Technical Report 1:

Lighting Existing Conditions and Design Criteria Report

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Towson Center Arena Addition

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Large Work Space: Press Room

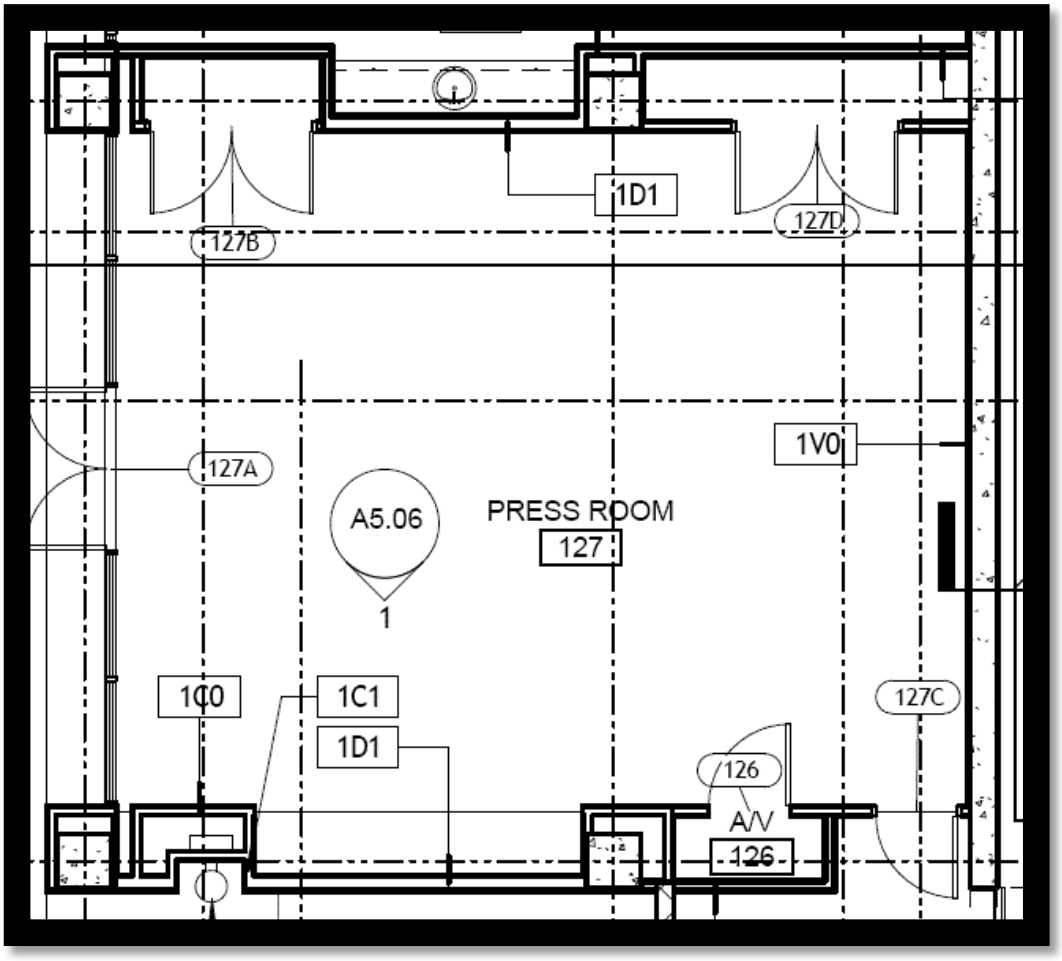

Figure 1.1

The large workspace will be the press room. Please see Figure 1.1 above. This will be designed to feel private. The press room is located on the first floor, adjacent to the court. It will be used to hold conferences after a game so that the media can receive feedback on the previous event from the players and coaching staff. It is room 127 on A1.03. The dimensions are 25' x 32' so the room is in a rectangular shape. The ceiling is a 10 feet high acoustical tile system, the walls are gypsum wall board painted satin silver and the floor will be painted a sunshine color. A podium or table will be placed at one end of the room. Chairs will be placed in rows for reporters to see. Artwork will be placed on the walls of the space. The space will be used for the press to take notes via electronic devices or paper. There needs to be enough light to record what is said, and there must be enough light on the speaker for television to broadcast the event. There is no daylight contribution in the press room.

Existing Lighting Systems

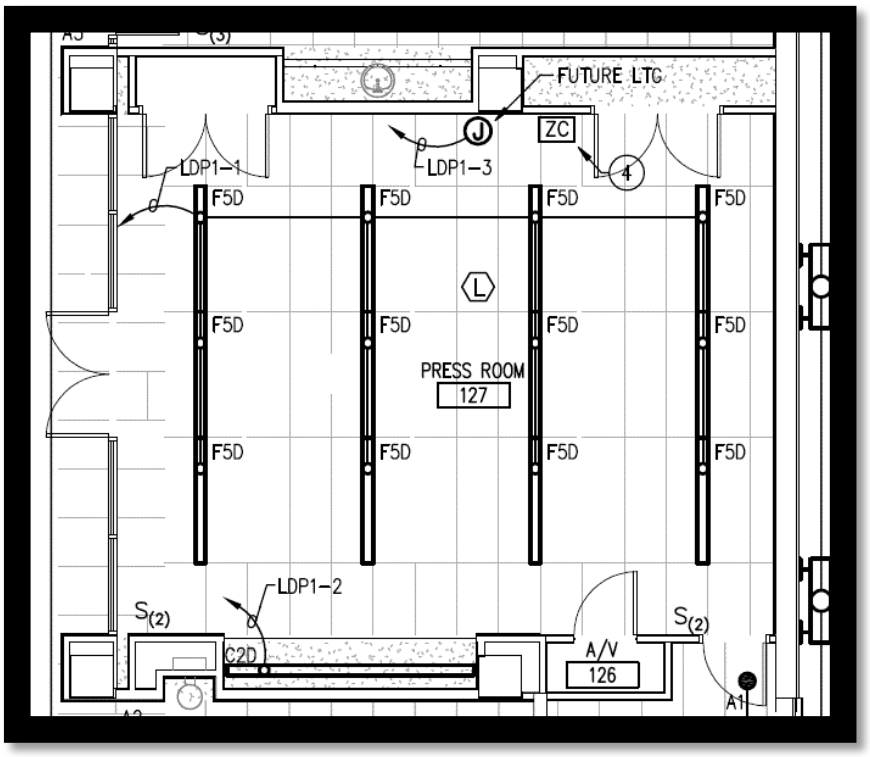

Figure 1.2

The space is illuminated by luminaire types F5D and C2D. Please see Figure 1.2 above. Fixture F5D is a 6 foot linear, surface mounted fluorescent with a 1% dimming ballast. There are two 21 Watt T5 lamps of 80 CRI and 4100 Kelvin. Fixture C2D is a linear LED cove accent lighting with adjustable mounting bracket and a dimmable driver. The LEDs are 2700 Kelvin.

