

Lighting Existing Conditions and Design Criteria

AE 481W

Tech Report 1 Part 2

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Computer files are located at Y:\Lange_Thesis\Tech_Report_1_Part_2

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Executive summary

This technical report is on the existing lighting conditions for four of the spaces at the County Courthouse. Each of the spaces is unique in the type of tasks that it is designed to accommodate. The spaces analyzed are as follows:

Large Workspace: Open Office 2520

Special Purpose Space: Ceremonial Courtroom 4100

Circulation Space: Main Lobby 1000

Outdoor Space: Main Plaza

For each of the spaces the room layout, finish materials, and furniture were documented and analyzed with respect to their effect on the lighting. The existing lighting layout, lighting fixtures, and lighting control systems were also documented and analyzed. Appropriate lighting design criteria were established for each of the spaces based on documents including ASHRAE 90.1 2013 and The Lighting Handbook 10th Edition. Final, the existing lighting system was briefly analyzed based on these criteria.

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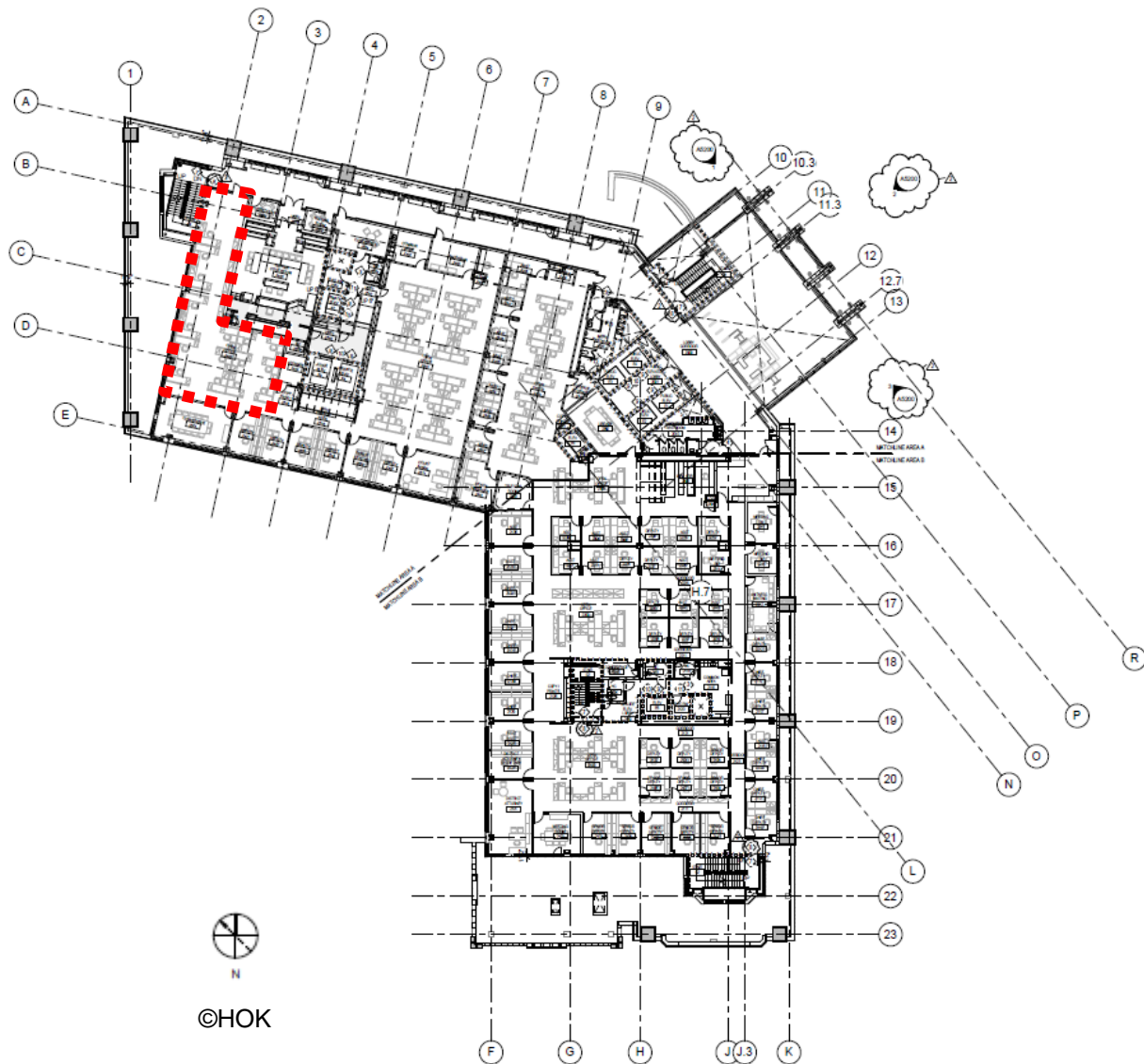
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1. Large Work Space – Open Office 2520

1.1 Existing Conditions

For the large work space Open Office 2520 was selected. Open Office 2520 is a 1600 SF “L” shaped open office located in the southwest corner of the building. This office has significant exterior exposure on the northwest side.

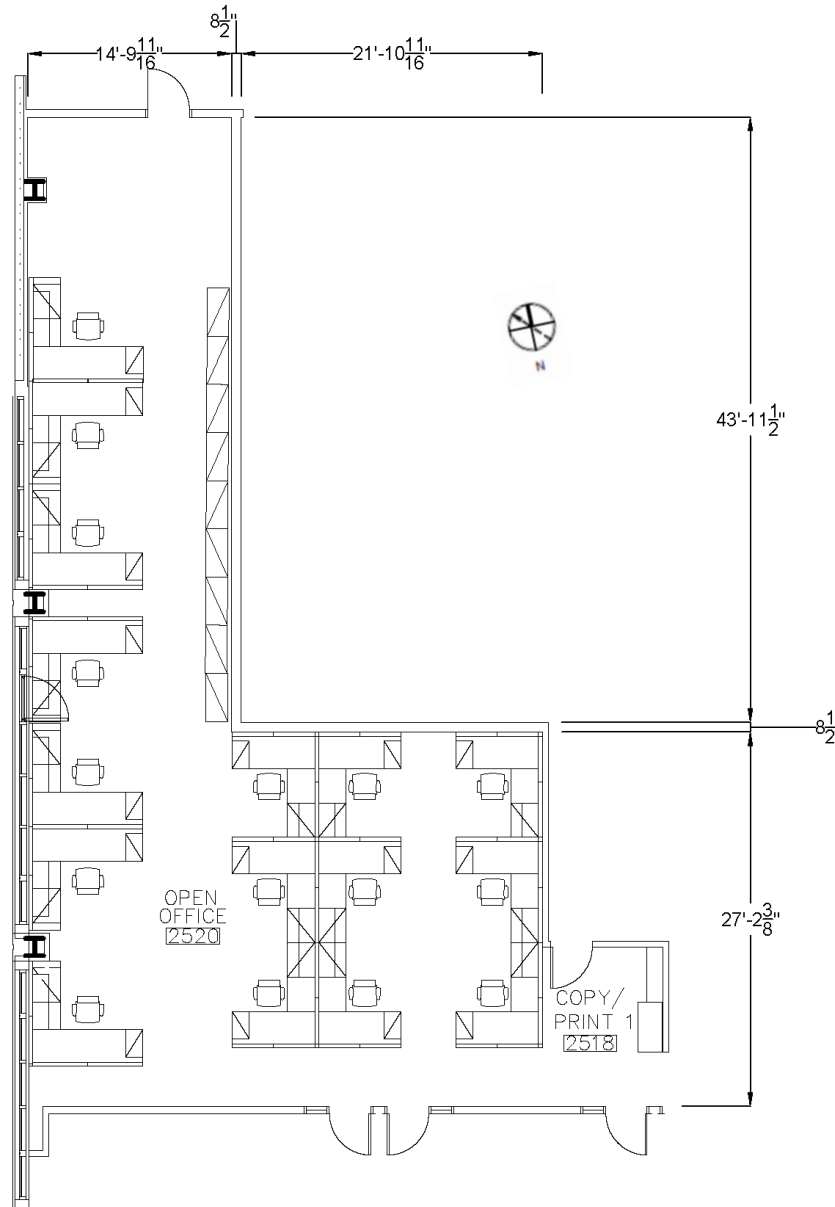
Figure 1 - Open Office 2520 Location



1.1.1 Dimensions and Layout

Open Office 2520 is a typical open office with individual workstations separated by half height (5'-0") desk integrated partitions. Several of the work stations are open to their neighbor on one side so there are slightly fewer partitions than other arrangements would have. Figure 2 below shows the dimensions of the space and the layout of the furniture.

Figure 2 - Open Office 2520 Layout and Dimensions



1.1.2 Materials

Figure 3 and Table 1 below show the finish materials for Open Office 2520. Figure 4 and Table 2 on the next page show the window sizes and glazing types.

