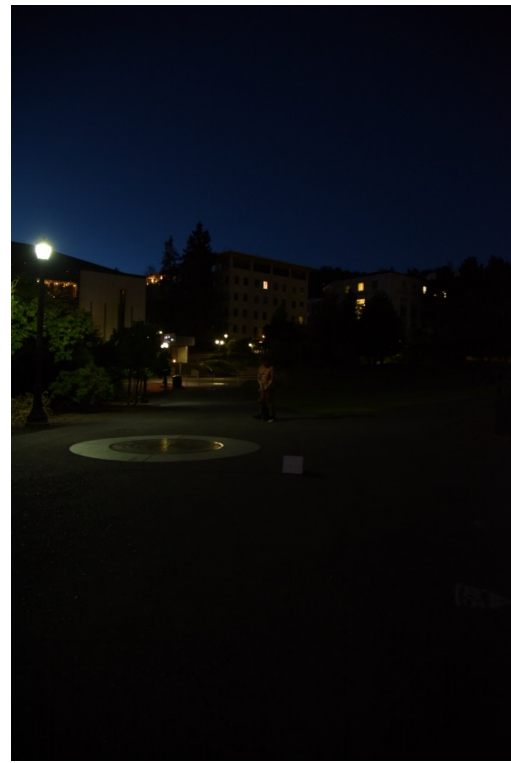
- The luminaire spacing should be decreased to 75 feet to improve uniformity along path.
- The light levels should be increased along the entire path.
- The code blue emergency light is glary.

Participant Survey

- Participants did not feel safe in this location at night.
- The light levels are too low and uneven to feel comfortable.
- Facial detection and identification was difficult.

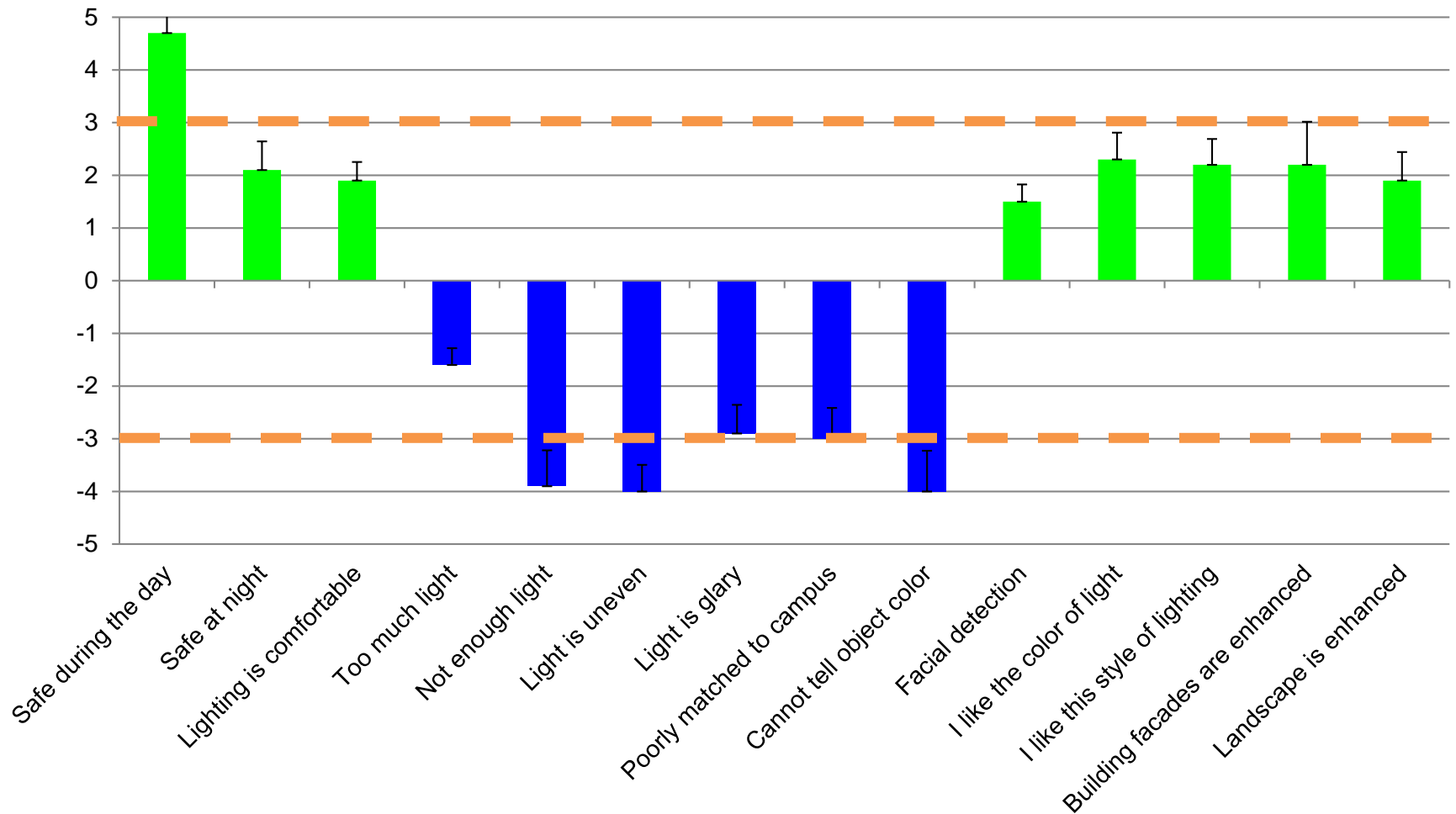
Criteria	Average	Illuminance (fc)		CCT (K)
		Horizontal	Vertical	
	Avg/Min	0.5	0.25	3000K (Recommended)
Wickson Glade/ Haviland	Average	0.2	0.13	4000K
	Avg/Min	15	12	