Space Lighting Design Theme

The theme of the lighting design is to have spaces conducive to social interaction and communication. In the press room one or a few people will be speaking to a room full of reporters and television crews. The goal of the space is to make the speakers feel comfortable answering questions. A private ambiance will help the speakers easily communicate to the reporters. Even though a million viewers may be watching, the person being questioned should feel as if the conversation is more personal.

Psychological Impression Space

Going along with the theme of encouraging social interaction and communication, the press room will have a private feel. By making a space, where millions of viewers may be watching at one time, feel private, the speaker will be more willing to share their thoughts and reflections.

Press rooms need high levels of light on the speaker for the television cameras. This will make the speaker feel like they are the center of attention. Fortunately this has become institutionalized and it is expected and understood. To help create a safe environment to speak in front of the cameras, lower light levels will be on the reporters. Around the periphery of the room there will be bright accent lighting contrasting at least 10:1 to the ambient light. This will help take some of the focus off of the speaker and to the artwork around the room. In turn this will allow the speaker to feel more comfortable in the space due to a private feel.

Space Lighting Design Criteria

Default illuminance ratio recommendations are as follows:

Maintain Visibility	**Max E Ratio**
Task Proper: avg to minimum across task margin	1.5:1
Task Area: avg to minimum across task area	1.5:1
Maintain Concentration	
Task Margin: avg to minimum across task margin	2:1
Task proper to task margin: avg to avg between task proper & task margin	1.5:1
Entire work space areas: max@ task proper/area to min of space	5:1

The space may be classified as a conference space. The guidelines are as follows:

Meeting: Discourse		
Eh @ 2'-6"	Eh = 300 lux	Task Area
Ev @ 4' AFF	Ev = 75 lux	Task Area

Presenter: Fixed Position		**Avg:Min**
Face: Ev @ 5' AFF	Avg ≥ 1 times but ≤ 3 times audience task Eh	3:1
Task Surface: Eh @ 3'-6" AFF	Avg ≥ 1 times but ≤ 3 times audience task Eh	2:1

Video Conferencing		
Faces	Eh @ 4' AFF	Ev @ 3'-5" AFF in direction of cameras
Eh = 300 lux	Ev = 400 lux	Avg:Min = 1.5:1
Walls	Ev @ 2'-6" – 6'-6" AFF	Avg:Min = 1.5:1
40% matte reflectance: 400 lux	50%: 300 lux	60%: 200 lux

Handwritten Work: white or canary paper			
Pencil, Graphite:	Eh @ 2'-6" AFF	Ev @ 4' AFF	Medium veiling reflection
	Eh: 300 lux	Ev: 75 lux	
Ballpoint Pen:	Eh @ 2'-6" AFF	Ev @ 4' AFF	Small veiling reflection
	Eh: 300 lux	Ev: 75 lux	

Reading & Writing: VDT Screen & Keyboard		
CSA/ISO Types I & II	Matte or Semi-specular Finish	Positive polarity
Eh @ 2'-6" AFF	Ev @ 3'-6" AFF	Small veiling reflection
Eh: 300 lux	Ev: 150 lux	
CSA/ISO Type III	Specular Finish	Positive polarity
Eh @ 2'-6" AFF	Ev @ 3'-6" AFF	Medium veiling reflection
Eh: 150 lux	Ev: 50 lux	

The main points of interest in the Press Room are the speaking area and the reporter area. The reporter area will consist of chairs with possible retractable desks, and the speaking area will consist of a podium or desk with adjacent seats.

Power Allowances

By Table 9.5.1, using the building area method to calculate lighting power densities allows 0.78 W/ft^2 for a sports arena.

By Table 9.6.1, using the space-by-space method allows 1.23 W/ft^2 for Conference/Meeting/Multipurpose.

Existing Lighting System Critique

The space is 25' x 32' so it is 800 ft^2(73.5 m^2). The two fixtures are a linear fluorescent source and an LED source. Type F5D uses two 21 Watt T5 lamps, and the LEDs are a strip of LEDs. The T5 linear fluorescent has initial lumens of 2100. Light loss factor of 0.7 is calculated with a 0.9 Ballast Factor, a 0.9 LLD and 0.9 LDD. Space reflectances are assumed to be standard 0.8, 0.5, and 0.2 for ceiling, walls, and floor respectively.

The calculated values are as follows:

Illuminance (lux)	Avg	Max	Min	Avg/Min	CV
Horz	297.0	493.3	71.9	4.1	4.4
Vert 4	128.3	229.8	39.2	3.3	4.6
Vert 5	133.0	252.6	37.0	3.6	5.0

The design values are as follows:

Illuminance (lux)	Avg	Max	Min	Avg/Min	CV
Horz	300			1.5:1	
Vert 4	75			1.5:1	
Vert 5	300 ≤ Avg ≤ 900			3:1	

The calculated average from the model is slightly less than what is recommended for horizontal illuminance. This could be a result of not adding in the LED accent light along the southern wall. With the addition of the LED accent light, more of the room would have higher lux values, but the avg/min ratio will be altered as well. Adding more light will increase the max and average, but the calculated ratio of 4.1 is already the recommended value of 1.5:1. The average vertical illuminance calculated in the model is acceptable for 4' AFF, but the 5' vertical illuminance for presenters is well under. Again, having a photometric file for the LED accent luminaire would help with analyzing a more accurate calculation. Each ratio of Avg/Min exceeds the recommended values. This means there are areas of excessive darkness that keeps the room from being uniformly illuminated. Please see Figure 1.3 below for identification of hotspot areas.

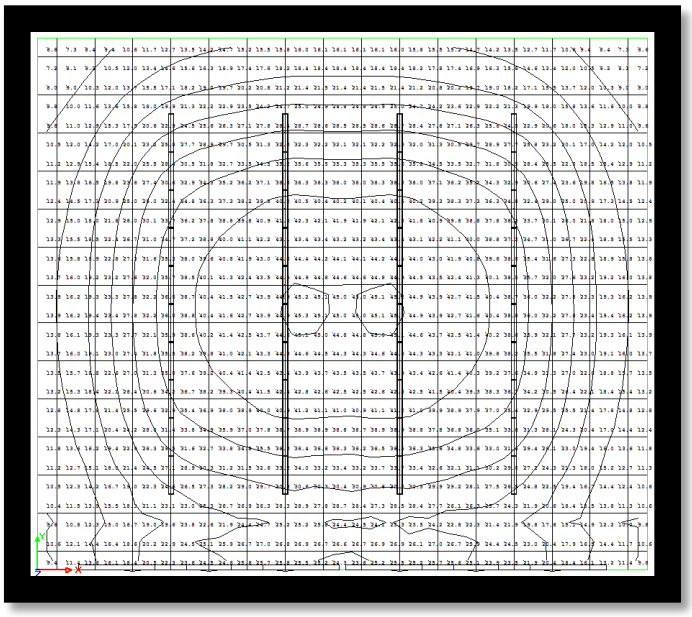

Figure 1.3

The space will need adequate accent on the speakers during conferences. Video conferencing may require up to 400 lux on vertical surfaces. Without having specification data on the LED fixture it is difficult to scrutinize the system. The space will be used by speakers and reporters/camera crews. The average illuminance is adequate, but more accent lighting may be needed on the speakers, especially for television. Also, the space is a simple rectangle, so a uniform layout is an easy solution to the space.