Figure 3 – Open Office 2520 RCP and Finish Plan

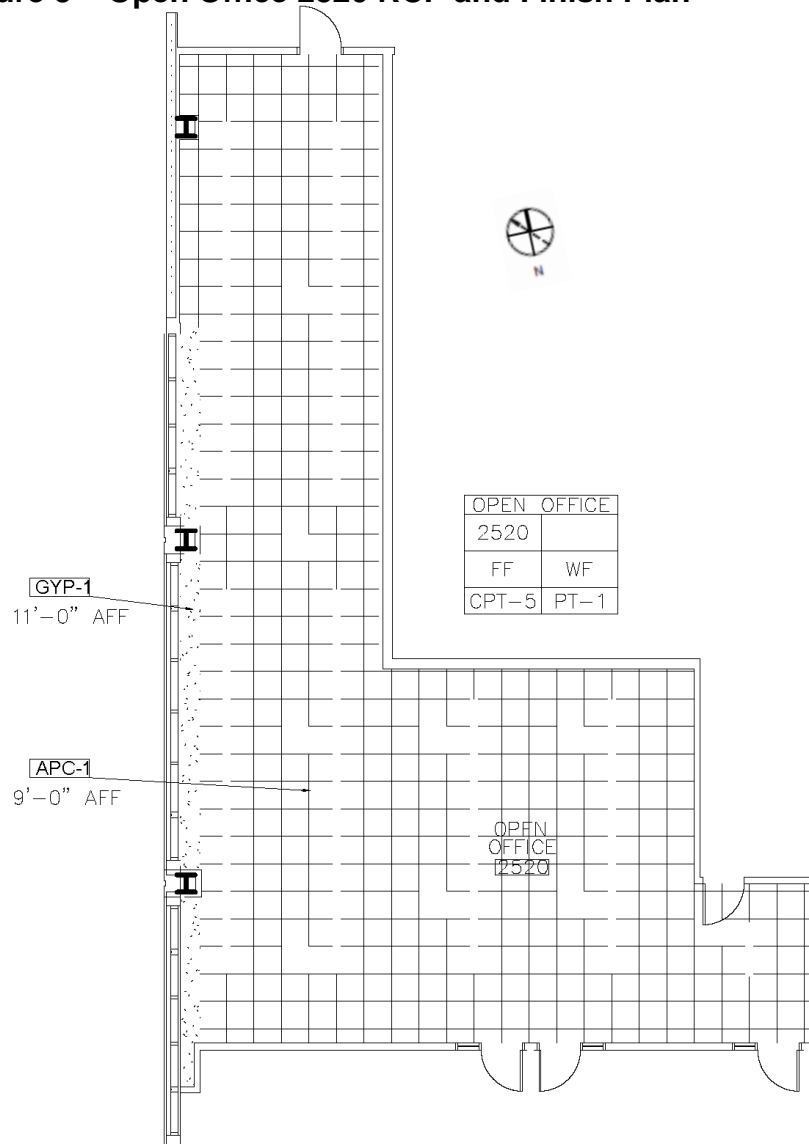
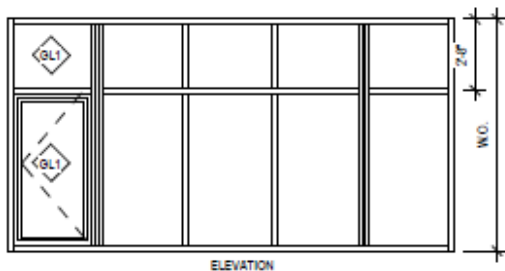


Table 1 – Open Office 2520 Finish Schedule

Tag	Description	Manufacturer	Type	Color	Reflectance
APC-1	Acoustical panel ceiling 24" x 24"	Armstrong	Ultima	White	0.90
CPT-1	Carpet Tile 24" x 24"	Bentley Mills	Illuminaire	Opening Night (403674)	0.04*
PT-1	Paint	Sherwin Williams	Eggshell	Pure White (7005)	0.85

*denotes reflectances that were calculated by AGI32 based on the manufacturers image

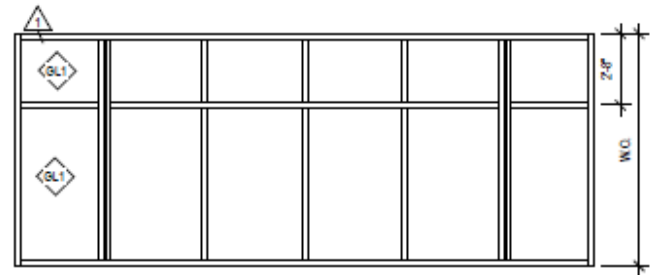
Figure 4 – Open Office 2520 Exterior Elevation and Window Types



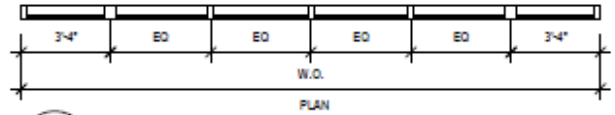
ELEVATION



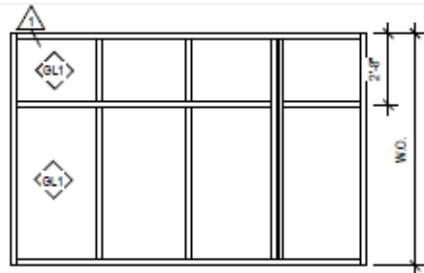
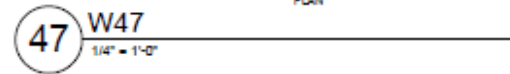
PLAN



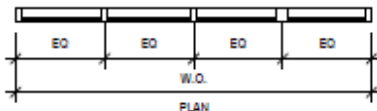
ELEVATION



PLAN



ELEVATION



PLAN

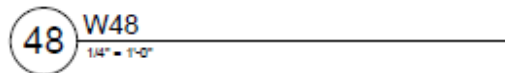


Table 2 – Open Office 2520 Glazing Types

Tag	Description	Manufacturer	Type	ρ_{EXT}	ρ_{INT}	ρ_{SOL}	VL _T
GL1	Vision glass	Viracon	VUE 1-50	0.11	0.11	0.26	.49

1.1.3 Equipment

Figure 5 – Open Office 2520 Lighting Layout

The primary lighting fixture for Open Office 2520 is linear fluorescent direct-indirect pendants. Figure 5 (right) shows the lighting fixture layout of the space. Table 3 (below) is the Lighting Fixture schedule.

The lighting system is controlled through digital power packs that are tied into a central light management hub. For the open office, a time clock is used during normal business hours; the vacancy sensors and wall switches are locked out during this time. For evening and weekend hours the low voltage switches allow the lights to be turned on for 2 hours at a time and turned off by the vacancy sensors. There is a warning of a pending shutoff (via a flash of the lights) 10 minutes prior to shutoff. There are 3 occupancy sensors distributed throughout the space. The design documents do not specify the type of vacancy sensor that is used in this space, but for other parts of the building dual technology vacancy sensors are used.

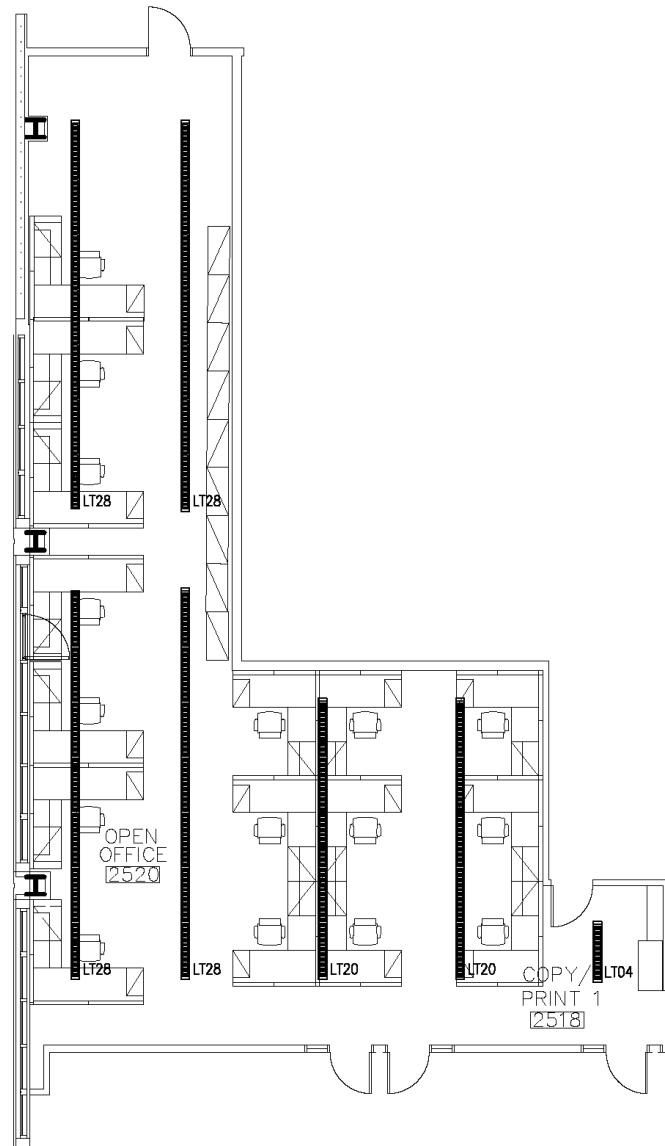


Table 3 – Open Office 2520 Lighting Fixture Schedule

Type	Description	Manufacturer	Model	Lamp	Input Watts	Voltage
LT04	4'-0" LONG LINEAR FLUOR. DIRECT/INDIRECT PENDANT FIXTURE W/ INTEGRAL ELEC.BALLAST, CROSS BLADE BAFFLE & WHITE FINISH ON ALL ITEMS.	GAMMALUX	GB72BW-232T8-UNV-ERS-28'-S12-OP/PBB-WSG	(2) PHILLIPS F32T8/TL835/ALTO	54	120/277
LT20	20'-0" LONG LINEAR FLUOR. DIRECT/INDIRECT PENDANT FIXTURE W/ INTEGRAL ELEC.BALLAST, CROSS BLADE BAFFLE & WHITE FINISH ON ALL ITEMS.	GAMMALUX	GB72BW-232T8-UNV-ERS-20'-S12-OP/PBB-WSG	(10) PHILLIPS F32T8/TL835/ALTO	270	120/277
LT28	28'-0" LONG LINEAR FLUOR. DIRECT/INDIRECT PENDANT FIXTURE W/ INTEGRAL ELEC.BALLAST, CROSS BLADE BAFFLE & WHITE FINISH ON ALL ITEMS.	GAMMALUX	GB72BW-232T8-UNV-ERS-28'-S12-OP/PBB-WSG	(14) PHILLIPS F32T8/TL835/ALTO	378	120/277
UF3	LED UNDERCABINET LIGHT WITH POWER SUPPLY AND CABLE WITH INLINE SWITCH. SILVER FINISH.	FINELITE	(1) UC-9W-S (Fixture) 9 277/24 21.3"x2.5" 0.8" Ext. (1) PS-66350 (Power supply) (1) DIF-110 (Occupancy sensor)	(1) 9W LED	9	277/24

1.2 Design Criteria

This is an open office space that must accommodate a range of office activities including reading and writing, filing, and the use of VDT's. The majority of this space is a daylight zone as classified by ASHRAE. High efficiency fixtures with high efficacy lamps should be utilized in order to minimize electricity usage. Long life lamps should be used. The lighting fixtures should have a CRI of ≥ 80 . Because of the large amount of daylight infiltration that occurs in this space the lighting fixtures should have a CCT of 3500K.