WICKSON GLADE/ HAVILAND



Green Bars are Positive Questions (High Values are Preferred)
Blue Bars are Negative Questions (Low Values are Preferred)
Orange Lines are Neutral Responses

Moffitt East Terrace/Sather Road



Level of Acceptability: Lowest

Low light levels with minimal vertical lighting create an uncomfortable nighttime environment.

Initial Site Observations

- The Moffitt Undergrad Library will be opening a new major 24 hour entrance.
- The new lighting on pathways will “stitch” major campus pathway to the Library Terrace project.
- An underground tunnel located between Moffitt Library and Doe Library prevents installation of pedestrian poles.

Lighting Measurements

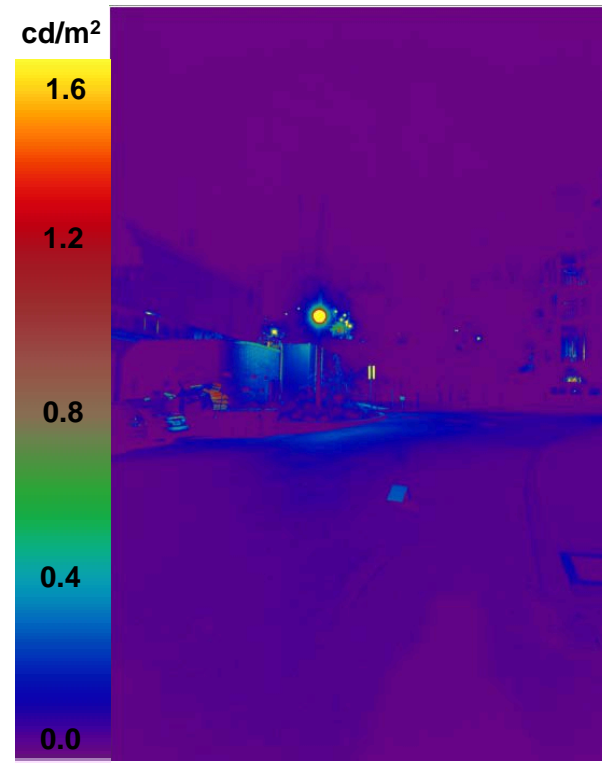
- Surrounding building surfaces are under lighted.
- This location would benefit from façade lighting.
- The trees around Moffitt Library creates shadows along the pathway.

Participant Survey

- Participants did not feel safe in this location at night.
- The light levels are too low, with too many shadows to create a comfortable environment.
- The low vertical light levels make facial identification difficult.

