EXTERIOR LIGHTING MASTER PLAN

19 JULY 2006

CANDELA
Lighting Design and Consulting

CONTENTS

I N T R O D U C T I O N

The Seattle Center Lighting Master Plan is an initiative of the Seattle Center staff and leadership as a positive step in the process of invigorating the public experience at Seattle Center. Linking the cultural, entertainment, educational and environmental aspects of the facility's mission to the night time experience through lighting will provide visitors with a unified experience and establish the Seattle Center as a destination of choice for residents and tourists alike.

Seattle Center has identified four objectives for the exterior campus lighting. These objectives are:

- As wayfinding for pedestrians as they traverse the campus in the evening;
- As a safety and security element to enhance the real and perceived sense of safety in use of the grounds after dark;
- As an aesthetic feature of the design of campus facilities intended to be welcoming, inviting, fresh, dramatic and/or playful; and,
- As a demonstration of environmental stewardship through the use of the most energy efficient fixtures and equipment, consistent with the purposes of campus lighting.

Candela undertook a survey of the designated main pedestrian pathways to identify how well these four objectives are currently achieved and to recommend improvements. That survey is documented in the Seattle Center Lighting Assessment, dated March 8, 2006.

Undertaking specific, well-coordinated improvements guided by the four objectives will strengthen the Center's distinctive identity and enhance its connection to the city it serves. The goal of this document is to establish design intent and standards to be followed when future improvements are being made to the exterior lighting. Targeted design efforts will be required to establish the specifics of these improvements.

The four objectives are the lens through which lighting for each of several areas and objects are viewed. Each section below includes a summary of how the improvement discussed meets the four objectives, and what design criteria are necessary to achieve them. Evaluation and weighting of priorities will be an ongoing process, affected by budgets and schedules. This Plan is intended as a tool to inform that process.

SEATTLE CENTER CAMPUS

There are distinct areas within the Seattle Center that naturally divide it into visually and functionally unique settings. These divisions not only often determine a visitor's destination, but provide visual cues to wayfinding and offer excellent opportunities to enhance the experience and create special treasured places. As a way of dividing the entire campus into comprehensible elements, both functional and visual divisions have been made.

Campus entries are the first impression visitors have of the facility's personality. This makes them a unique and primary element to be considered. Specific entries are addressed in terms of how lighting can be used to enhance their appearance and connect them visually to nearby venues.

Likewise, the experience of traveling the Pedestrian Pathways within the campus leaves a lasting impression of the spirit and content of the Seattle Center experience. On a very basic level these pathways need to provide a sense of safety and ease along with the welcoming experience. Because that experience includes objects and surfaces that surround the pathways, and not just the horizontal surface of the path itself, pedestrian pathways are treated as a general category with a number of sub categories that address the total visual environment.

The use of lighting to enhance already established Destination Places can extend the experience over a longer period of the day and even transform it into a different experience. Lighting itself can create special places at night that don't exist during the daytime, bringing the magic of color, sparkle, and movement to an otherwise normal pedestrian experience. Specific places on campus where potential currently exists for enhancement with light, as well as guidelines for future installations are addressed under the heading of Destination Places.

The lighting of Public Art in a facility that functions as both a daytime and nighttime gathering place is an important visual cue to its cultural commitment. Since artwork can also be a marvelous way to provide excitement and visual interest to an area, it is important to consider this aspect of the numerous public artworks on campus.

There are locations on campus where minor changes to existing light fixtures would greatly improve the visual situation and aid orientation. The Miscellaneous Maintenance category will encompass recommendations for improving these fixtures.

Each of these divisions will be used to encompass different aspects of lighting that can be used to enliven and decode Seattle Center for visitors, and make it the place of choice for an evening of culture, entertainment and companionship.

Light Sources

Our perception of the quality of the visual environment around us is greatly affected by the quality of the light that is illuminating the objects we see. There are two properties of the color of light that we can measure and use to determine how the visual environment will appear.

"Color temperature" is a measure of the “whiteness” of a light source. We often refer to light as warm (yellow/orange) or cool (blue/white). This refers to the color temperature of the light. "Color rendering" is a standard by which a light source reveals the true color of an object or material.

The human eye is more sensitive to a blue-white light source under low (night time) lighting levels than it is to warmer, more yellow sources. Recent research indicates that less light is required from blue-white sources than from yellow light sources under night time conditions. This condition, combined with the superior color rendering of ceramic metal halide light sources, means that ceramic metal halide is a superior source for outside at night where good visibility is desired. It enhances the perception of safety because people can more clearly identify elements in the environment. Establishing metal halide as the primary light source for exterior lighting on the Seattle Center campus will both promote a sense of safety and security, and contribute to energy savings.

As LED technology is improving, it is becoming a very good source for accent and supplementary lighting. It mixes quite well with metal halide is available in the same range of color temperatures. Although it is not suitable as the primary light source for the campus at this point, it should be considered for suitable applications.

Standardizing on metal halide as the primary light source meets objectives:	
Wayfinding:	*Uniformity of color provides clearer visual cues for orientation.*
Safety & Security:	*Good color rendering enhances identification of people and objects.*
Aesthetics:	*Good color quality enhance the visual environment.*
Environment:	*Energy efficient and long life lamps reduce waste and maintenance.*

CAMPUS ENTRIES

Well designed and functioning entries will draw people into the Seattle Center and create a sense of anticipation. A lively atmosphere that is evident from surrounding streets will attract people beyond those attending specific events, and create a sense of arrival for all visitors. This is of primary importance in creating an image of the Center as "welcoming, inviting, fresh, dramatic and playful."

In addition to the attract function of entries, they must also fulfill the wayfinding needs for visitors. If it is not obvious where a visitor should enter, there will be some discomfort that will lead to feelings of questionable safety. There should be no doubt that an entry is safe and that it leads into an environment that will continue to present that level of comfort to the visitor.

The primary pedestrian entrances to the Center are identified on the map below.

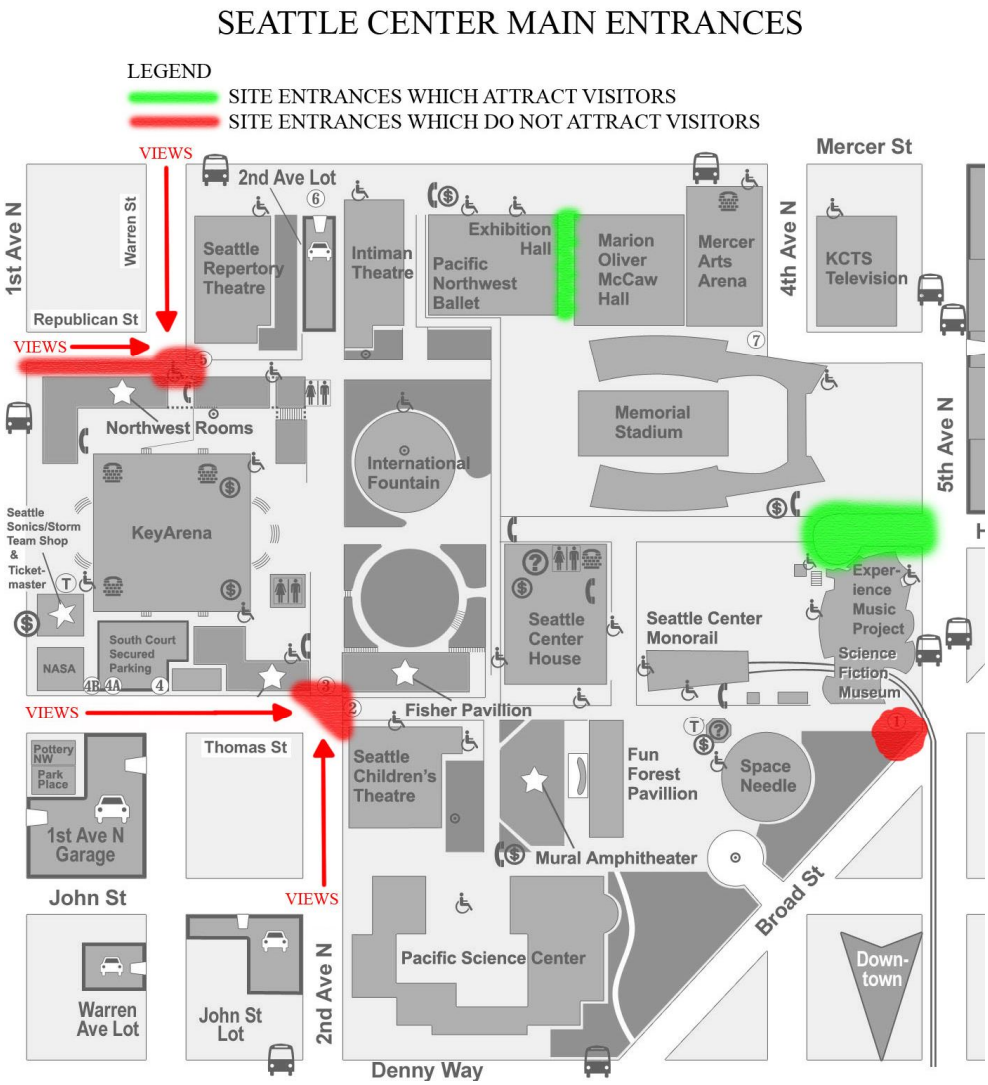

Figure 1: Map of Seattle Center with main pedestrian entrances highlighted.