1.2.1 Qualitative

Open Office 2520 should be a space that is inviting to collaboration. The views provided by the windows should be unhindered and daylighting should be utilized as much as possible.

1.2.2 Quantitative

The following criteria are listed in the order of importance.

ASHRAE 90.1 2013 must be followed because it is a code and the building will not be approved without compliance. For the Space By Space method the allowed lighting power density for an open plan office is 0.9 W/SF. This value may be exceeded as long as the total building watts are not exceeded.

For controls, ASHRAE 90.1 2013 requires that an open plan office meet all of the following requirements: Local Control, Bilevel Lighting Control, Automatic Daylight Responsive Controls for Sidelighting, and Automatic Daylight Responsive Controls for Toplighting. For the next control requirements one option from each of the following two pairs must be selected; Manual on or Restricted to Partial Automatic on and Automatic Full Off or Scheduled Shutoff.

The IES Lighting Handbook 10th Edition gives recommendations for appropriate illuminance levels for various tasks that occur in an office. These recommendations have been developed through much research and are the industry standard for lighting design. These recommendations should be followed in order to help make sure that the lighting meets the needs of the tasks for which the space will be used. The Handbook recommendations for reading and writing of printed media are given in Table 4 below.

Table 4 – Open office 2520 Illuminance Recommendations

Eh (lux)	Elevation Eh	Ev (lux)	Elevation Ev	Avg:Min
300	2'-6"	50	4'-0"	1.5:1*

*From Table 12.6

1.3 Evaluation

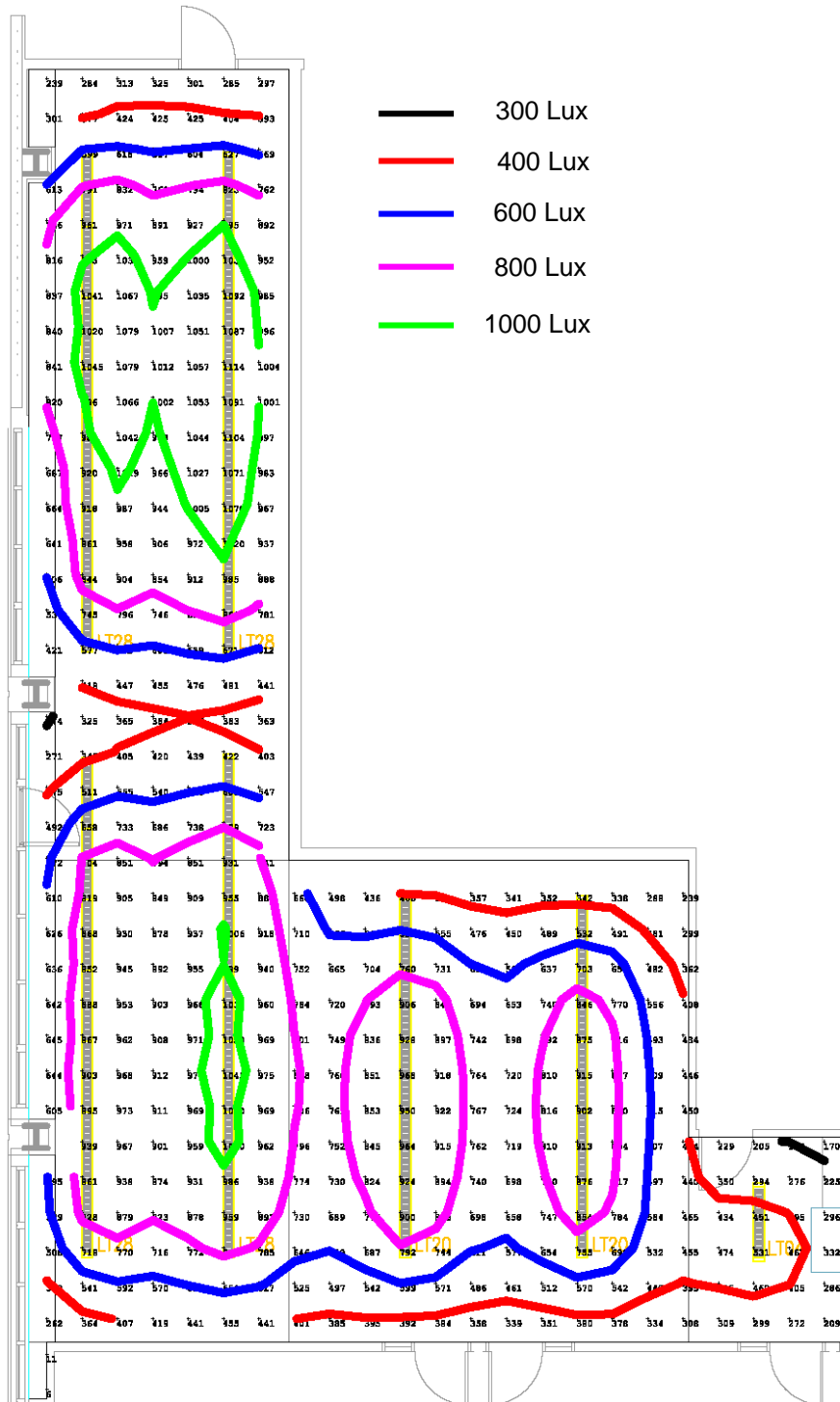
The LPD of Open Office 2520 was calculated to be 1.32 W/SF (see Table 5 below) which is above the LPD allocated for open offices. This will not break the codes as long as other spaces in the building are below their allocated LPD so that the total LPD is below the requirement. There do not appear to be any daylight sensors in Open Office 25020 which means that the design does not comply with the daylighting components of ASHRAE 90.1 2013.

Table 5 – Open Office 2520 LPD

Space	Fixture	Quantity	Lamps per fixture	Watts per lamp	Watts per fixture	Total watts	Room Area	LPD (W/SF)	Space Type	Allowed LPD	Allowed Watts
Open Office 2520						2106	1600	1.32	Open Office	0.9	1440
	LT04	1	2	32	54	54					
	LT20	2	10	32	270	540					
	LT28	4	14	32	378	1512					

Open Office 2520 was modeled in AGI 32 and an illuminance calculation was performed. An LLF of 0.8 was used for the lighting fixtures in this space. A 2'x2' grid at 2'-6" AFF was used for the analysis. The analysis found an average illuminance of 708 Lux. This level is far above the illuminance criteria that was set for this space. Figure 6 on the next page is the isoline illuminance plot from the analysis.