Criteria	Average	Illuminance (fc)		CCT (K)
		Horizontal	Vertical	
	Avg/Min	0.5	0.25	3000K (Recommended)
Moffitt East Terrace/ Sather Road	Average	0.1	0.10	4500K
	Avg/Min	6	8	

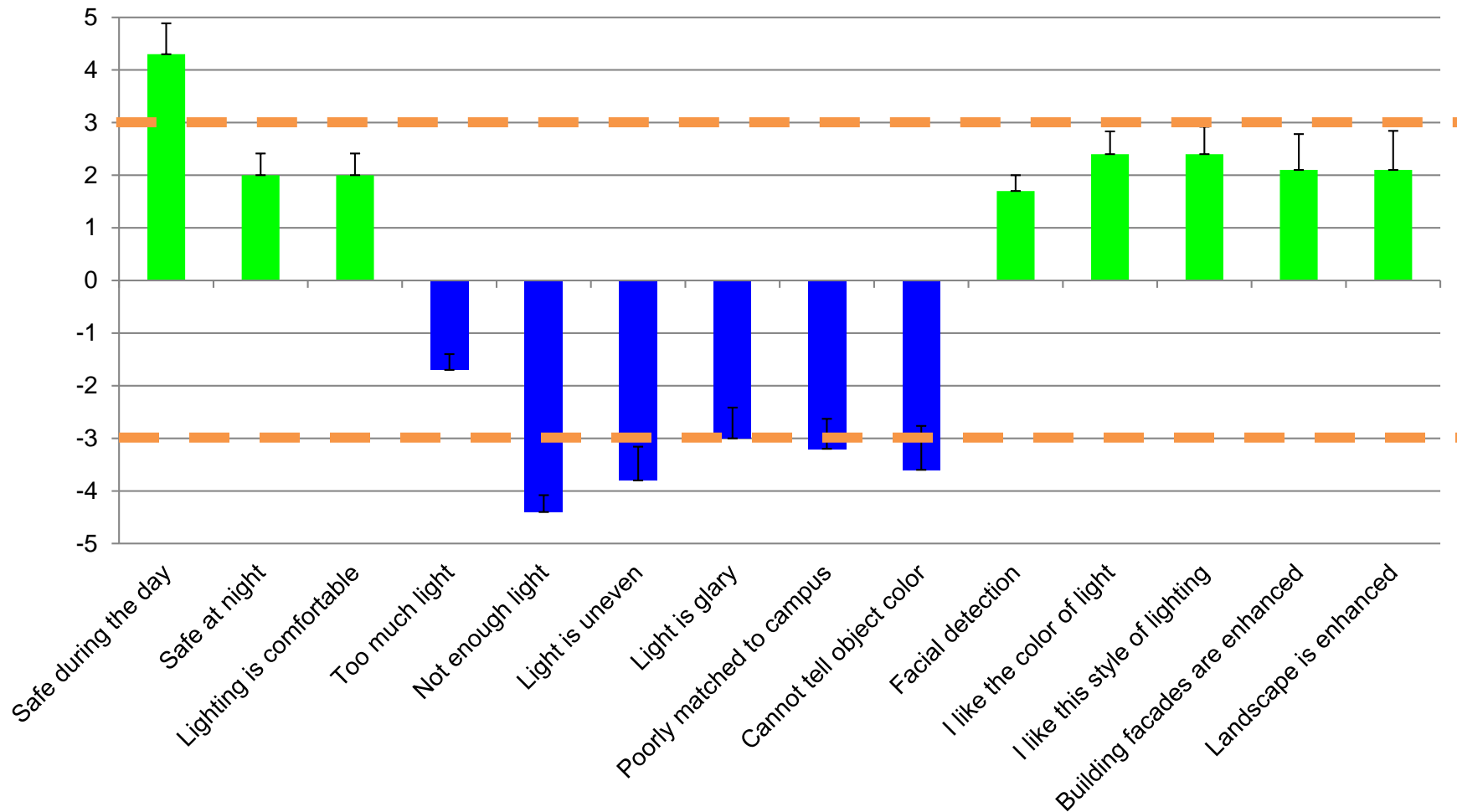
MOFFITT EAST TERRACE/ SATHER ROAD



Green Bars are Positive Questions (High Values are Preferred)
Blue Bars are Negative Questions (Low Values are Preferred)
Orange Lines are Neutral Responses

Level of Acceptability: Lowest
 Lack of sidewalk and surface brightness in the Faculty Glade make the space feel uncomfortable.