Entrances highlighted in green identify current locations where excitement is created by architecture and art, and enlivened by lighting. The Blades at the Harrison Street entrance set an intensifying rhythm for the visitor approaching the interior of the Center, and the lighting, though static, enhances that beat. The Kreielsheimer Promenade, with its magical mesh screens drenched in dynamic color is the epitome of an entrance playing its role to the hilt.

Entrances highlighted in red identify locations that should be major pedestrian entry points because of proximity to parking, restaurants and public transportation. Yet these intersections not only fail to attract, but actually create confusion as to whether they are visitor or service entries.

Republican Street & Warren Avenue North

The entrance at the intersection of Republican Street and Warren Avenue North is barely visible, tucked behind commercial buildings and dimly illuminated. This is the closest entry to the lively group of restaurants at the northwest corner of Seattle Center, and should be a major point of entry for pedestrians. It should be easily visible from the intersections of Republican/First and Warren/Mercer, each one block away. Features and lighting at this entrance should be bright, dynamic and colorful to establish its visibility from that distance.

Artwork, architecture, signage and special lighting effects are all candidates for improving the visibility from afar, and establishing this as a unique point of entry. "I'll meet you by the Giant Purple People Eater." Everyone will know where that is! An intensive design exercise is called for here to create something special. The wall of the Northwest Rooms extending west along Republican should be considered part of this entry experience.

Coordination with improvements to the pedestrian pathway leading east from this intersection is very important as well. Once this intersection is established as a major entry, the welcoming atmosphere must continue into the "Center of the Center." The pathway improvements will be addressed later in this document.

Figure 2: View of Northwest Seattle Center entrance from Republican Street. Enhanced lighting in this area will help define this location as a main pedestrian entrance.

Thomas Street & Second Avenue North

This is an entry with lots of possibilities. The proximity to the Children's Theatre, Fisher Pavilion and Center House, along with a substantial amount of nearby parking makes it a natural major entry. The billboard wall to the west of Fisher Pavilion is a potentially valuable piece of the solution since it can be viewed from the south along Second Avenue North. Colorful presentations that are well-illuminated with the sign lights above will create a focus. The view from Thomas needs to be enlivened in a way that works with that.

Adding illumination to the pole-mounted banners in front of the Children's Theatre, and extending that concept to the corner would be a simple fix that would add color and interest to the corner. This technique would also work very well with the illuminated signage on the billboard wall discussed above.

The addition of pedestrian lighting to the sidewalks of the first blocks west and south of the intersection would help as well. These sidewalks are outside of the Seattle Center's boundaries. It is highly recommended that Seattle City Light be encouraged to add appropriate pedestrian light poles for these two blocks. They are not adequately illuminated for an area immediately leading to a major civic amenity.

Figure 3: View of Seattle Center West entrance from Second Avenue North. Lighting and signage on Fischer Pavilion elevator walls will help draw visitors into the Center.

Broad Street, Thomas Street & Fifth Avenue North

There is a lot happening around the Broad Street/Thomas Street/Fifth Avenue North entrance. EMP's Science Fiction Icon stoops to conquer; the monorail whips by; and EMP itself swirls and dips into almost darkness to the south. It feels like you've reached the destination, not just begun to enter. Even the Space Needle in the near distance doesn't seem like a sure destination with the more brightly illuminated circular entry to the south.

The group of trees just south of Thomas Street offers one opportunity. Uplighting these trees would begin to balance the experience between EMP and the dark grassy knoll to the south. Adding an element of color, like the small group of trees on the west side of EMP would be even better. Dynamic color or the addition of a bright colorful element that is illuminated would be better yet. EMP is so much to compete with, that something fantastical and over-the-top would succeed here. Since there are a number of artworks located in the area south of this intersection, establishing this as the northeast corner of Seattle Center's sculpture park would be ideal. Further discussion of lighting for the artwork is presented later in this document.

Enhanced lighting at campus entries meets objectives:	
Wayfinding:	*Makes entry locations visible and obvious to visitor.*
	Connection to restaurants and transportation hubs is improved.
Safety & Security:	*Better visibility of pedestrians enhances identification and comfort level.*
Aesthetics:	*Establish a sense of anticipation, whimsy, grandeur that says WOW.*
Environment:	*Use energy effective sources and design techniques to maximize impact.*

PEDESTRIAN PATHWAYS

Once the visitor is within the grounds, maintaining orientation and a sense of security is best accomplished with good visibility and an organized visual environment. Currently, there is little uniformity to the illumination of the pedestrian walkways throughout the site. Light poles are not spaced consistently, some poles are single-headed while others are two-headed, and pole bases are a variety of sizes and materials.

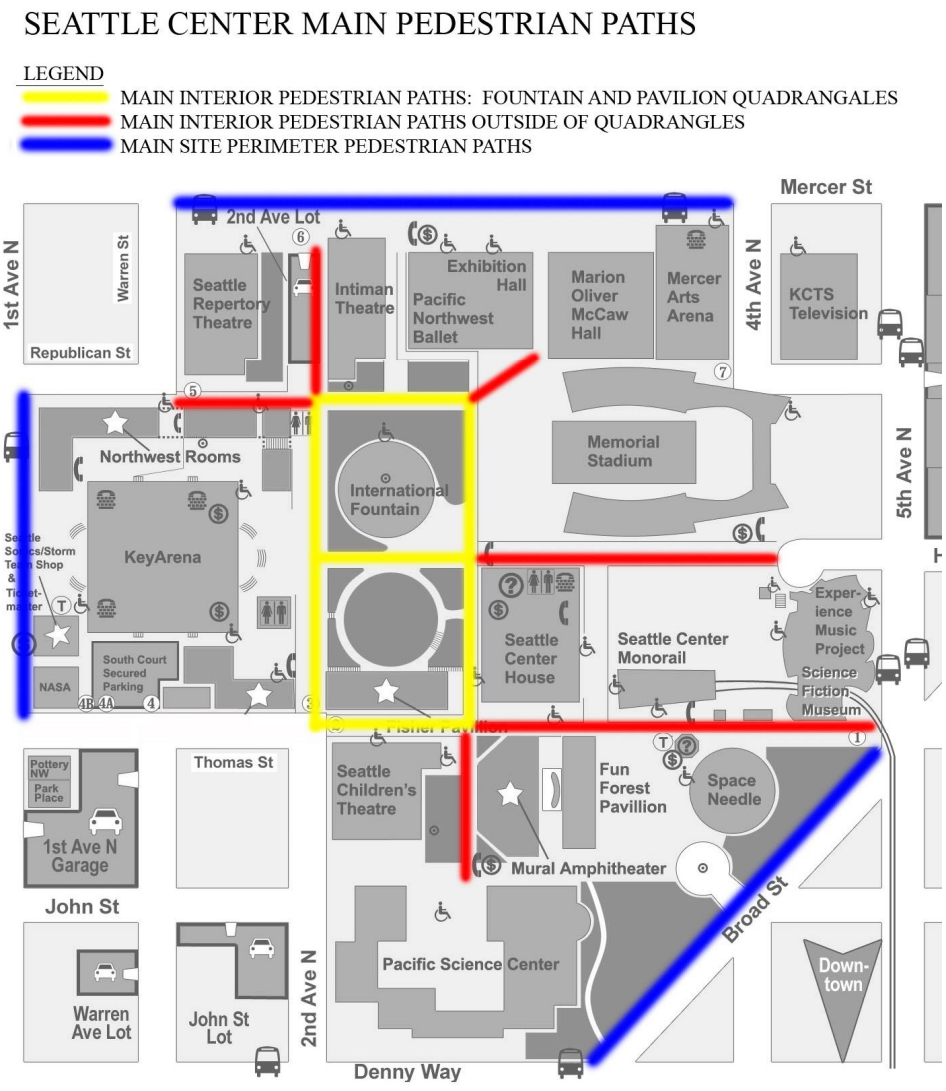

Figure 4: Map of Seattle Center main pedestrian paths.