Special Purpose Space: Court

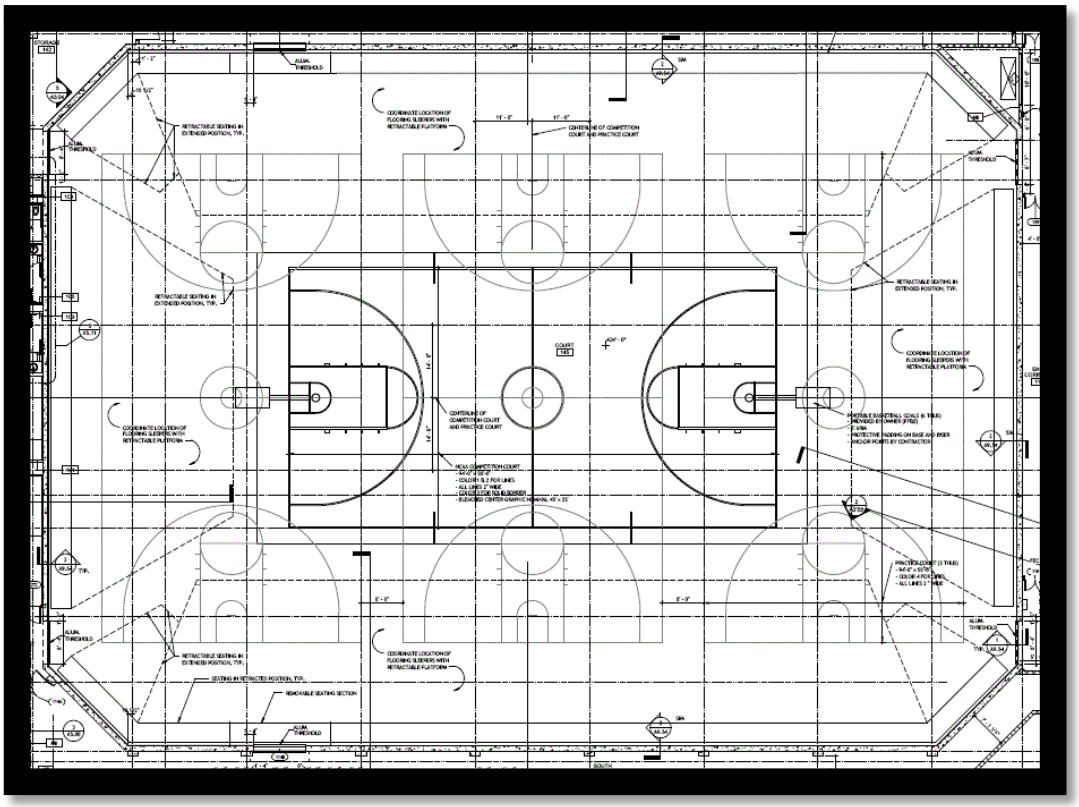

Figure 2.1

The Special Purpose Space will be the court. The basketball and volleyball games will be played in this space. The players will need to be able to see the ball and the other players on the court. Seating is also adjacent to the court, and retractable benches will cover some of this space as well. Light will be needed so the viewers can see the game and navigate the seating. Scorers will need light to record information and update the scoreboard. Daylight will be available in this space. A clerestory is on the top level of the arena, and it will draw in light during daytime activities. The glass is low-e-coated, clear insulating with an overall thickness of 1 inch. The interspace content is air, the visible light transmittance is 74 percent minimum, the U-Value is .35 maximum and the SHGC is .4 maximum. It is room 145 on drawing A1.03 of the first floor. The space is 188’ x 136’, and it extends three floors. The first floor has retractable bleachers. Concourses on the second floor open to the court area, and the third floor has arena seating and suites. The truss level has a series of catwalks above the court. The floor is a hardened rubber material beneath grade 2 maple that complies with floorscore standards. The ceiling is a structural truss system with a clerestory, and there are two tiers of seating along the edge of the space.