South Drive



Initial Site Observations

- The site is dark.
- A future Campus lighting project will connect HSB to key nighttime corridors.
- Pedestrians walk along the street due to the lack of sidewalk.

Lighting Measurements

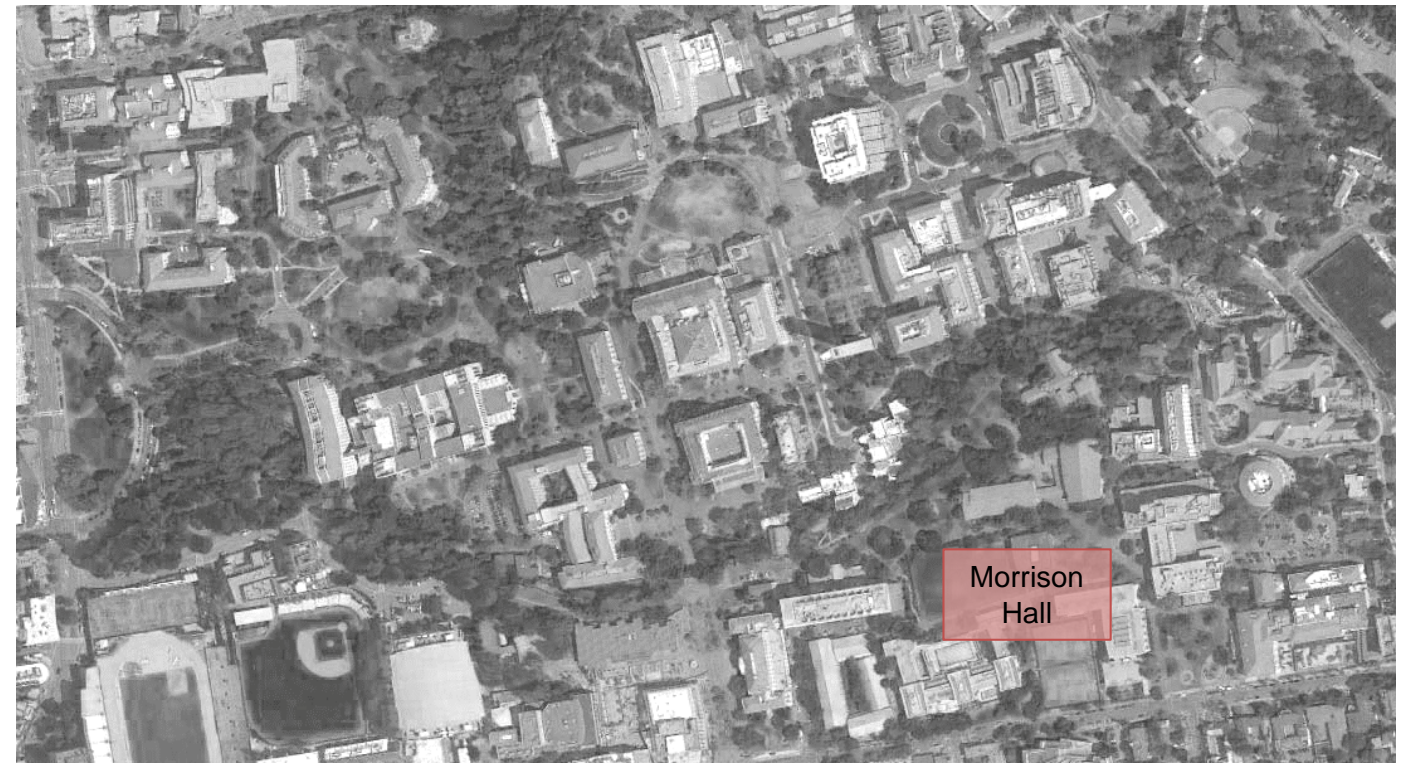
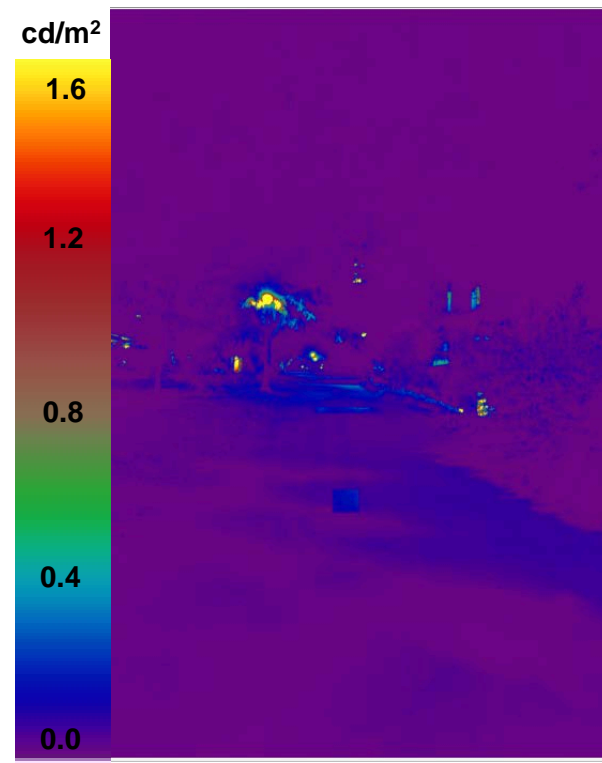
- The section of the street running underneath Hildebrand Hall has adequate lighting.
- The light levels in the Faculty Glade to the south of the building is low.
- Darker surrounding surfaces make the space appear dark and uncomfortable.