Consistent fixture spacing will not only provide more uniform light levels throughout the site, but also create a more appealing visual environment. This is most important along the main pedestrian corridors, but should ideally be applied to all pedestrian paths on site and some along the perimeter. While different light levels on pedestrian ways may result from specific functional requirements or decorative elements of the surrounding structures, the base layer of light for pedestrian circulation should be met throughout.

The Illuminating Engineering Society of North America recommends ranges of light levels for specific environments. Their recommendations for pedestrian ways distant from roadways are presented in the following table. The Seattle Center should be cognizant of these recommendations to ensure an acceptable level of visual acuity and comfort. However, there are other factors to consider in applying these recommendations. First, Seattle Center is a public facility that is used by a great number of people at all hours of the day and night. It is a festive environment that invites visitors to enjoy themselves in a variety of venues. As such, light levels somewhat higher than average minimums are desirable. Second, it should be recognized that the surrounding visual environment contributes to the visual acuity and perceived sense of safety even more than the actual light level on the ground. Because of this, as design of these areas is completed, the total visual environment within the field of view should be addressed in a holistic manner.

Table 1: IESNA Recommended Average Maintained Illuminance Levels for Pedestrian Ways*

	Minimum Average Horizontal Illuminance**	Average Vertical Illuminance
Sidewalks Adjacent to Roadways	0.5 Foot-Candles	1.0 Foot-Candles
Sidewalks Distant from Roadways	0.5 Foot-Candles	0.5 Foot-Candles
Pedestrian Stairways	0.5 Foot-Candles	1.0 Foot-Candles

** Taken from Table 2 IESNA DG-5-94; Recommended Lighting for Walkways and Class 1 Bikeways.*

*** Uniformity ratios should not be greater than 10:1 maximum to minimum*

There are three realistic methods for creating this uniform scenario. Each results in a different level of budget commitment and site disruption.

Option One: New Pedestrian Light Poles & Fixtures

Changing the pedestrian light pole fixtures to a new, more optically precise fixture would, in the long run, provide more even light on the pathways, using less energy and fewer overall poles and fixtures.

The fixtures currently in use do not have internal reflectors that help to distribute light in a particular way. They simply spread light in a somewhat omni-directional manner, altered only by the shade of the fixture blocking the light in the upward direction.

Commonly used fixtures now incorporate reflectors that distribute the light in specific patterns depending on where it is needed. This creates a more energy effective lighting design that results in wider spacing between poles while, at the same time, maintaining more uniformity over the pathway. With careful design and an alternating-side pattern, pole spacing could be as much as 75' which is significantly greater than the current spacing. Light levels could be lower than the levels in the brightest areas of the campus, and higher in other areas while reducing the overall energy use.

The most economically realistic way to accomplish this conversion over the entire campus would be to use a fixture that has a similar appearance to the existing fixtures so that the transition can be accomplished in stages. However, for a more obvious exhibition of change, a new fixture head type could be selected. Existing poles could still be used.

A typical layout for this option would utilize single headed poles spaced at a maximum distance of 75 feet on center. Poles would be located on both sides of a pathway in an alternating pattern as shown in the sketch to the right.

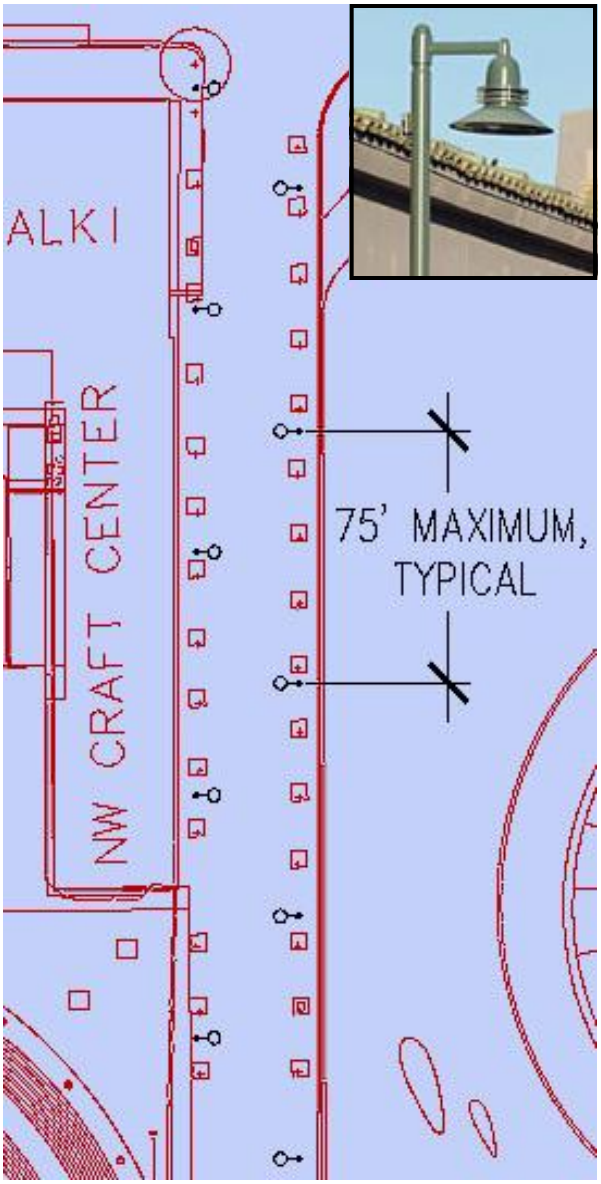

Figure 5: Typical pole layout and spacing for Option 1. Also shown is and example of a typical new proposed pedestrian post-top fixture.

Option One pole layout meets objectives:	
Wayfinding:	*Makes upcoming pedestrian path locations visible and obvious to visitor. Uniform light levels improve orientation.*
Safety & Security:	*Better visibility of pedestrians enhances identification and comfort level.*
Aesthetics:	*Uniform color and pattern of fixtures creates balanced effect.*
Environment:	*Fewer fixtures and lamps reduce energy and maintenance cost.*

Option Two: Two-headed Pedestrian Light Poles Using Existing Fixture Types

The lighting along the walkway adjacent to the Northwest Craft Center creates a pleasant, comfortable walking environment. The poles along this corridor have two fixture heads each and are spaced approximately 60 feet on center with an alternating offset pattern on the two sides of the path. Because the fixtures are non-directional in their light distribution, uniformity is created by using close pole spacing. This results in the higher overall light level. The illumination levels are actually higher than IES recommendations, between 1.0-2.5 foot-candles. Because this area is often the liveliest part of the campus, it does not seem over-illuminated.

Option two uses this typical spacing as a guide to layout the lighting along all of the main pedestrian corridors on site. This option would relocate many of the existing poles and fixtures on site to achieve a consistent pole spacing throughout. There is an added construction cost associated with this option due to the large amount of trenching required to provide power to new fixture locations, and many of the existing poles would have to be relocated to achieve consistent spacing. Some additional fixture heads would also be required. They would match the existing fixtures.