Existing Lighting Systems

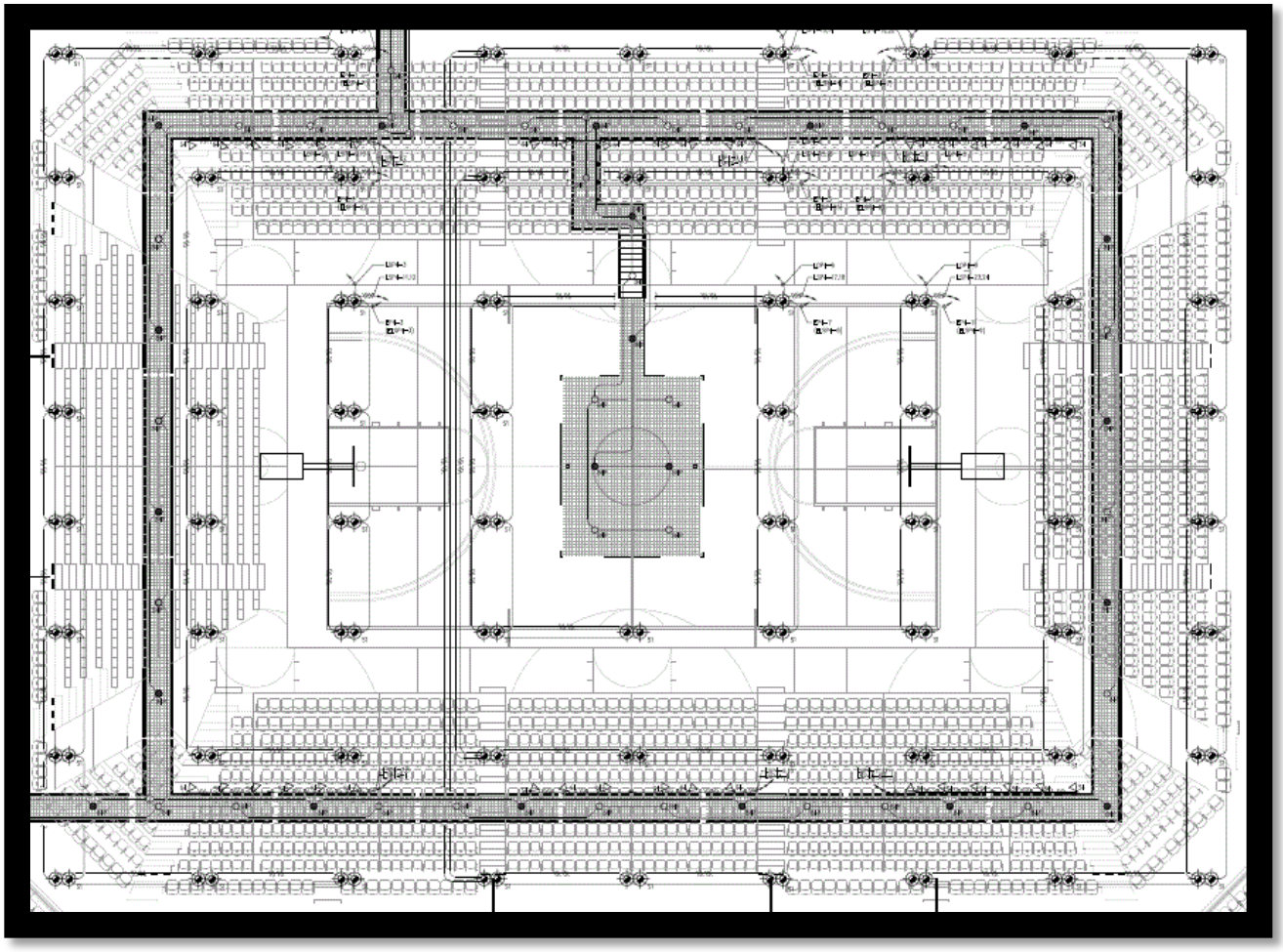

Figure 2.2

The space is illuminated by luminaire types H3, S1, S4. See Figure 2.2 above. Fixture H3 is a four foot gasketed fluorescent fiberglass, high impact acrylic, rated for wet location, and they are located behind the first floor bleachers. There are two 28 Watt T5 lamps with 80 CRI and 4100 Kelvin. Fixture S1 is a four circuit CFL high-bay with three 2-lamp switching ballasts and one 2-lamp 1% dimming ballast, twin-fixture cluster mounting bracket. There are six 42 Watt CFLs at 80 CRI and 4100 Kelvin. Also, there are two 42 Watt CFLs at 80 CRI and 3000 Kelvin. Fixture S4 is a broadcast sports lighting system with motorized shutters, catwalk mounting brackets and safety cables. The lamp is a 1000 Watt metal halide.

Space Lighting Design Theme

Going along with the central theme of social interaction and communication, the court should have an environment so the players and viewers can communicate easily. High light levels are needed for the court, 100 fc. This will spill into the arena seating. Also, lights are needed to light seating areas for egress of aisles. Vertical light levels are important so that the face of someone can be seen. This will aid in the communication of the space if the viewers can see each other easily. The light needed for the court and seating areas will create an environment conducive to conversation.

Space Lighting Design Criteria

The Court area will be used primarily for basketball, and it will be designed for such. Basketball can be categorized as a multi-directional aerial sport due to the fact that games are played in both directions and the ball is in the air for part of the game.

"Higher illuminance values allow the use of high speed shutters and small aperatures that increase image sharpness and depth of field"(DiLaura 35,3). Stop action, slow motion and special effects are aided by more light applied to the area. HDTV can be particularly affected by the lamp's stroboscopic effect in low frequency ballasts in HID lighting systems. "This can be minimized by ensuring the illumination is provided by multiples of three luminaires, with overlapping beams which are balanced across three electrical phases"(Dilaura 35.3).

The arena will have a maximum capacity of 5000 seats. For a college facility, the class of play is II due to the fact that the spectators will never be greater than 5000.

Basketball: Class II	**Observers age 25-65**	**Eh @ 3'**	
Eh: 750 lux	Ev: 200 lux	CVmax: .21	Max:Min: 2.5:1

Horizontal illuminance is calculated 3' above the competition surface while vertical illuminance matters over the entire height of the playing area. I made four vertical calculation grids at 3', 8', 13' and 18'. The 3' grid is angled west, the 8' grid is angled south, the 13' grid is angled east and the 18' grid is angled north. This should cover the range of heights the basketball will be located during a game.

Color temperature is an issue for the space due to windows, clerestories and television cameras. A color temperature range of 3000 K to 6000 K can be balanced for television. Lamps with a color temperature closer to that of daylight will minimize issues. The desired CRI is at least 65.

Power Allowances

By Table 9.5.1, using the building area method to calculate lighting power densities allows 0.78 W/ft^2 for a sports arena.

By Table 9.6.1, using the space-by-space method allows for 0.43 W/ft^2 for audience seating and 1.92 W/ft^2 for Class 2 sports. The facility is a class 2 because it is a college facility with a capacity of 5000 seats.

Existing Lighting System Critique

One of the flaws of this system is in the S4 fixture. It is almost impossible to find photometric information for a 1000W metal halide, sports accent light. This makes it very hard to comprehend the amount of light hitting the surfaces of the arena seating areas.

Space reflectances are assumed to be standard 0.8, 0.5, and 0.2 for ceiling, walls, and floor respectively. Light loss factor of 0.7 is calculated with a 0.9 Ballast Factor, a 0.9 LLD and 0.9 LDD.

The recommended illuminance values are:

Basketball: Class II	**Observers age 25-65**	**Eh @ 3'**	
Eh: 750 lux	Ev: 200 lux	Max:Min: 2.5:1	CVmax: .21

The calculated illuminance values are:

Calculated	**(lux)**				
	Avg	Max	Min	Max/Min	CV
Horz 3'	1499	2069	893	2.31	0.17
Vert 3'	593.1	718.7	267.9	2.7	0.19
Vert 8'	591.5	810.2	277.7	2.9	0.17
Vert13'	629.2	1053.1	302.7	3.5	0.23
Vert 18'	608.3	938.7	278.8	3.4	0.22

The horizontal illluminance values from the model more than compensate for the average illuminance needed for the court. It is acceptable to exceed the recommended as higher illuminance values benefit television cameras. The ratio of Max/Min, 2.31:1 was within the recommended value of 2.5:1. The hot spots are distributed evenly throughout the space to meet the coefficient of variance. The calculated value of 0.17 is below the recommended value of 0.21 for CV.

There is also ample vertical illumination at the different heights on the court. The guideline is 200 lux and each height exceeds this requirement. This will give the light needed for slow motion, stop action and other special effects used for television. See Figure 2.3 below for a distribution of hotspots from the simulated, computer model.