Participant Survey

- Participants did not feel safe or comfortable in this location at night.
- The light levels are uneven and the light is spotty along the street.
- The building mounted luminaires are not glary.

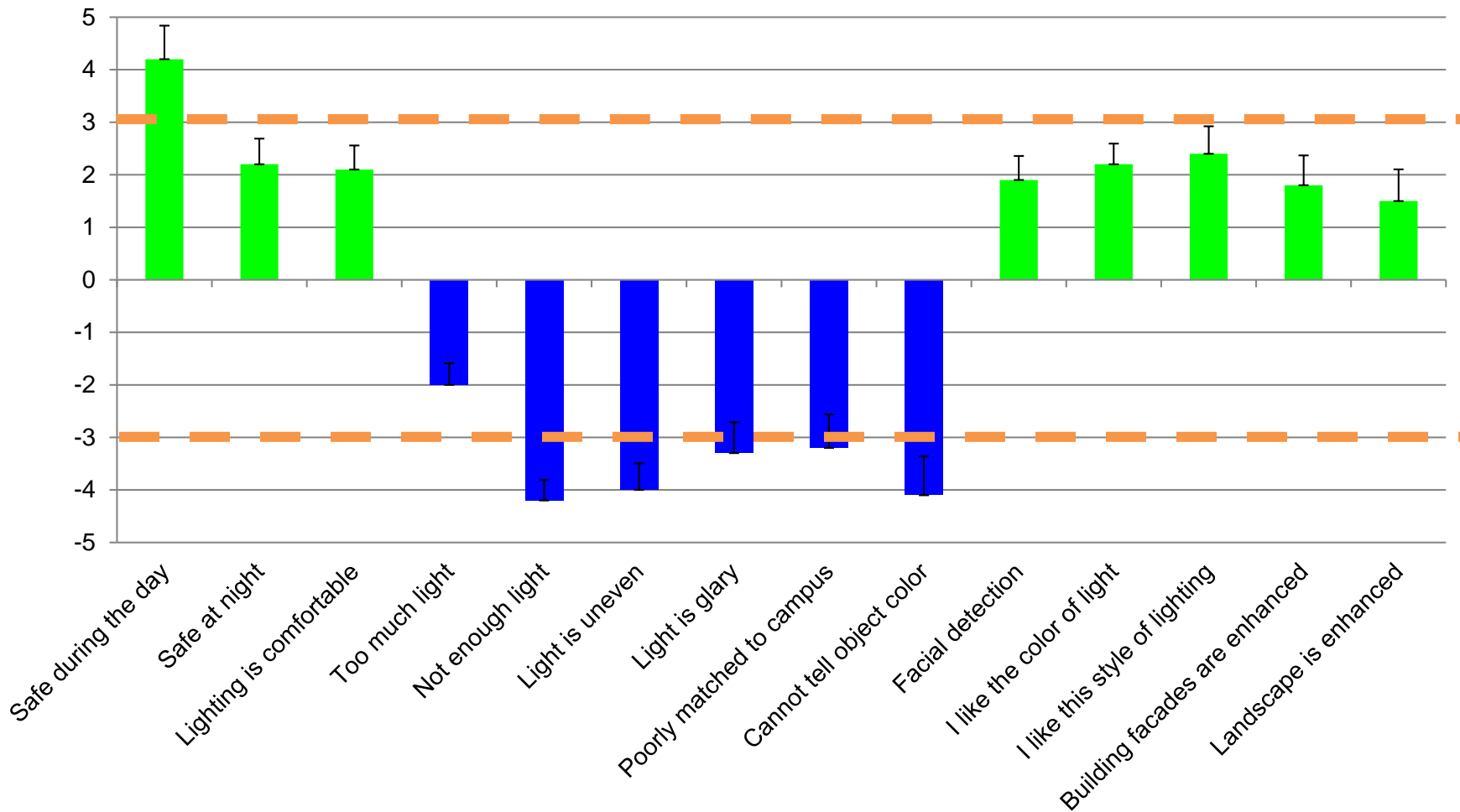
Criteria	Average	Illuminance (fc)		CCT (K)
		Horizontal	Vertical	
	Avg/Min	0.5	0.25	3000K (Recommended)
South Drive	Average	0.4	0.17	4000K
	Avg/Min	7	19	