Figure 6 – Open Office 2520 Illuminance Calculation

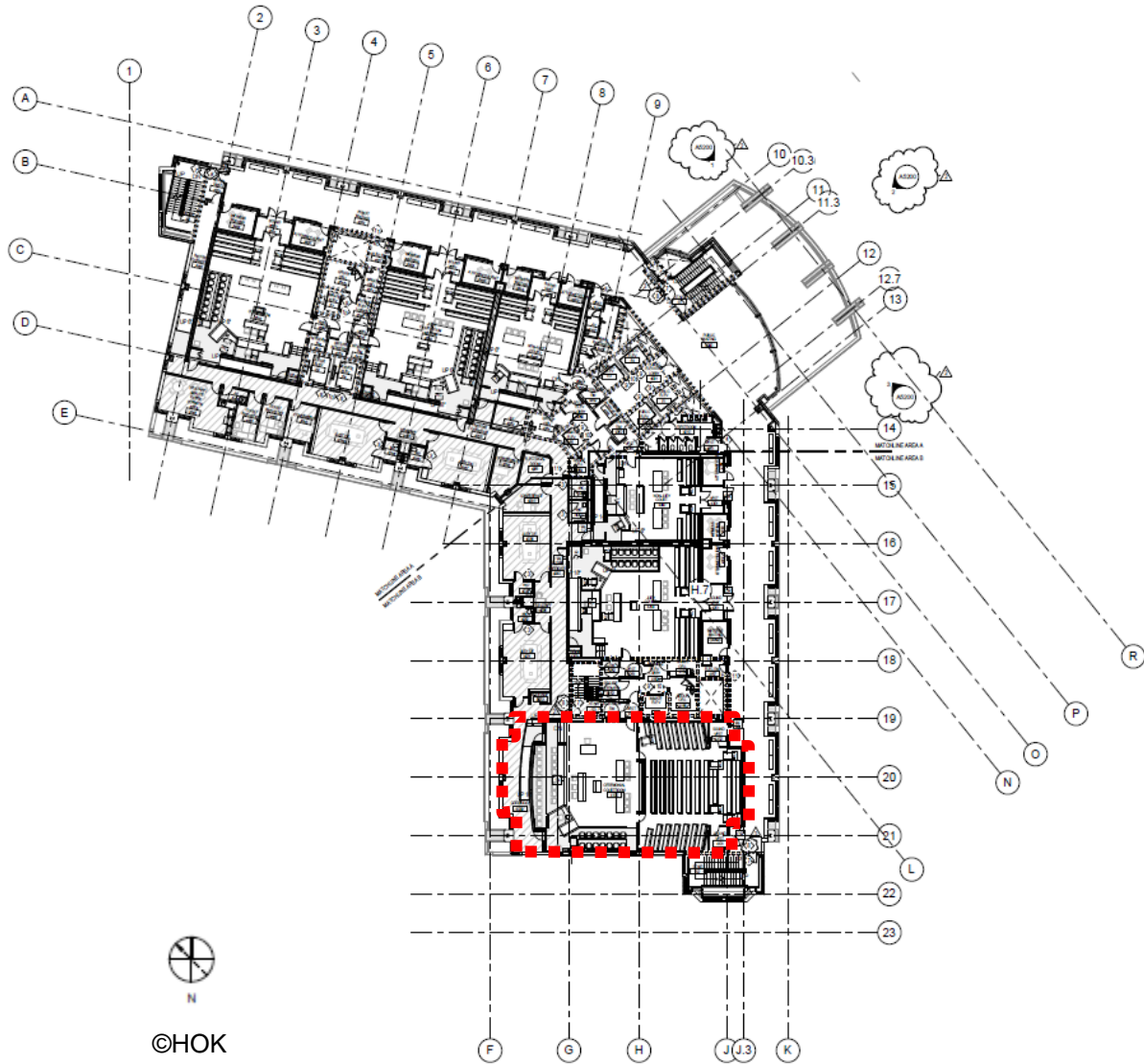


2. Special Purpose Space – Ceremonial Courtroom 4100

2.1 Existing conditions

For the special purpose space, Ceremonial Courtroom 4100 was selected. This 2900 SF courtroom is the largest of the courtrooms with 222 seats and is located in the southeast end of the building.

Figure 7 - Ceremonial Courtroom 4100 Location



2.1.1 Dimensions

Ceremonial Courtroom 4100 is arranged like a typical courtroom/ Figure 8 below shows the overall dimensions and the furniture layout for the space.

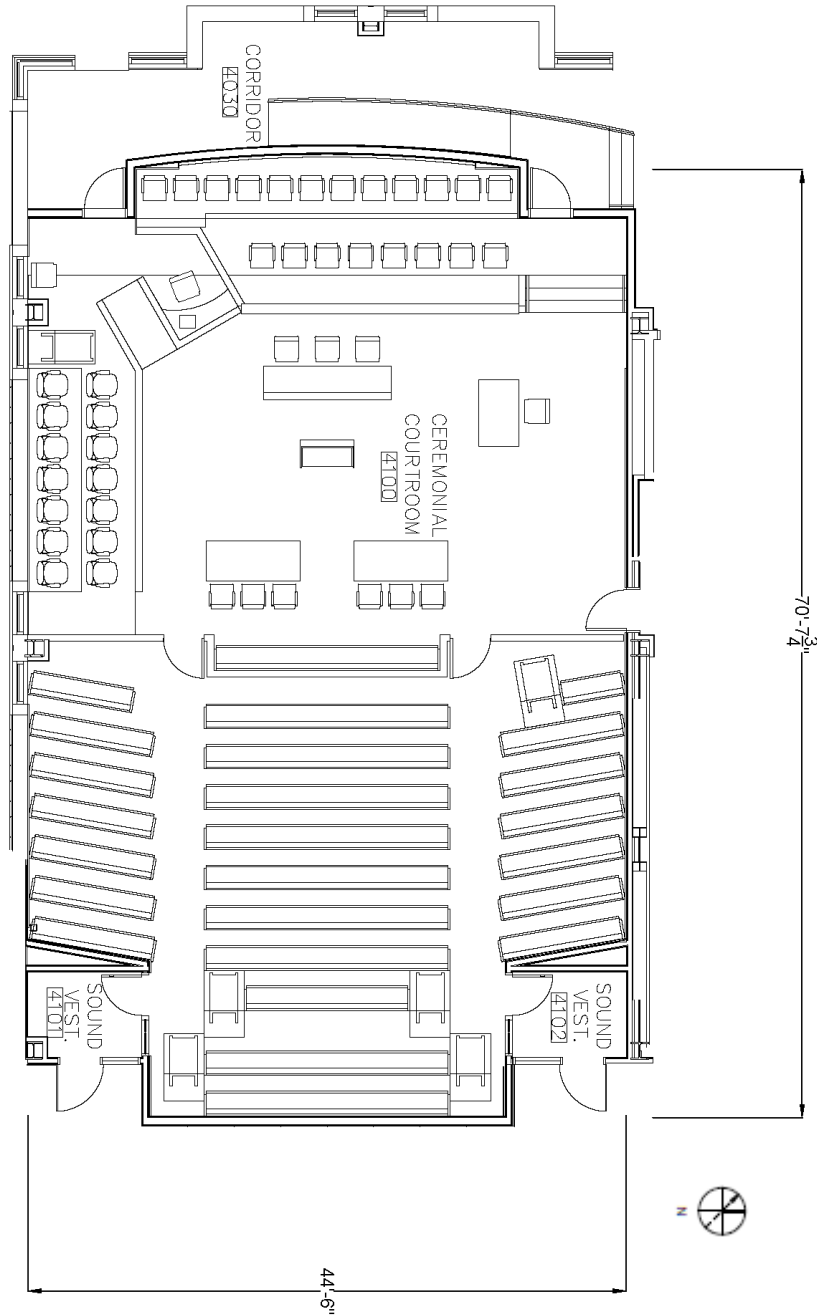


Figure 8 – Ceremonial Courtroom 4100 Layout and Dimensions

2.1.2 Materials

Figure 9 below shows the ceiling, floor, and general wall finish materials of Ceremonial Courtroom 4100. Figure 10 and Figure 11 and Table 6 and Table 7 located on the following pages show the interior elevations and the finish material properties respectively.