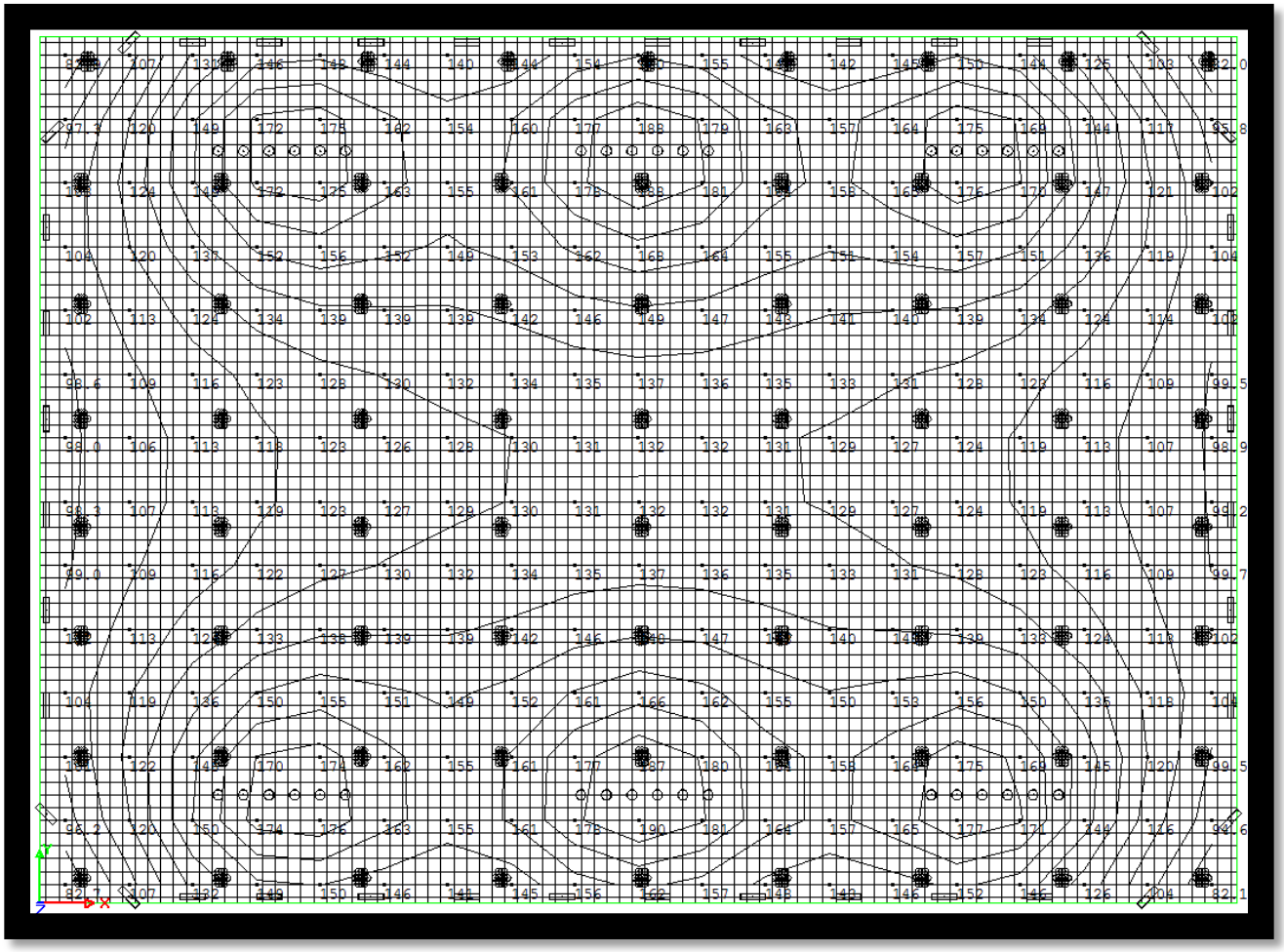

Figure 2.3

The lamp CCTs range from 3000 to 4100. Some of the CFLs are 3000 Kelvin for a warmer feel, however the 4100 Kelvin CFLs will be used with games with the linear fluorescent and metal halide lamps.

Circulation Space: First Floor Reception

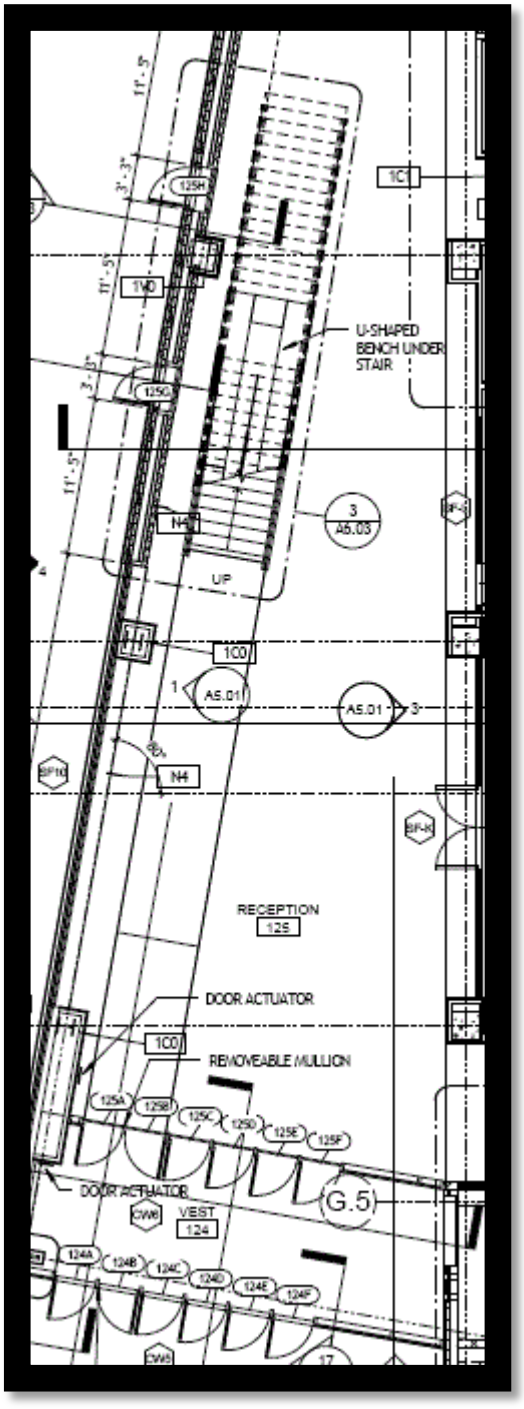

Figure 3.1

The circulation space will be the first floor reception area. This is an entrance to the building and is a two story atrium with a stairwell that leads to the second floor concourse area. This welcomes VIP players and viewers to the arena. It is a place for people to meet and a transition point into the busier areas. The tasks in this space will primarily be social, so people will need to be able to view each other. There may also be sports memorabilia around the walls and periphery. There are many windows and doors that allow access to this space on the first floor. This will allow daylight to be a factor in the lighting design of the space. The glass is low-e-coated, clear insulating with an overall thickness of 1 inch. The interspace content is air, the visible light transmittance is 74 percent minimum, the U-Value is .35 maximum and the SHGC is .4 maximum. The reception is room 125 on drawing A1.03. The dimensions are 80' x about 16', and the space extends upward two floors. A stairwell hugs a fully glazed wall along the western side of the building. Underneath of the stairwell there is a twelve foot long U-shaped bench. The space is in the shape of a triangle and the widest point is about 30'. The floor is porcelain floor tile of a nickel color, the walls are gypsum wallboard painted silver satin and graphite and the ceiling is acoustical ceiling tile. This space will have three different design solutions.