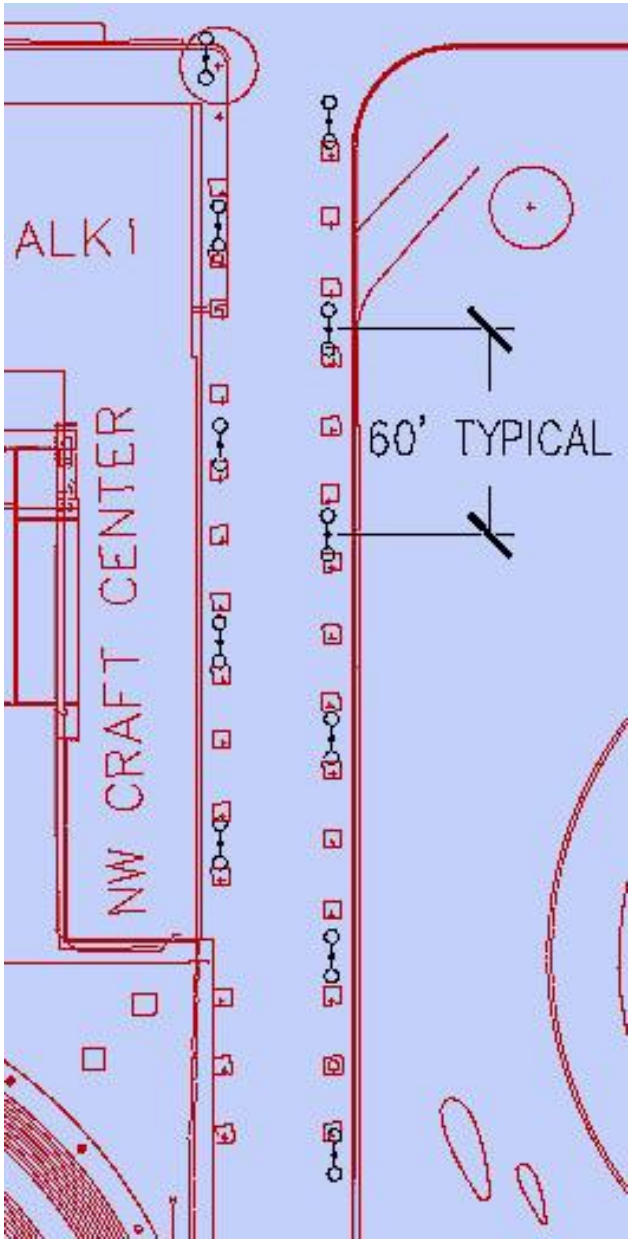

Figure 6: Typical pole layout and spacing for Option 2.

Option Two pole layouts meet some objectives better than others:	
Wayfinding:	*Makes upcoming pedestrian path locations visible and obvious to visitor. Uniform light levels improve orientation.*
Safety & Security:	*Better visibility of pedestrians enhances identification and comfort level.*
Aesthetics:	*Uniform color and pattern of fixtures creates balanced effect.*
Environment:	*Use more energy, fixtures and maintenance than Option One.*

Option Three: Adding New Pedestrian Light Poles and Fixtures Where Needed

The existing pedestrian path lighting includes areas where sufficient light levels are achieved, and other areas where this is not the case. There are significant spacing variations and pole/fixture configurations that detract from the overall visual environment. However, the least cost option for improving pedestrian walkway lighting would be to infill new equipment only into the areas where the light levels are below recommendations and pedestrians do not feel safe. In this option, poles currently on the site would not be relocated.

Although the cost for this option is significantly lower than the other two, it fails to meet the criteria for an improved visual environment.

PEDESTRIAN POLE LOCATIONS FOR OPTION THREE

AREAS HIGHLIGHTED IN BLUE INDICATE PATHWAYS
WHICH REQIRE SUPPLEMENTAL LIGHTING.

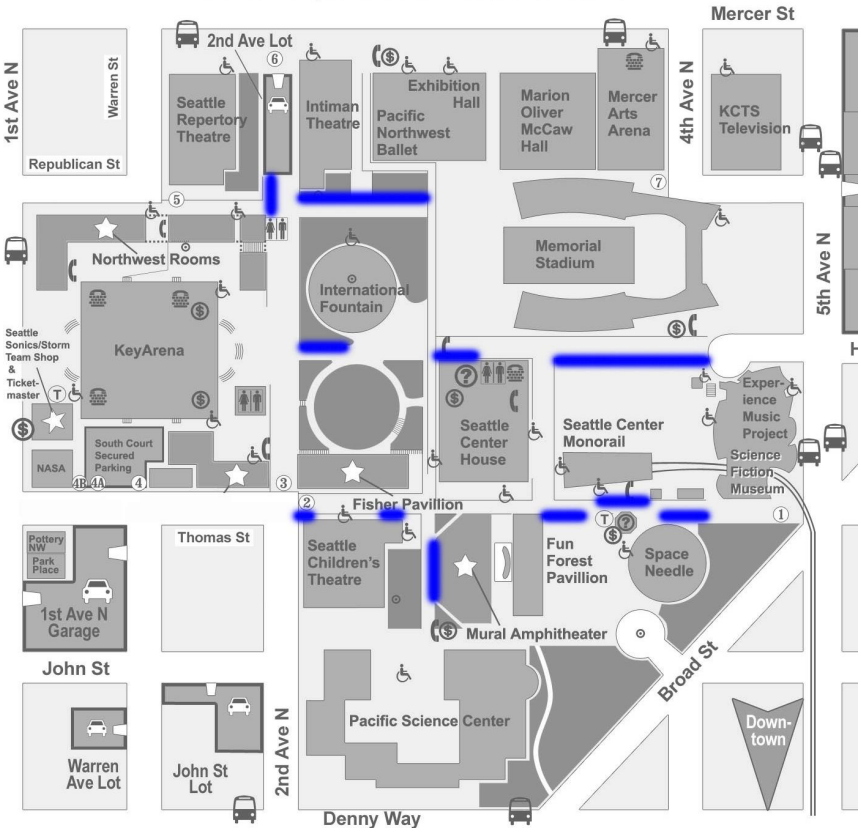

Figure 7: Map of Seattle Center indicating areas where supplemental lighting is required on pedestrian paths for Option 3.

Option Three pole layouts meet fewer objectives than the other two options:	
Wayfinding:	*Makes upcoming pedestrian path locations visible and obvious to visitor.*
Safety & Security:	*Better visibility of pedestrians enhances identification and comfort level.*
Aesthetics:	*Non-uniform pattern is less effective in creating consistent appearance.*
Environment:	*Use more energy and fixtures Option One, but less than Option Two.*

Recommended Hybrid Solution for Pedestrian Path Lighting

As a way to balance design, energy and economic issues, there is an excellent hybrid of these options that would meet the objectives while identifying the central quadrangle around the International Fountain and Fisher Pavilion as the center of festivities.

This plan incorporates Option One for the pedestrian paths leading from the perimeter of the campus into the central quadrangle. The intention is to provide even light with a high degree of visual acuity for pedestrians traveling along the lesser-used paths. These include some of the darker pathways on campus where supplementary illumination is clearly needed. Under any circumstance, new pole locations will have to be established, and new fixtures added. Using the most efficient type of fixture that provides glare-free illumination is the most responsible and economic way to accomplish this objective. The more optically sophisticated fixtures look almost identical to the existing fixtures except the internal globe is replaced by an efficient reflector.

In the central quadrangle, the existing lighting is doing an excellent job of providing a higher level of light that creates a festive atmosphere throughout most of the area. Following Option Three in this area will provide supplementary light where needed in areas that are somewhat darker, and will continue the active appearance throughout this central quadrangle. Economies can be achieved with the reuse of some of the fixtures and poles that will be replaced with the Option One poles on the other paths.

The overall campus will still appear unified with the same appearance for the pedestrian pole fixtures, while the Seattle Center's commitment to environmental stewardship will be maintained with the new efficient fixture layout. The budget commitment will be minimized by reusing many existing fixtures.