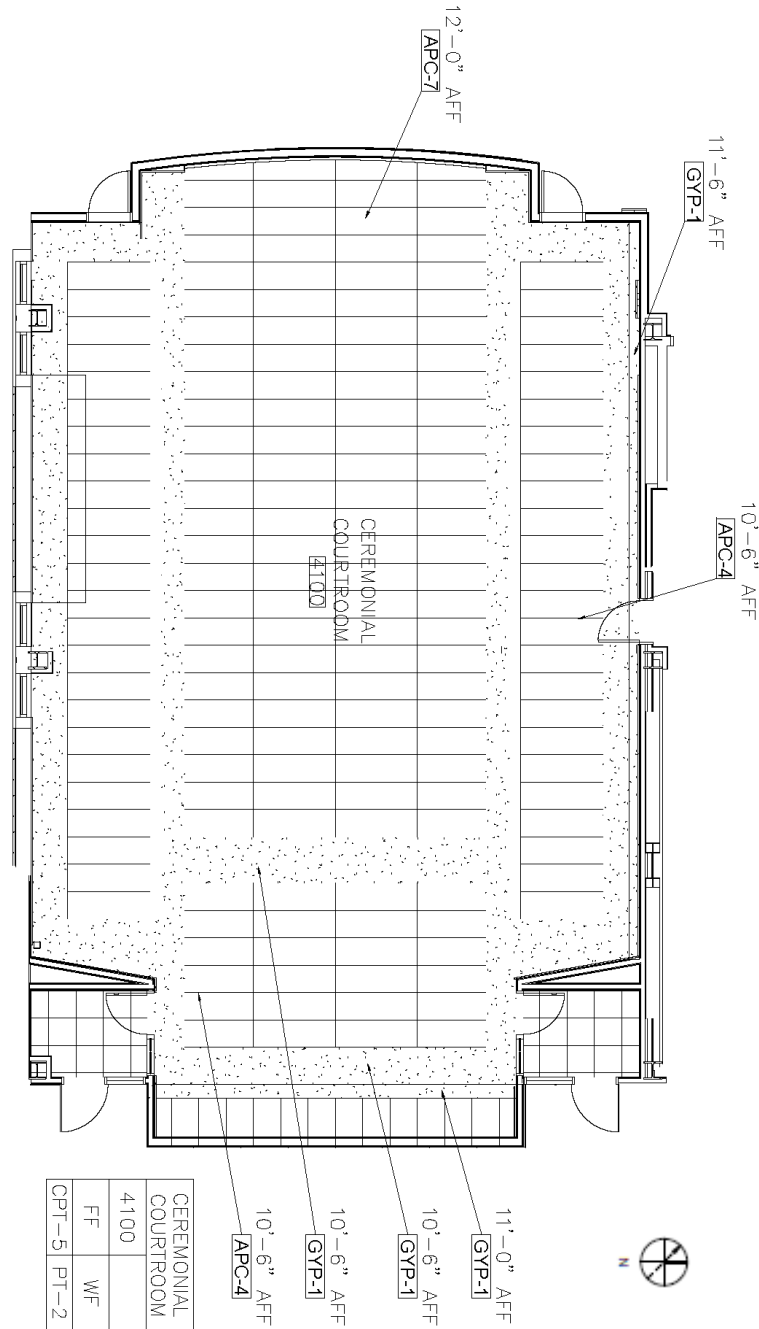


Figure 9 – Ceremonial Courtroom 4100 RCP and Finish Plan

Figure 10 – Ceremonial Courtroom Interior Elevations North and South

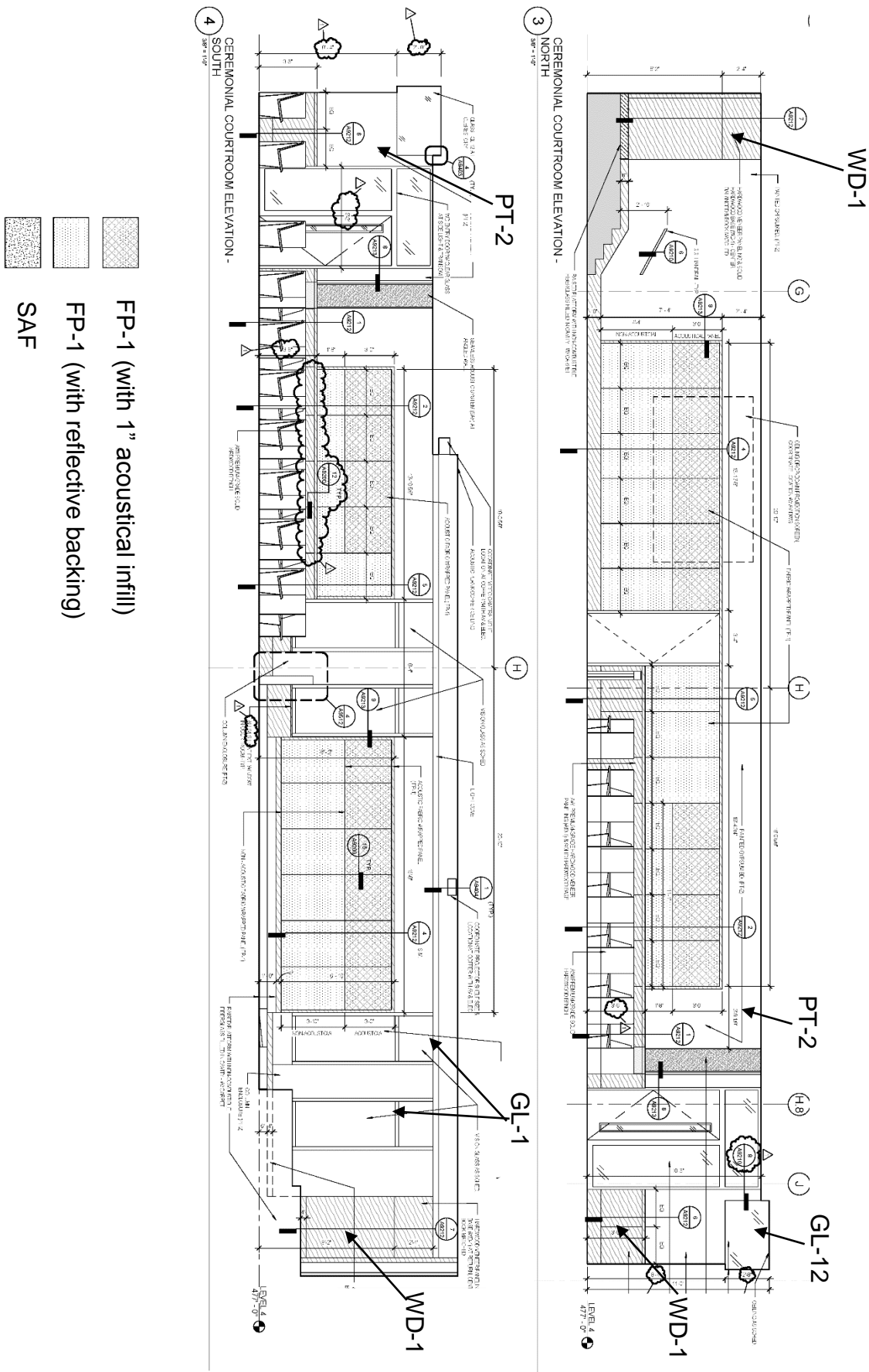
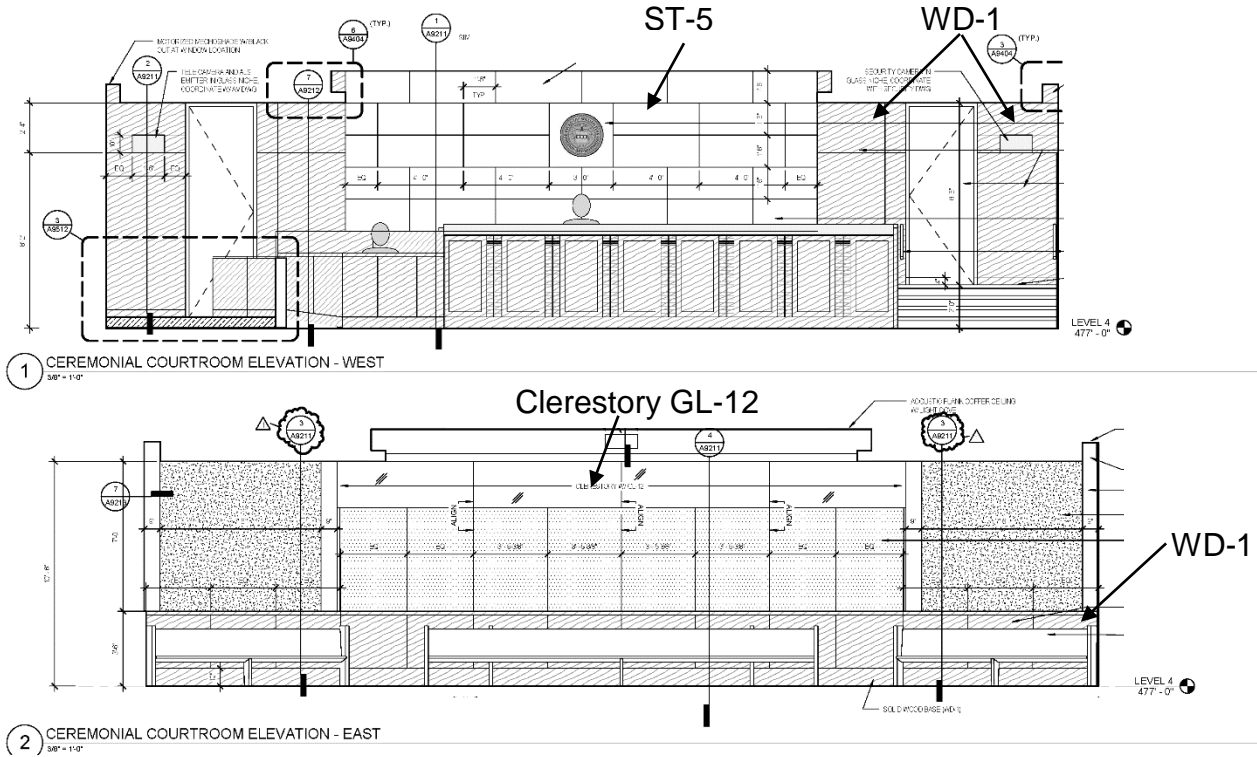


Figure 11 –Ceremonial Courtroom Interior Elevations West and East






-  FP-1 (with 1" acoustical infill)
-  FP-1 (with reflective backing)
-  SAF

Table 6 - Ceremonial Courtroom 4100 Finish Schedule

Tag	Description	Manufacturer	Type	Color	Reflectance
APC-4	Acoustical panel ceiling 24" x 72"	Armstrong	Ultima	White	0.90
APC-7	Acoustical panel ceiling 24" x 48"	Armstrong	Dune	White	0.83
CPT-5	Broadloom Carpet	Invision	Tussah (9144)	Dusk (921)	0.03*
FP-1	Acoustic Fabric Panel	StretchWall Installations, Inc.	MagniRoc FR Panels	Designtex 4139 102 Clay	0.72*
PT-1	Paint	Sherwin Williams	Eggshell	Pure White (7005)	0.85
PT-2	Paint	Sherwin Williams	Eggshell	Natural Choice (7011)	0.73
SAF	Seamless Acoustical System	BASWA	Phon Acoustic Panels		
ST-5	Handset Stone	Coldspring	Granite Diamond 10	Mountain Green	0.22*
WD-1	Hardwood veneer	Danzer Group	Quartersawn	Black Walnut	0.30*

*denotes reflectances that were calculated by AGI32 based on the manufacturers image

Table 7 - Ceremonial Courtroom 4100 Glazing Schedule

Tag	Description	Manufacturer	Type	ρ_{EXT}	ρ_{INT}	ρ_{SOL}	VLT
GL-1	Vision glass	Viracon	VUE 1-50	0.11	0.11	0.26	.49
GL-12	Acoustic Glazing						

2.1.3 Equipment

Several lighting fixtures types are utilized in Ceremonial Courtroom 4100. The majority of the general illumination is provided by recessed circular CFL down lights. A central light cove is illuminated by surface mounted linear fluorescent fixtures. The lighting fixtures utilize Hi-lume dimming ballasts. Figure 12 and Table 8 on the following pages show the lighting fixture layout and the lighting fixture schedule respectively.

The lighting system is controlled through a 96 channel dimming panel that is used for all of the courtrooms on this floor. There are 3 control stations in the front of the room (two 5 button controllers with raise/lower buttons and one 2 button controller). The lights are distributed among 8 dimmer channels. The lighting control system is also tied into the electronic window shades and the projector screen. Dual technology occupancy sensors with 360° views are included in this space.