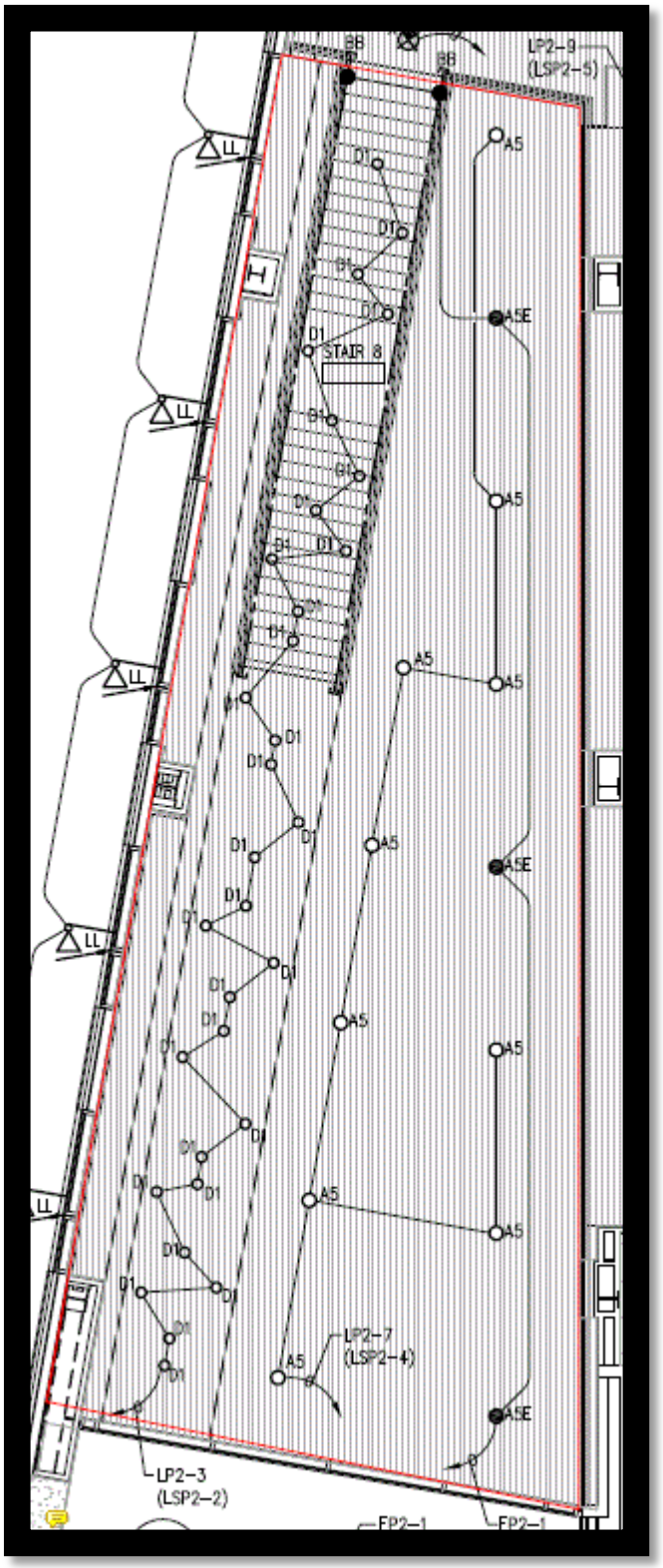

Figure 3.2

Existing Lighting Systems

The space is illuminated by luminaire types A5, D1 and BB. Fixture A5 is a 7" recessed downlight with medium base par lamp, open specular clear alzac cone and steel housing. The lamp is a ceramic metal halide 70 Watt par30 flood. Fixture D1 is a 4-3/4" diameter by various heights LED architectural pendant with remote drivers, processor, manual controls and timeclock. The LEDs are RGB color-changing. Fixture BB is an LED handrail with LEDs at 4100 Kelvin.

Space Lighting Design Theme

The reception area will be conducive to social interaction and communication. It is a meeting and transition space. Vertical illuminance will allow the users to see other people and engage in conversation. It is a two story atrium with full glazing on one side and a staircase in the middle of the glazed wall. The space will feel dynamic and as if everyone will be or will need to be moving. Accent lighting on artwork around the periphery will help take the focus off of the people using the space. This way the users may freely interact with each other and not feel as if they are the center of attention.

Space Lighting Design Criteria

The primary considerations for building entries, from IES, include the following:

Degree to which entries are covered from the elements
Proximity of vehicular traffic to pedestrian traffic
Anticipated nighttime activity levels
Nighttime outdoor lighting zone for the project under consideration
Security

Building Entries: Vestibules – Medium Activity					Avg:Min
Day	Eh @ floor	Ev @ 5' AFF	Eh: 100 lux	Ev: 50 lux	2:1
Night	Eh @ floor	Ev @ 5' AFF	Eh: 50 lux	Ev: 30	2:1

Lobbies that are in close proximity to building entry should assist with transition from exterior to interior and vice versa.

Transition Spaces: Lobbies – At building Entries					Avg:Min
Day	Eh @floor	Ev @5' AFF	Eh: 100 lux	Ev: 30 lux	4:1
Night	Eh @floor	Ev @5' AFF	Eh: 50 lux	Ev: 20 lux	4:1

Transition Spaces: Stairs					Avg:Min
Typical	Eh @floor	Ev @5' AFF	Eh: 50 lux	Ev: 30 lux	2:1

Medium activity is moderate pedestrian traffic with occasional occurrences of swells of activity. Lamp type and color qualities should also be consistent with adjacent spaces to transition space.

The main point of interest in the first floor reception is the stairwell to the second floor. A freestanding column along the curtain wall of glass pulls the viewers' eyes to the left as they enter the space. Their attention will follow the line of the stairs to the second floor.

Power Allowances

By Table 9.5.1, using the building area method to calculate lighting power densities allows 0.78 W/ft^2 for a sports arena.

By Table 9.6.1, using the space-by-space method designates an allowance of 0.90 W/ft^2. An atrium allows for 0.03 W/ft^2 per foot of height for the first 40 feet of height.

Existing Lighting System Critique

It can be difficult to critically analyze the lighting design of a space without a correct computer model. This difficulty is compounded by the uncertainty of lumen output by LED sources. However, assessments and educated inferences may still be made.

The CMH 70w par30 gives off 4700 lumens initially. There are 13 A5 fixutes, so that is roughly 61,100 lumens before LLF. After LLF are applied the lumen output total for all 13 fixtures is roughly 44,500 lumens. The total area is around 524 square meters so the lux in the space is about 85 lux. This value does not include the LED downlights as the lumen output is not precisely known. During the day the required horizontal illuminance may not be met. On a sunny day, there should be enough daylight entering the space in the morning and until about noon. In the afternoon, the space will be in shadow, so there may not be enough horizontal illuminance. Cloudy days may not provide the amount of light needed for the recommended 100 lux during the day. However, on a clear of cloudy night, the 85 lux horizontal value will more than cover the guideline of 50 lux. It is very difficult to predict or calculate the vertical illuminance or Avg:Min ratio.

The space is a two story atrium and a majority of the users will make their way through the space and ascend the stairwell. The existing lighting design has a cluster of LED downlights that follow the path of the entrance to the stairwell. This cluster of brighter light will draw the user to the stairwell. The rest of the space has CMH par30 fixtures that are evenly spaced as to not draw much attention. A LED handrail runs along each side of the stairwell to draw the users' attentions. The illuminated handrail also helps to connect the second and first floor atrium.