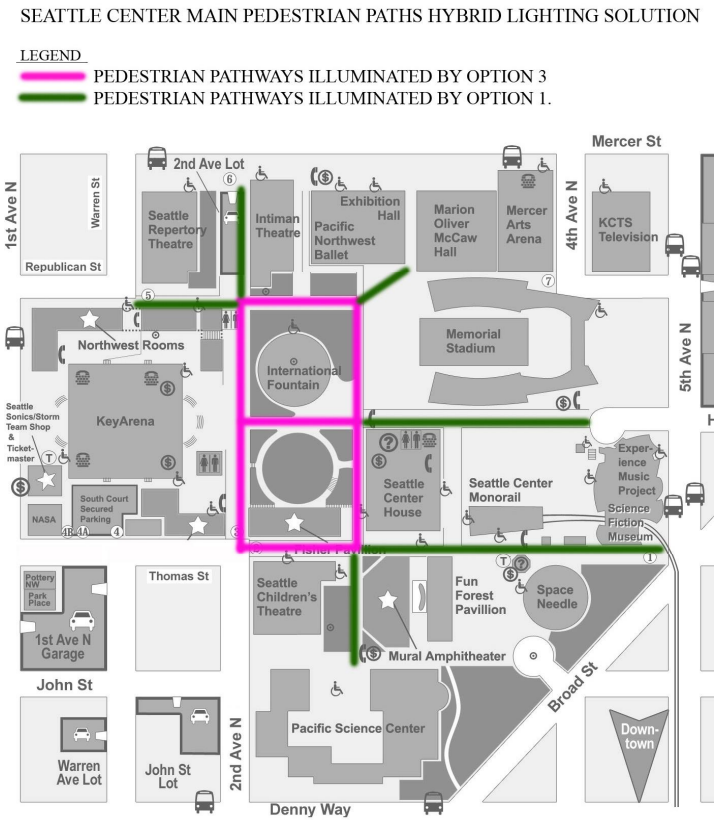

Figure 8: Map of Seattle Center illustrating hybrid solution for pedestrian path lighting.

Hybrid pole layout meets objectives:	
Wayfinding:	*Makes upcoming pedestrian path locations visible and obvious to visitor. Uniform light levels improve orientation.*
Safety & Security:	*Better visibility of pedestrians enhances identification and comfort level.*
Aesthetics:	*Uniform color and pattern of fixtures creates balanced effect for each area while indicating different levels of activity.*
Environment:	*Using efficient new fixtures reduce energy and maintenance costs.*

Canopied Pedestrian Paths

The two covered walkways along the eastern side of the International Fountain and Fisher Pavilion would be very pleasant pedestrian experiences if the color and distribution of the lighting were improved. They are currently illuminated with quite glary fixtures, one canopy with high pressure sodium sources and the other with metal halide sources.

Glare is a visual issue, particularly at night, because the human eye focuses on the brightest source in its visual field. When that source is overly bright compared to other areas in the field of view, those darker areas actually appear even darker than they are in contrast to the bright source. This is the primary reason that shielding of light sources is so important when a sense of security is a priority.

In order to improve the visual environment under these canopies, the fixtures need to be replaced with some that can distribute the light mostly down toward the path, but with a little upward to maintain the sparkle that the illuminated glazing provides. The light should not be emitted between 45° and 90° from vertical, which is the area that causes glare. The light on the path itself should be maintained to levels and uniformity ratios similar to surrounding pathways. Examples of fixtures that would satisfy these criteria can be seen on the following page.

Adding light on walls adjacent to the canopies and on surrounding landscape elements will further improve the visibility and sense of safety.

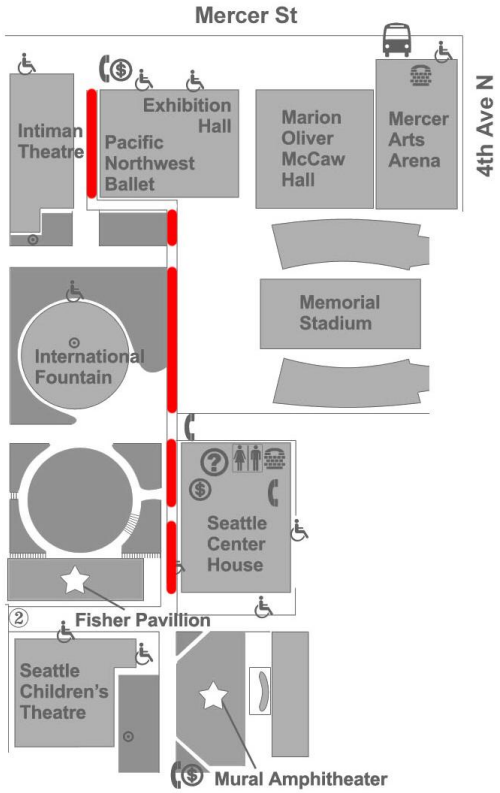

Figure 9: Partial Seattle Center map showing locations of canopied pedestrian paths.

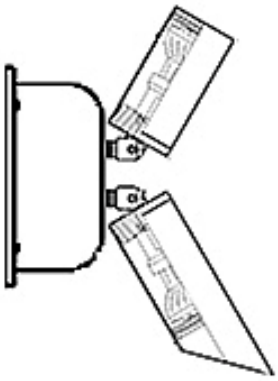

Figure 10: Double headed accent fixtures, with one head directed up to illuminate the canopy, and one directed at the pathway can provide the required functionality without the glare. The uplight component requires a wide spread distribution, probably with the use of a spread lens or reflector, and the downlight component requires source shielding to meet the criteria.

Figure 11: A lensed fixture with a single lamp can satisfy the criteria as long as the source is shielded from view with an internal or external element.

Figure 12: Rendered image of enhanced canopy lighting and landscape lighting beyond.

Enhanced canopy lighting meets objectives:	
Wayfinding:	*Uniformity with surrounding light levels is critical.*
Safety & Security:	*Reduced glare enhances visibility and apparent safety.*
Aesthetics:	*Reduced glare creates more pleasing environment.*
Environment:	*Sources are similar to existing in energy use.*

Lighting Vertical Surfaces and Elements Adjacent to Pathways

Where there are vertical surfaces adjacent to pedestrian walkways it is extremely advantageous to illuminate them. The reflected light supplements the pathway lighting and improves the visibility of all surroundings. This enhanced vertical illumination increases the pedestrian's sense of safety. Lighting landscape elements adjacent to pathways can have a similar effect. Dark landscape areas can make pedestrians feel unsafe. Just enough lighting to reveal the interior of the landscape area helps assure people that no one is hiding within. There are several locations on campus where this lighting technique will enhance the visual environment and also present opportunities for adding color and whimsy to the pedestrian experience.

The north canopy discussed on the previous pages would benefit from both wall washing and landscape lighting.

The north wall of the San Juan and Olympic Rooms along Republican Avenue is a prime candidate for wallwashing or uplighting with some element of color or pattern. As the approach to the theater district from the south, a splash of color or pattern, or even a projection that announces a current event would enliven the pedestrian experience and enhance the feeling of having arrived at a special place. A surface mounted, uplight/wall wash type fixture located in the planting bed would be very effective in providing a wash of white or colored light on the wall. An exterior grade pattern projector could also be used to enliven the image or even provide information about events. A projector would have to be located across the pathway for optimum projection angle.

Figure 13: Rendered image of North wall of San Juan and Olympic Rooms, looking West. Adding colored light or projecting a pattern on this wall will enliven the entrance.

There are a number of locations on campus where high pressure sodium and mercury vapor light fixtures are located under building overhangs. As a general rule they do not provide effective light for either the wall or pathway but degrade the visual environment. Replacing these fixtures with a metal halide downlight that provides a regular pattern of light on the wall and distributes light to the pedestrian and planting areas is a priority in the effort to unify the visual environment. One-to-one replacement is most likely a good option, although each condition needs to be reviewed individually. The beam spread of the fixture needs to provide an attractive scallop on the wall surface, or else have a wall wash distribution to even the light out across the surface. The map on the next page indicates the locations of where these fixtures are currently installed.