Figure 12 – Ceremonial Courtroom 4100 Lighting Plan

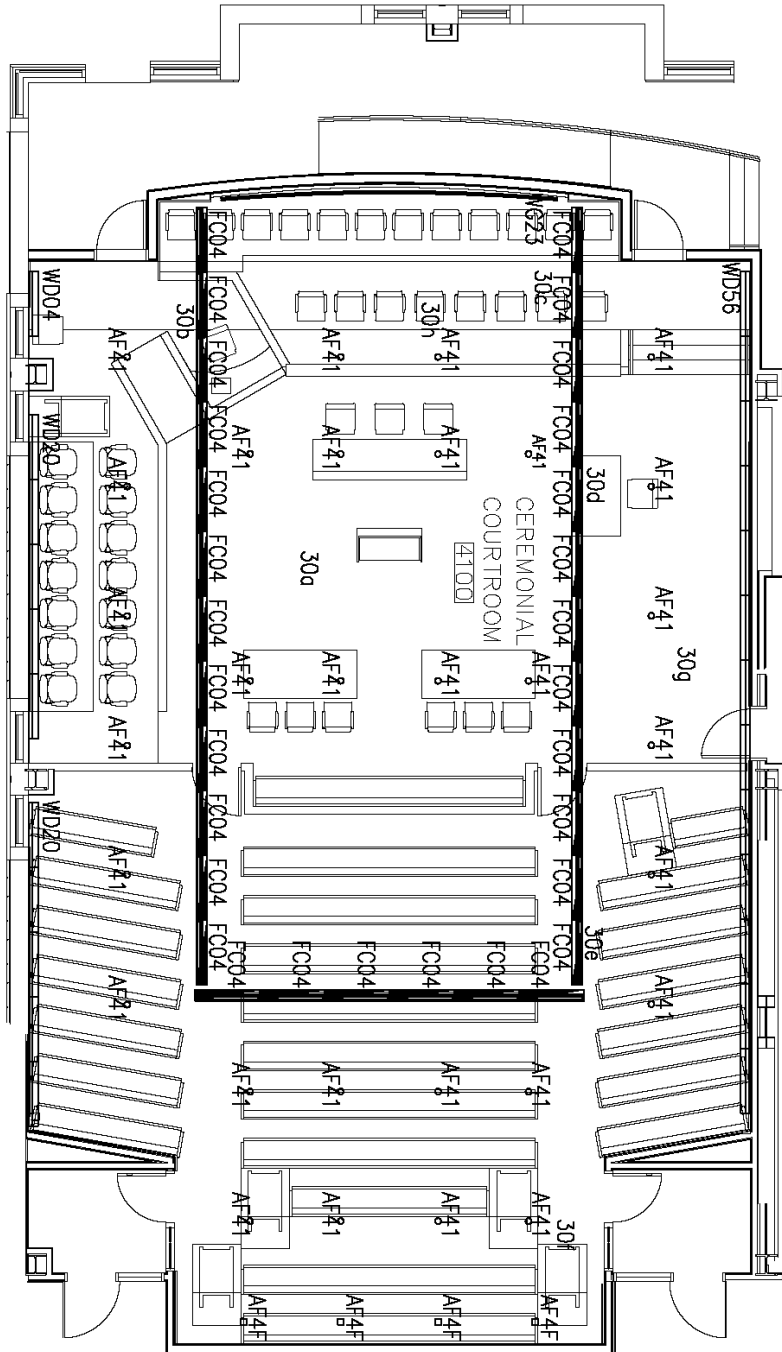


Table 8 – Ceremonial Courtroom 4100 Lighting Fixture Schedule

Type	Description	Manufacturer	Model	Lamp	Input Watts	Voltage
AF41	RECESSED COMPACT FLUORESCENT OPEN DOWNLIGHT WITH NEW-WORK HOUSING, SPECULAR CLEAR ALZAK REFLECTOR, LUTRON HILUME BALLAST & WHITE FLANGE	COOPER LIGHTING	C4026-HILUME-4051-LHWF	(1) PHILLIPS P-L-T 26W/835/4P/ALTO	29	277
AF4F	RECESSED SQUARE COMPACT FLUORESCENT FLANGED DOWNLIGHT WITH INTEGRAL ELECTRONIC BALLAST, BEVELLED RECESSED TRIM AND SOLITE LENS, WHITE FINISH.	USA ILLUMINATION	6314-10-S-VST626-NC-27TV	(1) PHILLIPS P-L-T 26W/835/4P/ALTO	29	277
FC04	SURFACE MOUNTED 4'-0" LONG LINEAR FLUORESCENT SINGLE CIRCUIT COVE LIGHT WITH INTEGRAL LUTRON HI-LUME BALLAST, SEMI-SPECULAR REFLECTOR AND WHITE FINISH.	FOCAL POINT	FCV-68-1T8-1C-277-D(HILUME)-CV-HW-4'	(1) PHILLIPS F32T8/TL835/ALTO	28	277
ML14	RECESSED IN LAY-IN CEILING, 1' X 4', CUSTOM 1-LAMP T8 INDIRECT FLUORESCENT WITH WHITE REFLECTOR, PERFORATED CENTER SHIELD AND ELECTRONIC BALLAST.	FOCAL POINT LUNA	FLU-14-B-1-T8-S-UNV-G-PS-WH	(1) PHILLIPS F32T8/TL835/ALTO	28	120/277
WD04	RECESSED LINEAR 4'-0" LONG FLUORESCENT OPEN PERIMETER WALL SLOT WITH INTEGRAL HILUME BALLAST, SLIDING SLEEVE AND END CAPS.	LITECONTROL	1) 85N 14T8-S-BW-CWM-DP-HILUME-PR 2) 85N-SE-CWM 2) 85N-EC-CWM	(1) PHILLIPS F32T8/TL835/ALTO	28	277
WD20	RECESSED LINEAR 20'-0" LONG FLUORESCENT OPEN PERIMETER WALL SLOT WITH INTEGRAL HILUME BALLAST, SLIDING SLEEVE AND END CAPS.	LITECONTROL	5) 85N 14T8-CWM-DP-HILUME-PR 2) 85N-SE-CWM 2) 85N-EC-CWM	(5) PHILLIPS F32T8/TL835/ALTO	135	277
WD56	RECESSED LINEAR 66'-0" LONG FLUORESCENT OPEN PERIMETER WALL SLOT WITH INTEGRAL HILUME BALLAST, SLIDING SLEEVE AND END CAPS.	LITECONTROL	7) 85N 18T8-CWM-DP-HILUME-PR 2) 85N-SE-CWM 2) 85N-EC-CWM	(14) PHILLIPS F32T8/TL835/ALTO	378	277
WG23	23'-0" LONG SURFACE MOUNTED LED WALL GRABZING FIXTURE LOCATED IN ARCHITECTURAL REGRESS IN COURTROOM AT JUDGES WALL. PROVIDE ALL DRIVERS, FEEDS AND CONNECTIONS REQUIRED FOR CONFIGURATIONS INDICATED IN PLANS. 12° BEAM, LEDS 2' O.C. MATTE FINISH.	MP LIGHTING	L106-23-S2W35S-12-F-MA (2) TLDDLV100W/4100(Driver)	BY MANUFACTURER	138	277/24

2.2 Design Criteria

The lighting of the courtroom should enhance the sense of authority and should help to ensure that justice is achieved in a timely manner while ensuring that security is not compromised. Courtrooms are very complex spaces with a large range of visual tasks being performed. There are two main areas of a court room; the area of proceedings and the audience area. The area of proceedings includes the judge's bench, jury box, witness stand, attorney's tables, presentation screen, and evidence table. In addition to the visual tasks that are being performed in the room there must be sufficient light for security cameras and possibly for video conferencing and video recording.

2.2.1 Qualitative

High efficiency fixtures with high efficacy lamps should be utilized in order to minimize electricity usage. Long life lamps should be used; particularly in locations that are hard to access like in the ceiling coves. The lighting fixtures should have a CRI of ≥ 80 . In order to promote uniformity throughout the building, the lighting fixtures should have a CCT of 3500K.

There are various architectural features in this space including light coves, wood paneling, stone paneling, and the county seal that must be lit appropriately. The county seal, located in the center of the front wall behind the judge's bench, is made out of a specular metal. It should be highlighted, but care should be taken to avoid unwanted reflections.

Vertical illuminance levels are very important for video quality. Particular care should be taken to provide adequate vertical illuminance for the areas that will be videoed. Additionally, matte finishes should be utilized in order to minimize reflections from surfaces.

In order for the lighting to meet the needs of the various tasks that this space will accommodate, there must be several unique scenes. One should be for general proceedings which will light the proceedings area and audience area; another for AV driven proceedings which would have reduced lighting on the audience area and particularly on the projection screen, and a last scene for AV presentations which is for when video/image quality is of the utmost priority.

2.2.2 Quantitative

The following quantitative criteria are listed in the order of importance.

ASHRAE 90.1 2013 must be followed because it is a mandatory code and the building will not be approved without compliance. For the Space By Space method the allowed lighting power density for a courtroom is 1.72 W/SF, but this value may be exceeded as long as the total building watts do not exceed the limit.

For controls, ASHRAE 90.1 2013 requires that a courtroom meet all of the following requirements Local Control, Bilevel Lighting Control, Automatic Daylight Responsive Controls for Sidelighting, and Automatic Daylight Responsive Controls for Toplighting. For the next control requirements one option from each of the following two pairs must be selected; Manual on or Restricted to Partial Automatic on and Automatic Full Off or Scheduled Shutoff

The IES Lighting Handbook 10th Edition gives recommendations for appropriate illuminance levels for various tasks that occur in a courtroom.

Table 9 below summarizes the recommendations for the various locations within the courtroom.