Space reflectances are assumed to be standard 0.8, 0.5, and 0.2 for ceiling, walls, and floor respectively. Light loss factor of 0.7 is calculated with a 0.9 Ballast Factor, a 0.9 LLD and 0.9 LDD.

Outdoor Space: Northeast Entrance

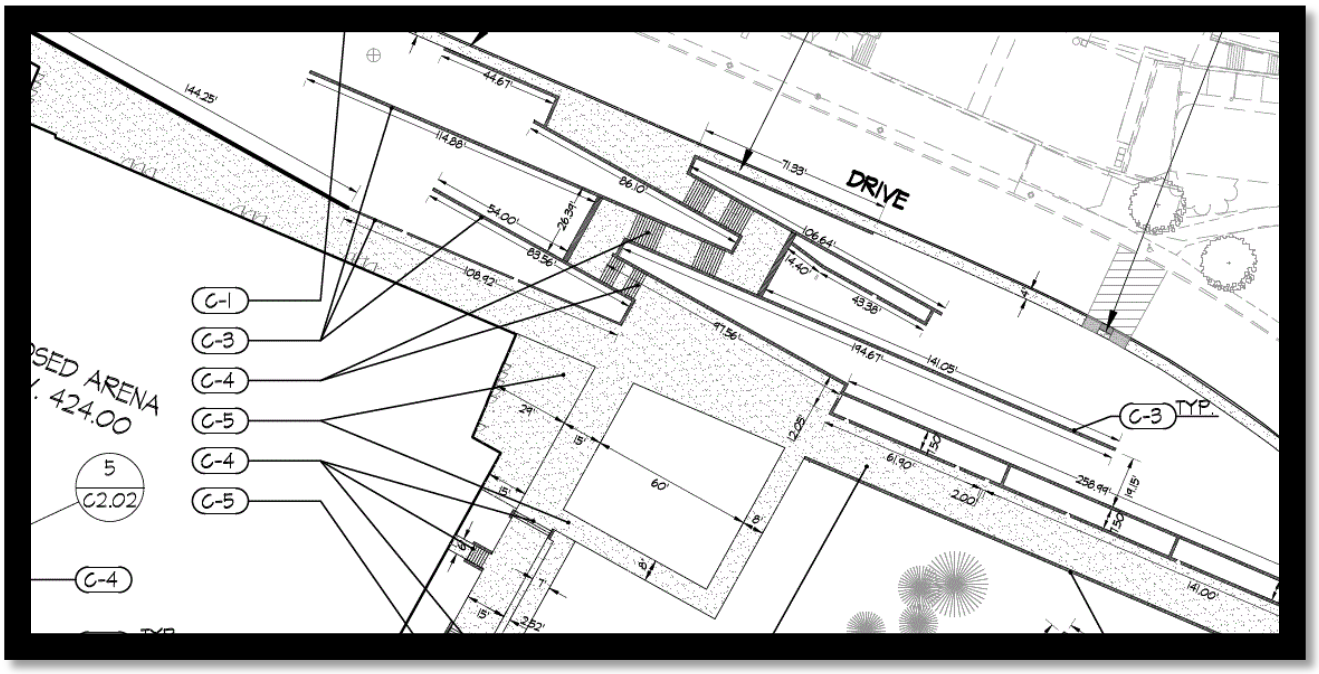

Figure 4.1

The outdoor space will be the northeast entrance to the tiger arena. Most of the attendees will enter and pass through this space. There is a large glass façade and overhang at the corner and all along the northern side of the building. A grassy lawn and system of stairs and ramps is also in this space. The steps wind down in a "Z" shape. People may use this space to meet or just as a transition space into the building. After events many people will need to exit the building at once and enough light needs to allow people to see as they exit the grounds. This space can be viewed on drawing C2.01. The dimensions are approximately 180' x 180' with a branch on the northern side of the building that is about 200' x 20'. The walkways and plaza are concrete. No exterior seating or benches exist, only walkways. The façade is metal paneling and glazing. This space will be a social space and a way to egress away from the building. The walkways need to be visible and other people need to be visible for the users of the space.

Existing Lighting Systems

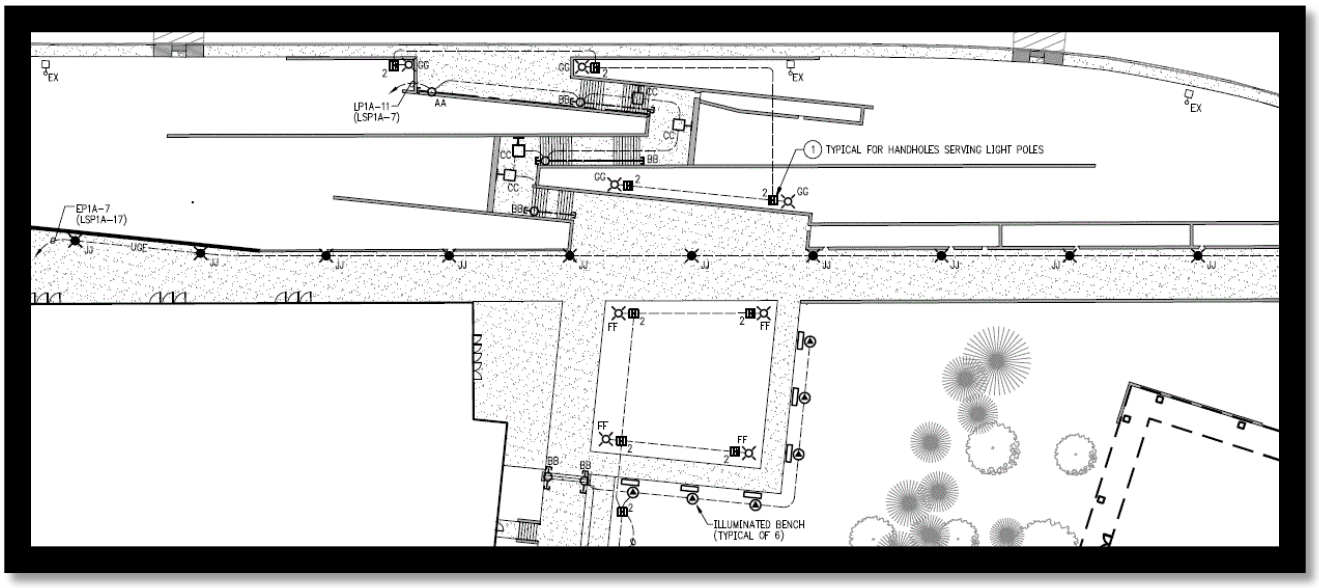

Figure 4.2

The space is illuminated by luminaire types JJ, BB, GG, FF, AA and CC. Fixture JJ is a 13' promenade post light with indirect light source behind tempered glass and specular reflector, type V distribution, included tapered pole with handhole. The lamp is a 150 Watt pulse start metal halide. Fixture BB is an LED handrail with LEDs at 4100 Kelvin. Fixture FF is a post top metal halide site fixture with a vertical lamp and type V distribution on a 12' pole. Fixture AA is a linear LED wall grazer with a wet location listing, and the LEDs are 4000K. Fixture GG is a post top metal halide site fixture, vertical lamp, Type V distribution on an 18' pole. The lamp is a 150 Watt metal halide at 277V. Fixture CC is a square recessed compact fluorescent in-wall steplight with concrete pour housing and cast aluminum body. The lamp is a 32 Watt triple biax CFL at 80 CRI and 4100 Kelvin.