SOUTH DRIVE



Green Bars are Positive Questions (High Values are Preferred)
 Blue Bars are Negative Questions (Low Values are Preferred)
 Orange Lines are Neutral Responses

Morrison Hall



Level of Acceptability: Lowest

A lack of ambient building light creates an uncomfortable nighttime environment.

Initial Site Observations

- This is a primary east-west nighttime pathway.

Lighting Measurements

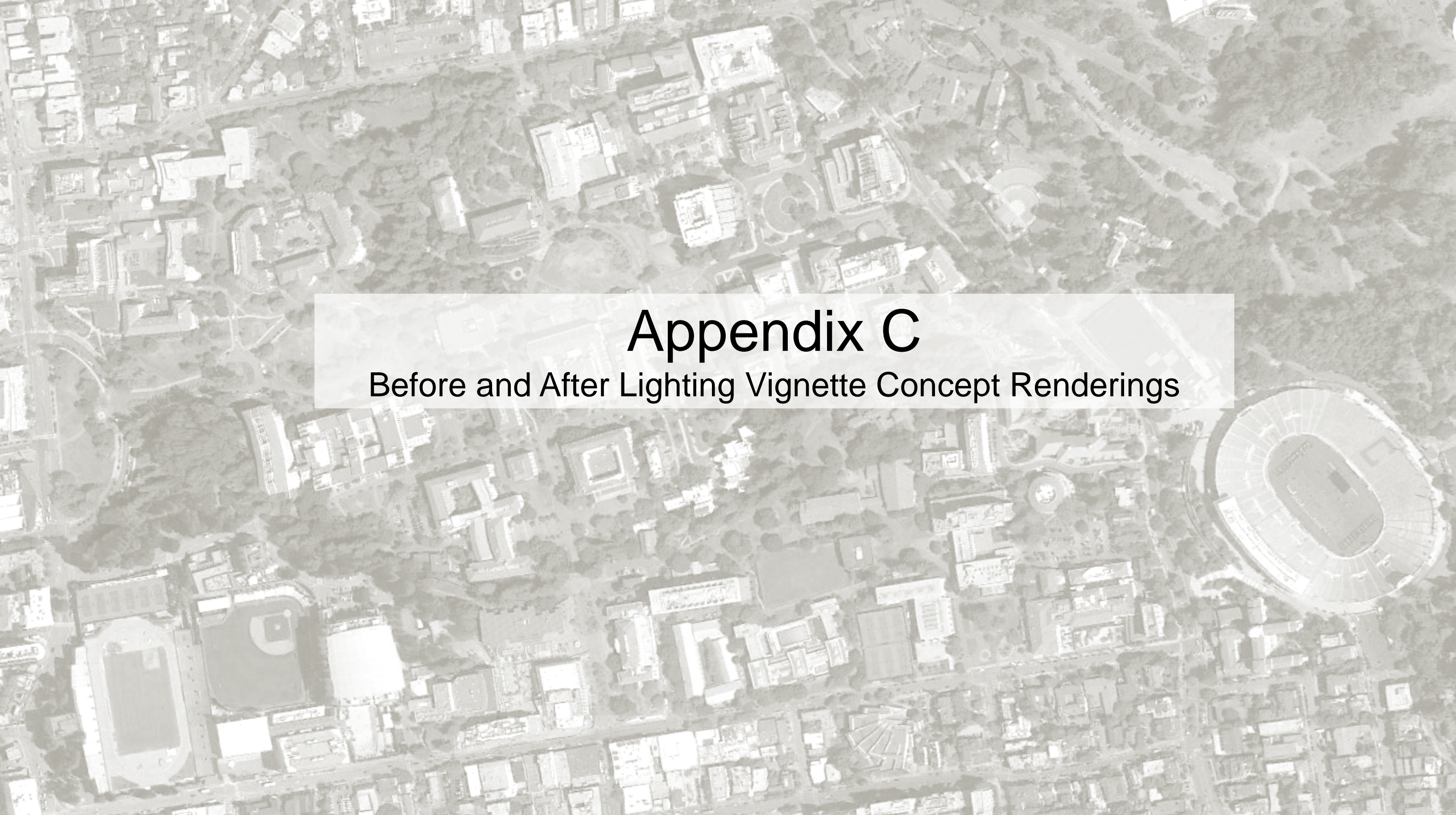
- Few people were seen walking in this area at night.
- The surrounding trees and darkened building made the area feel dark and unused.
- Uniformity along the pathway is poor and the area is under lighted.