Table 9 – Ceremonial Courtroom 4100 Illuminance Recommendations

Location	E _h (lux)	Height E _h	E _v (lux)	Height E _v	Max:Avg	Avg:Min	Notes
Attorneys' Tables	500	2'-6"	200	4'-0"		2:1	
AV Presentation, General	75	2'-0"	30	4'-0"		2:1	Note taking intended
AV Presentation Screen			50		2:1		Max value
Bailiff Station	500	2'-6"	200	4'-0"		2:1	
Bench and Clerks	500	2'-6"	200	4'-0"		2:1	
Evidence Table	500	2'-6"	200	4'-0"		2:1	
Jury Box	300	2'-6"	150	4'-0"		2:1	
Lectern or Podium	500	2'-6"	200	4'-0"		2:1	
Public Seating	100	2'-6"	50	4'-0"		2:1	
Witness Stand	300	2'-6"	150	4'-0"		2:1	
Faces for Video Conferencing	300	4'-0"	400	3'-5'		1.5:1	E _v should be in the direction of the camera

2.3 Evaluation

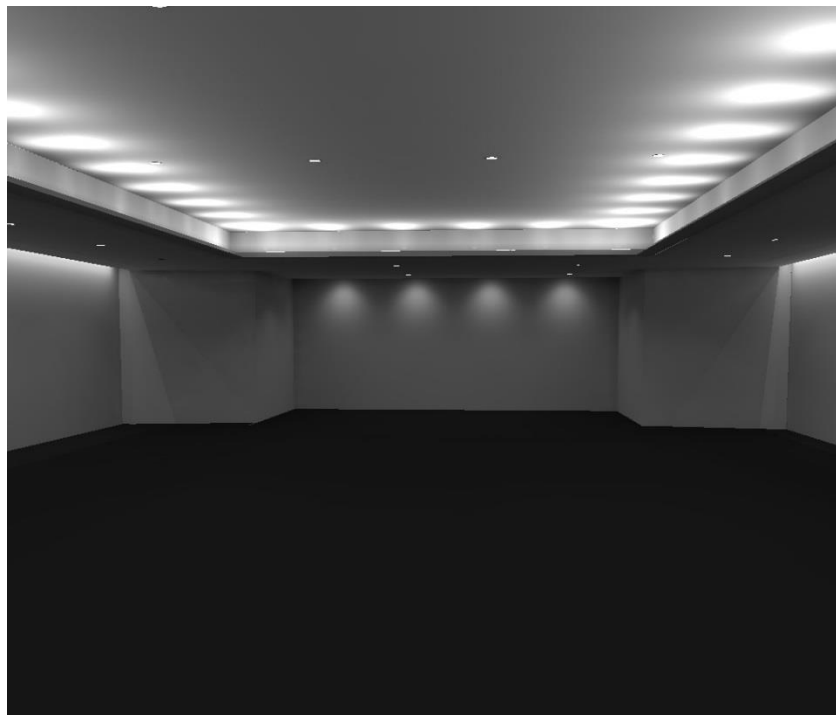
The LPD for Ceremonial Courtroom 4100 was calculated to be 1.10 W/SF, see Table 10 below, which is significantly below the maximum LPD that ASHRAE allows.

Table 10 – Ceremonial Courtroom 4100 LPD

Space	Fixture	Quantity	Lamps per fixture	Watts per lamp	Watts per fixture	Total watts	Room Area	LPD (W/SF)	Space Type	Allowed LPD	Allowed Watts
Ceremonial Courtroom 4100						3192	2900	1.10	Courtroom	1.72	4988
	AF41	30	1	26	29	870					
	AF4F	4	1	26	29	116					
	FC04	30	1	32	28	840					
	WD04	1	1	32	28	28					
	WD20	2	5	32	135	270					
	WD56	1	14	32	378	378					
	WG23	5			138	690					

A model of Ceremonial Courtroom 4100 was created. The walls were all given a reflectance of 0.85 and LLF's of 0.70 and 0.80 were used for the LED and fluorescent fixtures respectively. Figure 13 below is a ray trace of the model looking from the public seating area towards the area of proceedings. A single analysis was run with all of the fixtures fully on. The results of this analysis are shown in Figure 14 on the next page. The public seating area had an average illuminance of 178 Lux and the proceedings area had an average illuminance of 212 lux. The calculated illuminance for the proceedings area is significantly below the design criteria of 500 lux that was set for the attorneys' tables, evidence table, and bench and clerks. The calculated illuminance for the public seating area is significantly above the criteria that was set.

Figure 13 – Ceremonial Courtroom 4100 AGI32 Render



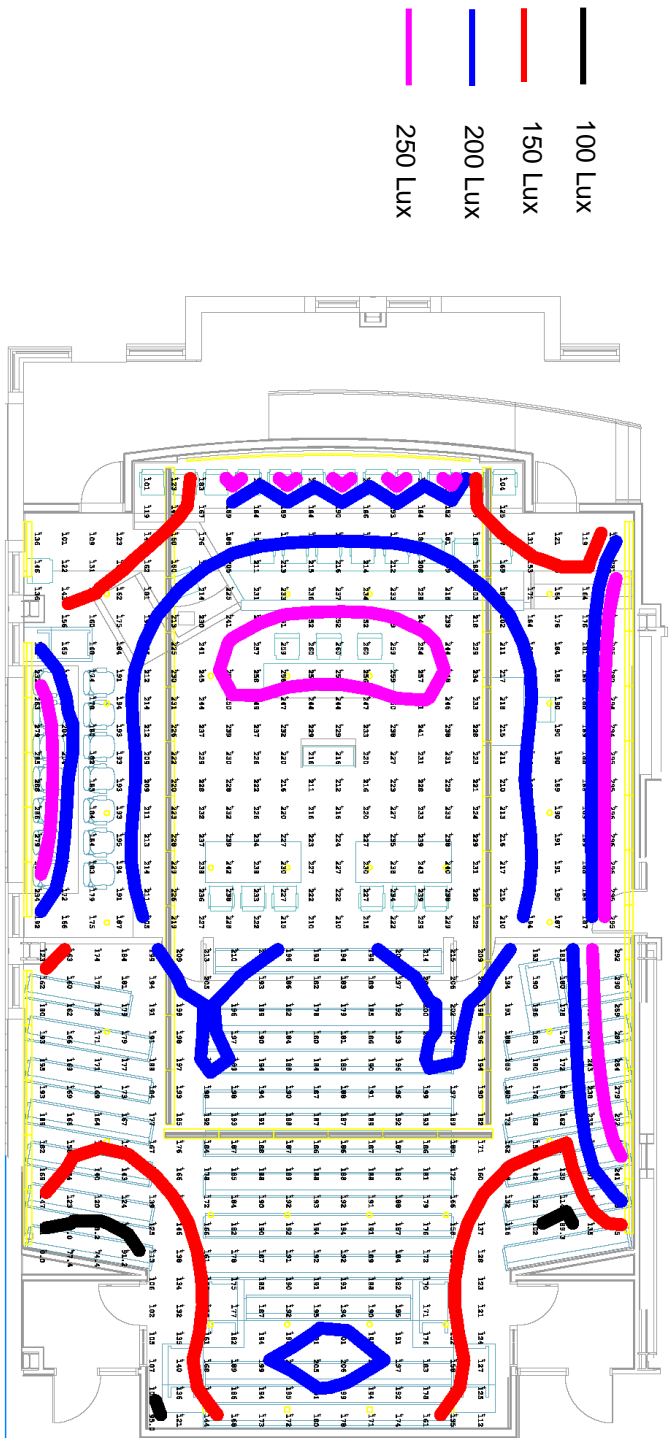


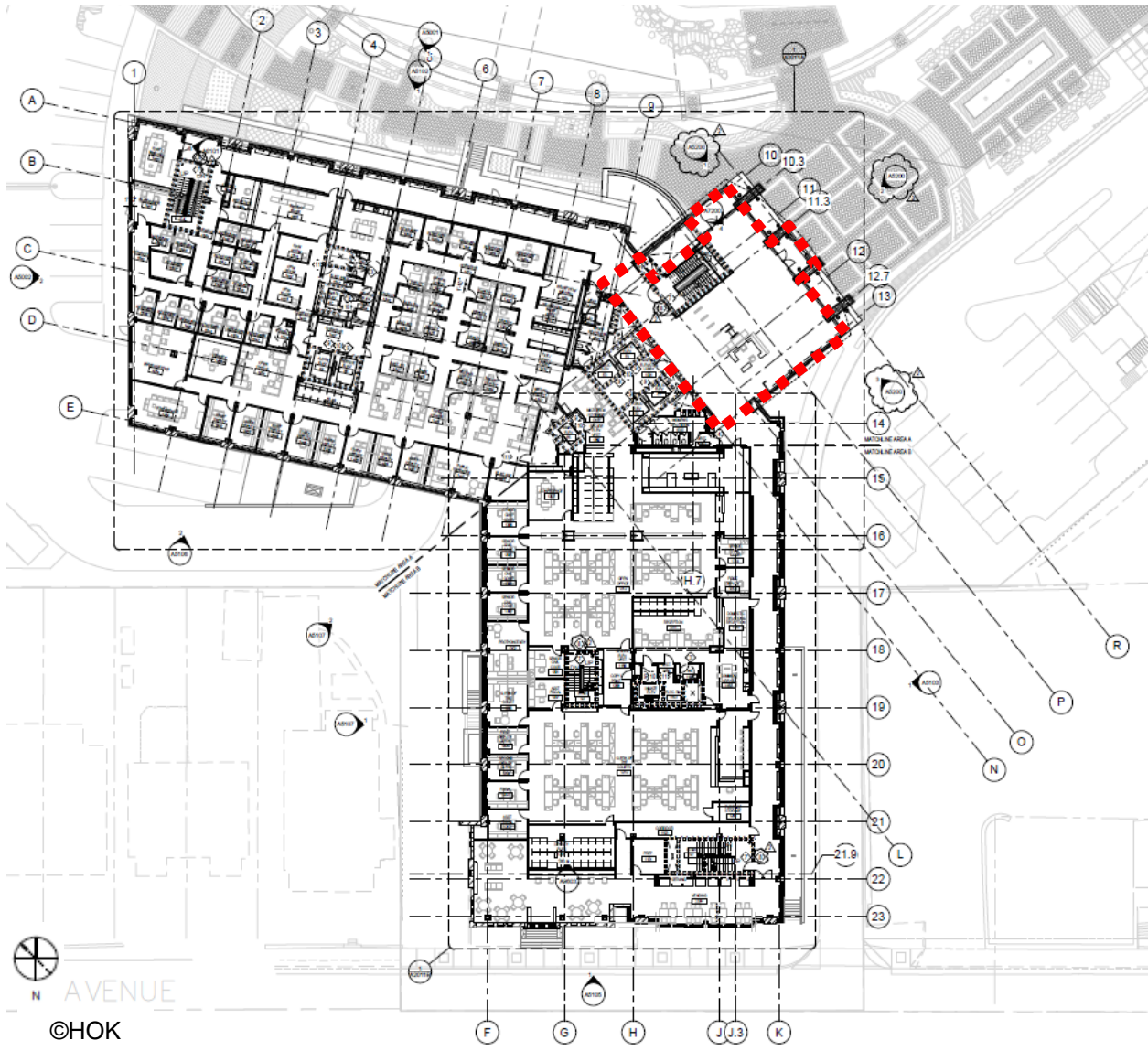
Figure 14 – Ceremonial courtroom 4100 Illuminance Calculation

3. Circulation Space – Main Lobby 1000

3.1 Existing Conditions

For the circulation space Main Lobby 1000 was selected. Main Lobby 1000 is approximately 3000 SF and is located on the east side of the building at the intersection of the two wings. It is double height with a second floor balcony overlooking it. The east façade is primarily glass which provides extensive exposure to daylight.