Space Lighting Design Theme

During the day the exterior of the building will be well illuminated so as to foster social interaction and communication. At night, the space will be much different. While exterior lighting is required for egress purposes, this does not always accommodate communication. Vertical illuminance is essential for people to feel safe. Seeing someone's face registers a feeling of safety, and if that face is familiar then it is easier to communicate as well. Power density for the exterior of the building will be monitored stringently, but pole mounted lights can help spread light and illuminate users. The exterior space should be a place for people to discuss the preceding events and enjoy the plaza and building. Light levels that allow communication will encourage people to use the space.

Space Lighting Design Criteria

The main point of interest at the northeast entrance is the glass façade that encases the building underneath an L-shaped overhang. The users will need to see this part of the building and be able to decide that this is the entrance into the arena. The exterior walkway, plaza and stairs are transition spaces to and from the arena. The busiest time of use will be immediately following a sporting event in the arena. This is when all of the spectators will be leaving. Before the event there will be a steady stream of pedestrians, but a swell will occur at the end.

Other points of particular interest will be the stairs and plaza area. The stairs will need a certain level of light for egress and the plaza is a gathering point outside the arena. The stairs will lead up to the plaza where the viewer can see an encompassing view of the northeast entrance.

Other considerations include foliage in the vicinity of the luminaires. If not properly cared for, light may be shielded from walkway surfaces. BUG rating is also important when trying to control light spill from luminaires.

The following are design guidelines from the IESNA handbook:

Table 22.2 Common Applications Illuminance Recommendations

Building Entries: Canopied Entries – High Activity					Max:Avg	Avg:Min
LZ4	Eh @grade	Ev @5' AFG	Eh: 40 lux	Ev: 20 lux	4:1	Eh 2:1 Ev 4:1
LZ3	Eh @grade	Ev @5' AFG	Eh: 30 lux	Ev: 15 lux	4:1	Eh 2:1 Ev 4:1

Table 22.2 Common Applications Illuminance Recommendations

Building Entries: Non-Covered Entry – Paths to Curb – High Activity					Max:Avg
LZ4	Eh @grade	Ev @5’ AFG	Eh: 15 lux	Ev: 8 lux	3:1
LZ3	Eh @grade	Ev @5’ AFG	Eh: 10 lux	Ev: 6 lux	3:1

The walkway underneath the overhang will have periods when pedestrian traffic will swell, and the users will be adapted to LZ4, high ambient light levels, from the arena. The primary considerations for building entries, from IES, include the following:

Degree to which entries are covered from the elements
Proximity of vehicular traffic to pedestrian traffic
Anticipated nighttime activity levels
Nighttime outdoor lighting zone for the project under consideration
Security

Suggested guidelines for exterior lighting include:

Establish and confirm the need for light
Carefully define areas of application and the application itself
Establish the lowest illuminance criteria appropriate to the need
Independently address unique areas of interest
Design lighting layouts to address only those areas of interest
Select equipment with distribution and optical control to address criteria
Use controls to energize, dim and extinguish lighting to address activity levels

Table 34.2 Retail Illuminance Recommendations

Centers, Outdoor: Plazas – High Activity					Max:Avg	Avg:Min
LZ4	Eh @pavement	Ev @5’ AFG 2-dir	Eh: 8 lux	Ev: 4 lux	4:1	5:1
LZ3	Eh @pavement	Ev @5’ AFG 2-dir	Eh: 6 lux	Ev: 2 lux	4:1	5:1

The vertical illuminance is measured in two directions and should be coordinated with security cameras.

Table 34.2 Retail Illuminance Recommendations

Centers, Outdoor: Ramps, Stairs and Steps – High Activity					Max:Avg	Avg:Min
LZ4	Eh @treads	Ev @5’ AFG 2-dir	Eh: 10 lux	Ev: 6 lux	4:1	5:1
LZ3	Eh @treads	Ev @5’ AFG 2-dir	Eh: 8 lux	Ev: 4 lux	4:1	5:1

Horizontal illuminance is measured at the tread or landing. The vertical illuminance is measured in two directions and should be coordinated with security cameras. Lighting should also draw attention to the change of elevation with contrasting light levels.

Power Allowances

From ASHRAE 90.1, Table 9.4.3A Exterior Lighting Zones, the lighting zone for the northeast entrance will be categorized as Lighting Zone 3. The base site allowance for Zone 3 is 750 W. Tradable surfaces include building grounds, building entrances and exits, and canopies and overhangs.

Table 9.4.3B Individual Lighting Power Allowances for Building Exteriors	
Building Grounds	
Walkways less than 10 ft wide	0.8 W/linear foot
Walkways 10 ft wide or greater/Plaza areas	0.16 W/ft^2[21]
Stairways	1.0 W/ft^2
Landscaping	0.05 W/ft^2
Building entrances and exits	
Main entries	30 W/linear foot of door width
Other doors	20 W/linear foot of door width
Entry canopies	0.4 W/ft^2

Nontradable Surfaces include building facades and are in addition to the tradable surfaces already addressed in the previous table. The allowance for building facades is 0.15 W/ft^2 for each illuminated wall or surface or 3.75 W/linear foot for each illuminated wall or surface length, for Zone 3.

By Table 9.5.1, using the building area method to calculate lighting power densities allows 0.78 W/ft^2 for a sports arena.

Existing Lighting System Critique

It is difficult to understand the horizontal and vertical illumiance values for an exterior space without a computer model. Within the confines of walls, it is easy to estimate the horizontal illuminance, but with a wide open area it is hard to determine where the light will reach.

A “Z” shaped step system is illuminated by LED handrails, recessed CFLs and 18’ metal halide pole lights. The illuminated handrails pull the users through the space by giving their eyes a path to follow as they traverse the space. From the parking roadway an LED wall grazer invites the user to the main site stair.

The main walkway has a colonnade of 13’ pole metal halide lights. They line the walkway and lead right to the entrance of the arena. They lights pull the users through the space. There are also 12’ metal halide pole lights that illuminate a green plaza area. This aids as a transition area from the exterior of the building into the main entrance of the arena. The brightly illuminated façade will also draw the users through the space once they get a glimpse of the arena.

Space reflectances are assumed to be standard 0.8, 0.5, and 0.2 for ceiling, walls, and floor respectively. Light loss factor of 0.7 is calculated with a 0.9 Ballast Factor, a 0.9 LLD and 0.9 LDD.

Work Cited

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