Participant Survey

- Participants did not feel safe in this location at night.
- The light levels are too low and uneven to feel comfortable.
- Facial detection and identification was difficult in this location.

Criteria	Average	Illuminance (fc)		CCT (K)
		Horizontal	Vertical	
	Avg/Min	0.5	0.25	3000K (Recommended)
Morrison Road	Average	0.2	0.13	5000K
	Avg/Min	10	32	

MORRISON HALL



Appendix C

Before and After Lighting Vignette Concept Renderings

Ceremonial Lighting Vignette Concept

North Gate – Adding ingrade lighting to North Gate will illuminate the columns, giving the gate as much nighttime prominence as the landmark has during the day. Surrounding bollard lighting will add ambient and way-finding lighting.

BEFORE (NORTH GATE)



AFTER (NORTH GATE)



Ceremonial Lighting

Sather Gate - The crown of the gate should be a prominently seen feature on campus at night. Additional lighting along the walls that lead into campus can improve ambient lighting and wayfinding on this pathway.

BEFORE (SATHER GATE)



AFTER (SATHER GATE)



Architectural Lighting

California Hall - Lighting the eastern façade of the California Hall will improve the ambient light levels along Sather Road, creating a well lit nighttime corridor.

BEFORE (CALIFORNIA HALL)



AFTER (CALIFORNIA HALL)



Architectural Lighting

Doe Memorial Library - Illuminating the Doe Memorial Library entry will define the edges of the Memorial Glade.

BEFORE (DOE MEMORIAL LIBRARY)



AFTER (DOE MEMORIAL LIBRARY)



Architectural Lighting

Wheeler Hall – Façade lighting will define Wheeler Hall and improve the ambient lighting levels.

BEFORE (WHEELER HALL)



AFTER (WHEELER HALL)



Architectural Lighting

West Gate - Illuminating this entry to campus will help ensure the feeling of safety for students and faculty.

BEFORE (WEST GATE)



AFTER (WEST GATE)



Architectural Lighting

Memorial Pool - Subtle, low level lighting along the Memorial Pool alters the mood from one of disquiet to serenity.

BEFORE (MEMORIAL POOL)



AFTER (MEMORIAL POOL)