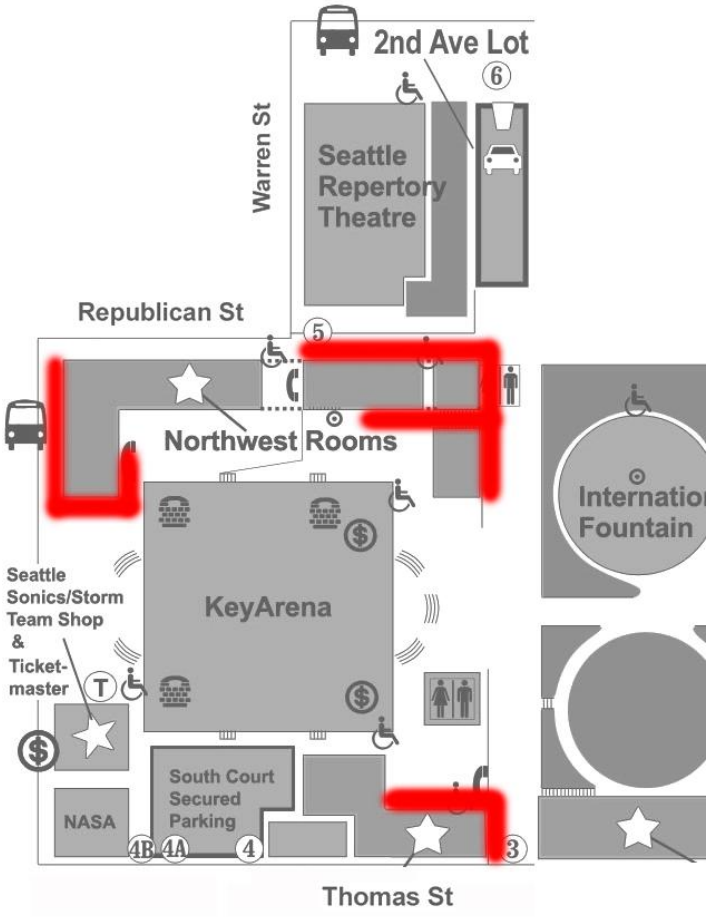

Figure 14: Partial Seattle Center map showing locations of fixtures mounted beneath building overhangs.

Lighting vertical surfaces and landscape elements along pathways with low-glare fixtures meets objectives:	
Wayfinding:	*Vertical surfaces offer good cues to pedestrians.*
Safety & Security:	*Better visibility of pedestrians enhances identification and comfort level. Elimination of dark areas reassures pedestrians.*
Aesthetics:	*Illuminated surfaces create visual rooms with interesting walls.*
Environment:	*Use energy effective sources and design techniques to maximize impact.*

Perimeter Pathways

Pedestrian walkways surrounding the Seattle Center Campus are an important part of the image that the Center presents to the community. They are the approaches to the entries, and have their own role in creating anticipation. They should be organized in appearance and represent the campus functions that abut them.

Broad Street from the Science Center to the Space Needle Entry

The extensive lawn areas along Broad Street are dark and forbidding at night. While the art works scattered around the area present a lot of potential (discussed in the Public Art section), the sidewalk south of the Space Needle circular drive is particularly uninviting. There are several possibilities for adding pathway lighting to this area to enhance its appeal.

While it is not desirable to encourage visitors to cross the lawn, it would be very easy to establish a quickening of pace as a pedestrian approaches the Space Needle. Using "The Blades" as a model, bollards can be located along the Broad Street sidewalk with the spacing shortening as the Space Needle entry approaches. Though barely perceptible, this technique will create an increased brightness that will subtly attract without overwhelming surrounding elements. Using bollards similar to those surrounding the Space Needle circular drive will create a seamless experience and quicken the pace of passersby.

Another possibility would be to add pedestrian light fixtures to the path that winds through the *Illiad* sculpture along the side of Pacific Science Center.

Enhanced lighting at Broad Street meets objectives:	
Wayfinding:	*Makes entry locations visible and obvious to visitor.*
Safety & Security:	*Brightening adjacent lawn area reduces mystery factor.*
Aesthetics:	*Establish a sense of place.*
Environment:	*Use energy effective sources and design techniques to maximize impact.*

DESTINATION PLACES

The goal of making the Seattle Center campus "welcoming, inviting, fresh, dramatic and/or playful" is accomplished very well in a number of ways and places. The challenge is to unify the experience and extend it throughout the campus in a cost and energy effective way. Creating discrete areas with unique or special lighting effects can establish special places that people remember and return to. Excellent example are the neon sculptures in the plaza south of the San Juan Room, the Dupen Fountain of Creation, the colorfully-uplit trees southwest of EMP, The Blades sculpture on Harrison, Kreielsheimer Promenade, and the soon-to-be-constructed Poetry Garden.

An important aspect of creating these special places is to locate them at some distance from each other so that the experiences stand out. If everything is special, nothing is. Every technique does not apply to every situation. That's what makes it unique.

Uplighting Trees

Uplighting trees can have a dramatic or playful effect, depending on the way in which it is done and the structure of the trees being illuminated. The small trees by EMP are too small yet to provide drama, but the color lends a playful air that delights. On the other hand, the mature weeping willow west of the Space Needle drop-off is a marvelous candidate for uplighting for dramatic effect. Depending on the position of uplights, it could be made to appear a glowing green ball or a soft green canopy above a twisted structure of substantial branches. Either way, it would provide a lovely backdrop to the drop-off rather than a black void.

Figure 15: Trees near EMP are uplight with a splash of color which creates a dramatic effect.

It is important to select trees that will take the light and transform their appearance with it. Trees with interesting branching structure, unique bark or seasonal color are good candidates for uplighting. Evergreen conifers should usually be avoided as their branching structure is messy and lighting them from outside the canopy flattens them out. Ceramic metal halide is the best source to use because of its good color quality. It can enhance both the greens of the leaves and the browns of the trunk and branches.

It is also important to add the lighting in groups to maximize the effect. Three or four surface-mounted adjustable fixtures aimed at a major mature tree will provide sufficient light to make it stand out. Two or three fixtures are fine for smaller trees, but the distribution of light up into the entire width of the canopy will provide the best appearance. In large groves, groups should be identified to create a pattern of lightness and shadow. In groves with depth, some trees in back should be illuminated to provide visual depth to the grove.

In the area between Pacific Northwest Ballet and Intiman Playhouse pedestrian poles light the curving pathway to a low level that should be supplemented. Rather than adding more poles, inserting tree uplights that illuminate some of the trees and perhaps some of the walls behind would improve the visual environment while creating a more special place. A careful look at the entire plaza is important in determining which trees are best to uplight. Sufficient numbers of fixtures should be added to provide a sense of the shape of the path as it curves through the plaza.

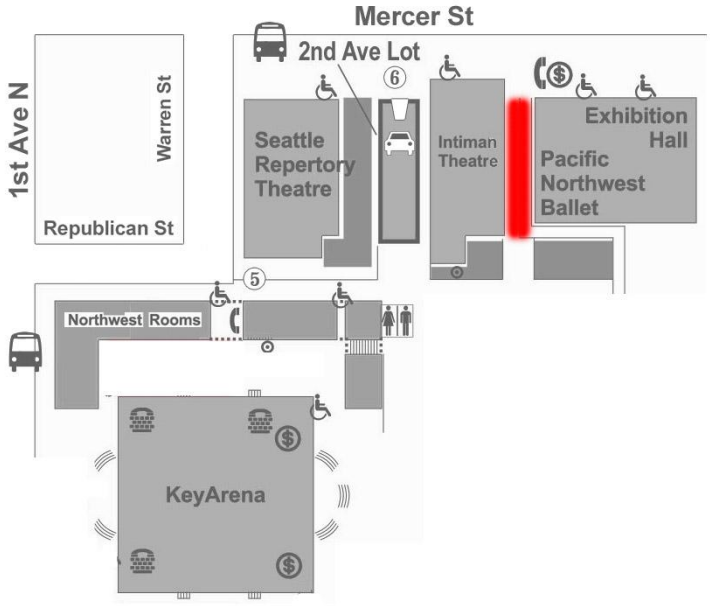

Figure 16, left: Partial Seattle Center map showing areas that would benefit from tree uplighting.

Figure 17, above: Typical tree uplight fixture.

Uplighting trees meet objectives:	
Wayfinding:	*Visual cues to reveal details of plantings enhance orientation.*
Safety & Security:	*Light in surrounding plantings increases pedestrian comfort.*
Aesthetics:	*Lighting trees enhances park-like appearance.*
Environment:	*Use carefully-place, energy effective sources to maximize impact.*

International Fountain Plaza

The area immediately south of the International Fountain is currently quite dark. Although it is technically a pedestrian pathway, it widens to a plaza-sized space that presents a perfect opportunity to surprise visitors with a magical lighting experience.

Pedestrian poles are not desirable in this area because they would break it up visually and separate the two halves of the open area. Better options would be low-level or even ground-recessed fixtures that are bright, colorful and lively. An interactive element would be ideal. LED tiles that illuminate or make sounds when stepped on, or turtle type light fixtures that spread patterns of light across the ground are possibilities to consider.

This is really the central destination place for the campus. It is very much worth a creative design effort to develop concepts for lighting will delight visitors.

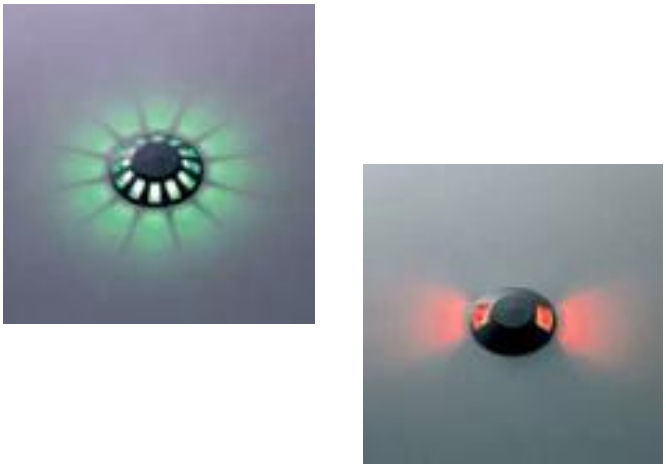

Figure 18: Examples of semi-recessed LED fixtures with light patterns.

Figure 19: Example of recessed LED tiles.

Active low-level lighting at the International Fountain Plaza meets objectives:	
Wayfinding:	*Color and movement will draw visitors' attention as they approach.*
Safety & Security:	*Added light in the area will increase comfort level.*
Aesthetics:	*Playful lighting will enhance the festive atmosphere.*
Environment:	*Using energy effective fixtures will minimize energy use.*
	Using low-brightness fixtures with color will minimize light spill.

Children's Theater Entrance

All rules must have exceptions, and a place where whimsy and imagination are encouraged is certainly the place to consider that. Along the walkway on the north side of the Children's Theatre there are six poles with banners that are not illuminated. Adding light fixtures to these poles and using the banners to light the pedestrian path with reflected light will create a special environment for the entry to the Children's Theatre. Each banner would require two fixtures, one per side, mounted above each banner. Care must be taken to minimize glare while providing sufficient light for circulation. If that cannot be accomplished, then supplementary pedestrian pole fixtures will have to be incorporated. However, this technique will be most effective if supplementary poles are not interfering with the visibility of the banners.

Using this technique only at the Children's Theater will enhance its special character and reinforce its theatrical nature.

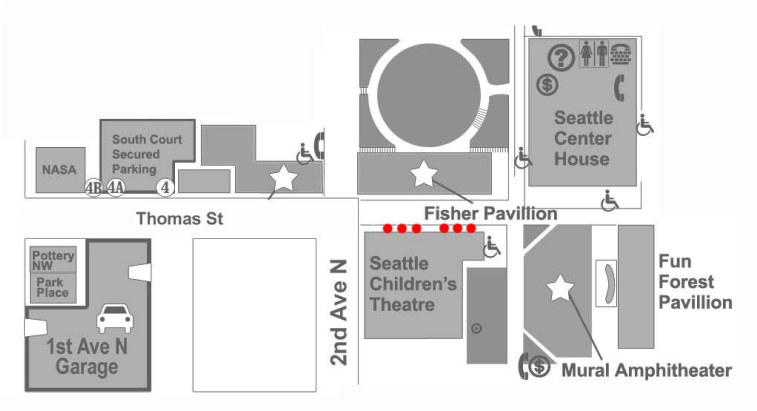

Figure 20, above: Partial Seattle Center map showing locations of currently installed banners to the North of the Children's Theater.

Figure 21, right: Illuminated banner affect.

Banner lighting in front of the Children's Theatre meets objectives:	
Wayfinding:	*Indicates the area is a unique destination while maintaining light levels. Connection can be made to adjacentThomas/3rd campus entry.*
Safety & Security:	*Maintains good visibility and enhances identification and comfort level.*
Aesthetics:	*Establish a unique character for the Children's Theatre entrance.*
Environment:	*Use energy effective sources and design techniques to maximize impact.*

Special Structures

The Mural Amphitheater is often a lively place in daylight, and certainly when music is being presented. It could become a place for evening picnics and play if the now-defunct lighting on the mural were replaced. With sufficient light projected onto the mural, reflected light would provide a soft ambient light during evening hours that would be very pleasant to sit near. The existing fixtures need to be removed, and replaced with wet location uplights. These could be either linear fluorescent as the previous source was, or ceramic metal halide. Inspection of the existing electrical feeds and service will be required, and some alterations may be necessary to the concrete wall in which the existing fixtures are located.

Figure 22, left: Rendering of illuminated mural.
Fixture 23, above: Example of a linear fluorescent wall wash fixture for illuminating mural.

The Center House is a much-loved structure that actually contains some quite nice Moderne style detailing on the north and south facades. Accenting this detailing and adding circulation light will provide the building with the same presence at night as it has in the daytime. This will be most effectively accomplished with selective illumination of details rather than flood-lighting the entire façade. Both the north and south facades could benefit from similar treatments.

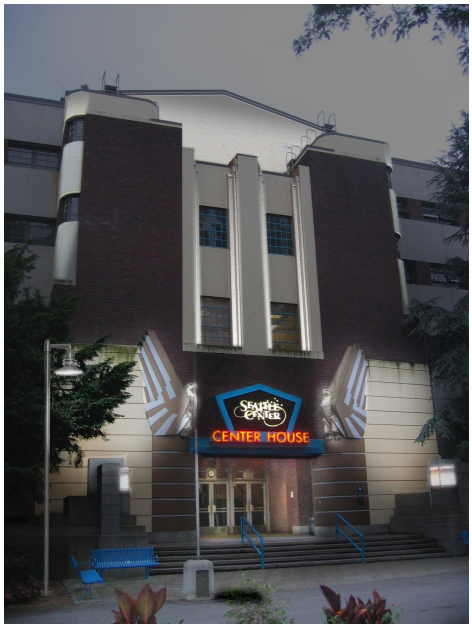

Figure 24: A potential version of the relighting of the north façade of the Center House.

Illuminating special structures meets objectives:	
Wayfinding:	*Landmarks create visual cues to aid orientation around site.*
Safety & Security:	*Better visibility of pedestrians enhances identification and comfort level.*
Aesthetics:	*Establish a sense of place with lighting unique to a structure.*
Environment:	*Use energy effective sources and design techniques to maximize impact.*

The Theatre District

The north edge of the Seattle Center has developed into a real theater district. Although there is variety in the architecture of the buildings, the lighting can unify the image and create a statement about the theatrical content at the same time. The north façade of Pacific Northwest Ballet is a very good example of a relatively simple lighting layout that works with the architecture and presents the building and its arcade as a public space that is welcoming. The downlights provide both light on the walking surface, and have wide distribution so relatively even light washes the wall. The north facade of Mercer Arena has the potential to present the same image with relatively minor changes. This change would make this multi-block experience seem more like the edge of a unified facility, a proscenium around the stage of the Kreielsheimer Promenade.

Figure 25: Lighting under the Pacific Northwest Ballet's canopy creates a welcoming environment.

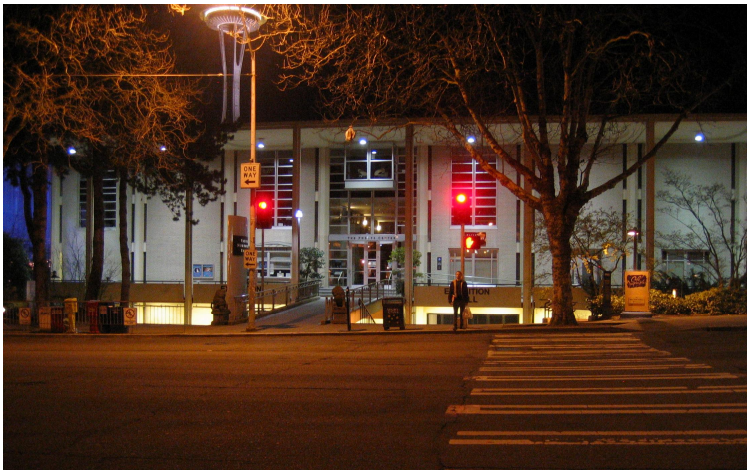

Figure 26: View of North façade of Pacific Northwest Ballet from across Mercer Street.

Unified lighting of Mercer Street facades meets objectives:	
Wayfinding:	*Uniformity of surround will make entry point more obvious in contrast.*
Safety & Security:	*Better visibility of pedestrians enhances identification and comfort level.*
Aesthetics:	*Establish a uniform campus edge for an improved sense of arrival.*
Environment:	*Use energy effective sources and design techniques to maximize impact.*

PUBLIC ART

Four sculptures located within the expanse of the Broad Street Green are in need of appropriate lighting that will improve their visibility at night and make the public's experience of them more interesting. Accomplishing this would greatly improve the impression that this area is really part of the Seattle Center. Its current dark expanse is rather forbidding and misses a great opportunity to create a lively public face for the campus.

The lighting of sculptures is a unique design task that is best accomplished with a mock-up process. Materials like bronze can take light and reflect it in a variety of ways depending on the surface texture. A mock-up will reveal exactly what different light sources and directions will do. As with all art work, it is important to use the light to enhance the work and reveal the artist's intent rather than subvert it. Therefore, if the artist is available, a consultation is a good idea.

Some possibilities to consider for the four sculptures include:

- Black Lightning: Surface, ground-mounted ceramic metal halide bullet fixtures located in adjacent planter
- Olympic Iliad: Ground recessed ceramic metal halide uplights near sculpture columns
- Moon Gates: Ground recessed point-source of linear LED accent fixtures. Visitor interaction with the sculpture makes metal halide a less ideal source because of heat.
- Moses: Surface, ground mounted ceramic metal halide bullet fixtures. It might be most effective to light the surrounding landscape elements since the sculpture is painted black and will not reflect light well.

The whale sculpture adjacent to the International Fountain is already illuminated by nearby pole-mounted floodlights. The focus and beam spread of those floodlights is in need of adjustment. It is likely that the current equipment is satisfactory and only requires re-lamping and re-aiming. It is also possible that the addition of another fixture to the pole would improve the appearance of the sculpture. The sculpture could take on a more dramatic appearance with improved focusing. Here, again, a mock-up would be a great help in determining the best design solution.

Enhanced lighting for artworks meets objectives:	
Wayfinding:	*Visible markers provide orientation cues to pedestrians.*
Safety & Security:	*Lighting of large objects enhances people's comfort level after dark.*
Aesthetics:	*Expresses commitment to public art and enhances apearance.*
Environment:	*Use energy effective sources and design techniques to maximize impact.*

Figure 27: Illiad Sculpture.

ENVIRONMENTAL STEWARDSHIP

The goal of achieving and demonstrating environmental stewardship is an important one for a public facility like Seattle Center. However, from a lighting point of view, it is also quite a difficult for a public entertainment venue to practice environmental stewardship because the need for novelty to attract visitors can sometimes conflict with both energy and dark skies goals. To achieve as much as possible, a balance must be struck based on clearly defined priorities.

To limit energy use by lighting while still creating an exciting and complex visual environment, the concept of energy effective design must be used. This method of lighting an environment seeks to use the principles of visual perception to illuminate surfaces and objects that have the greatest impact on the perception of brightness or that create positive contrast for accents that enhance rather than degrade visual acuity. Much of the discussion in the previous sections is informed by this concept. Careful distribution of light with appropriate levels of uniformity allows the designer to use minimum light levels. Good color quality light is also an important ingredient. Vertical surfaces, when they are available, are often the most effective element to light because that is what is most evident to humans eyes as we walk around. However, each individual scene must be evaluated on its own.

Energy efficient light sources are important as well. Because the high color quality of ceramic metal halide provides good visibility at low light levels, it is the best current technology to use outdoors.

"Dark Skies" has become a frequent subject in lighting discussions. It refers to the admirable goal of limiting or even eliminating light spill into the night sky so that future generations will be able to experience the kind of sky views that even now are only available outside urban areas. This is where much of the balancing must be done. The kind of wayfinding principles discussed earlier often conflict with this goal. The need for relatively high levels of vertical illuminance required for facial recognition put the requirement for perceived safety in opposition to limiting light spill above ninety degrees. While energy effective design methods can often be applied to these needs as well, there are still areas and times where uplight is both appropriate and desirable. Using low wattage fixtures and scheduling them off after closing hours can make uplighting a relatively guilt-free lighting application.

FIGURE 32: Satellite image of the United States at night. Small amounts of unnecessary light cast into the night sky add together to create an enormous amount of sky glow.

In general, Seattle Center has been heading in an appropriate direction in regards to installing lighting systems while keeping the environment in mind. Most sources on site are metal halide with a cutoff distribution. The pedestrian pole top fixtures have a small amount of "glowy" element to them that aids in wayfinding, so it is a positive thing in this situation. The most recent lighting additions to the site appear to all be metal halide. Many fixtures on site are non-cutoff style. These fixtures, mainly wall packs, emit much of their light upward into the night sky, rather than down, where the light is needed most. When retrofitting these types of fixtures, care should be taken to use cut off style fixtures and downlights should be considered.

When looking at Seattle Center's long term plans for lighting upgrades and renovations, LED sources should be considered. Presently, the color consistency between LED lamps is not as reliable as other sources and the output in lumens per watt is not yet equal to metal halide. Also, since this technology is very new, the published lamp life of LEDs is under much scrutiny. However, the advances in LED technology over the past five years have advanced exponentially, and their use in architectural lighting design has become widespread. LED technology may become the premier lighting source of the future and keeping current on the issues and advances surrounding this technology will help the Center to make educated lighting choices in the future.

MISCELLANEOUS / MAINTENANCE

Utility fixtures that illuminate non-public entries along pedestrian pathways should be minimized in number and appearance. Overly bright wall-pack type fixtures draw the eye and make everything around them appear darker in comparison. Rather than the visitor being guided toward a pleasant experience and well-illuminated pathways, these fixtures quickly break the mood. Replacement of these fixtures throughout the site will improve the visual experience and may save energy as well. Many of them are high pressure sodium, and most of them are higher wattage then they need to be.

The appropriate fixture for this application is a low wattage metal halide full-cutoff fixture with a flat lens on the bottom and a distribution that pushes the light away from the wall to prevent an overly bright splash of reflected light. A maximum 39 watt ceramic metal halide lamp should be used. There are now 20 watt ceramic metal halide lamps available, and as more fixtures become available for this lamp, it will become the preferred option for this application.

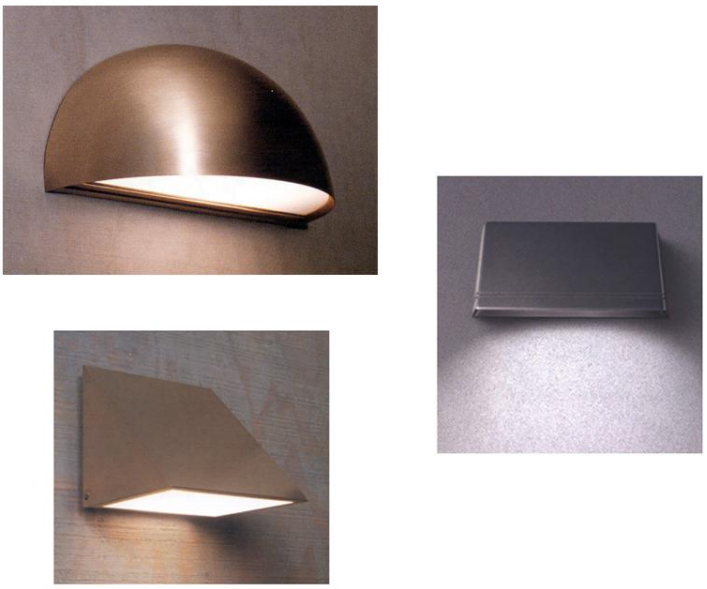

Figure 28: Examples of full-cutoff style wall pack fixtures.