Figure 15 – Main Lobby 1000 Location



3.1.1 Dimensions

Main Lobby 1000 is a fairly typical double height lobby. The main security screening station for the building is located in the center of the lobby. Figure 16 below shows the dimensions and the furniture layout of the space. Figure 17 on the next page is an elevation looking from the main entrance towards the security area.

Figure 16 – Main Lobby 1000 Layout and Dimensions

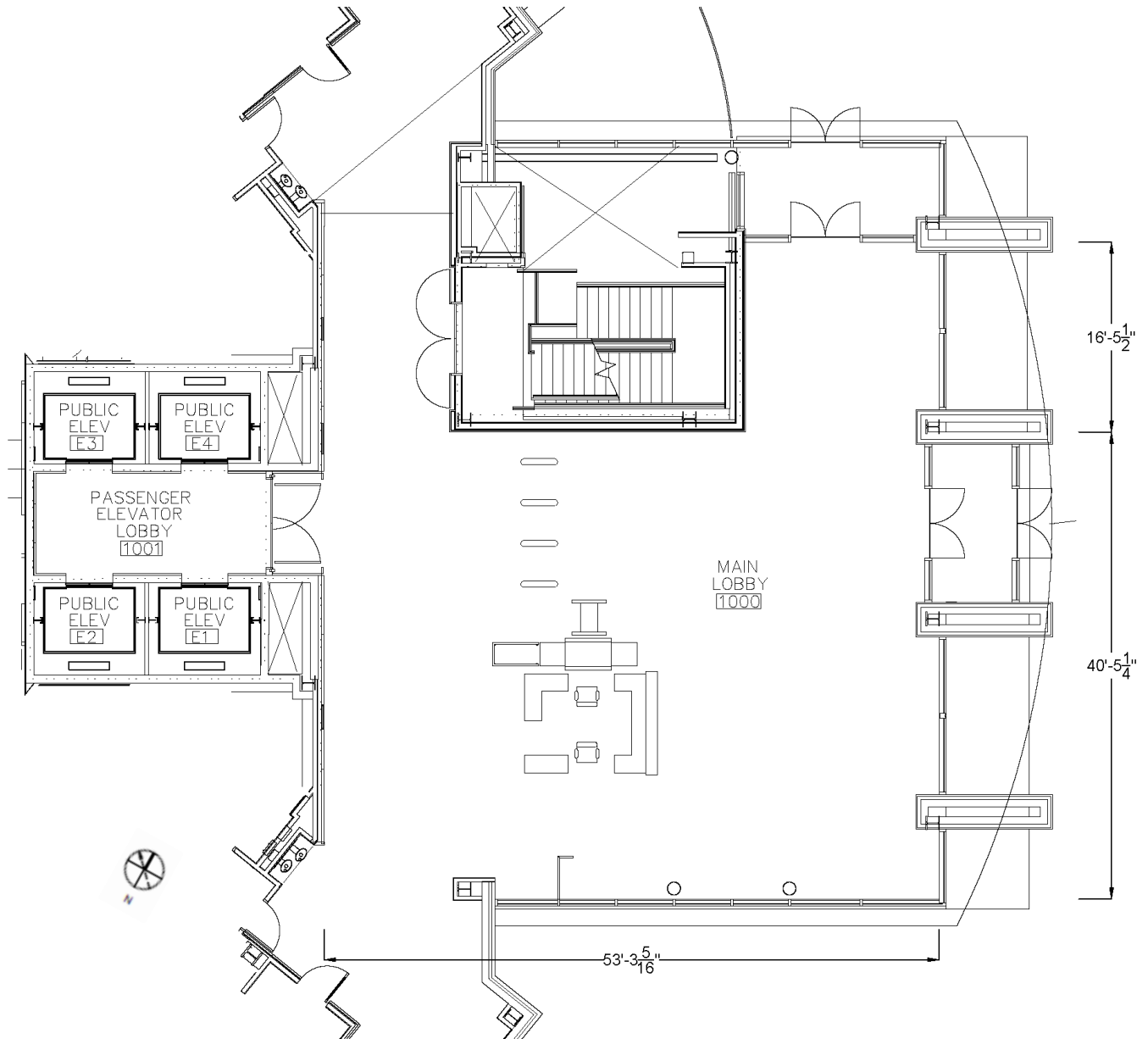
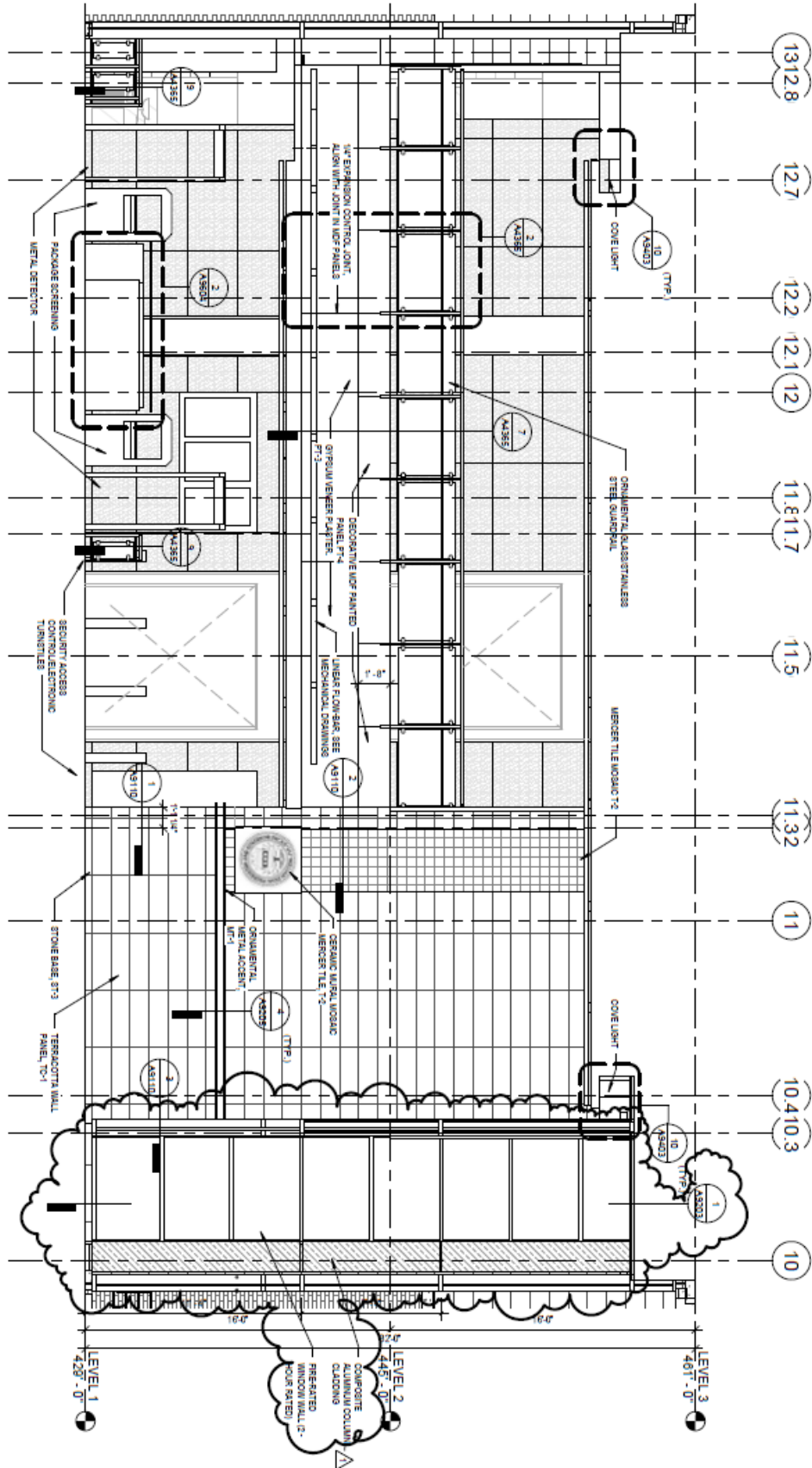


Figure 17 – Main Lobby 1000 Interior Elevation



3.1.2 Materials

The primary finish materials of Main Lobby 1000 are stone, terracotta, and a metal panel ceiling. Figure 18 below and Table 11 on the next page show the ceiling, wall, and floor finish materials of the space.

Figure 18 – Main Lobby 1000 RCP and Finish Plan

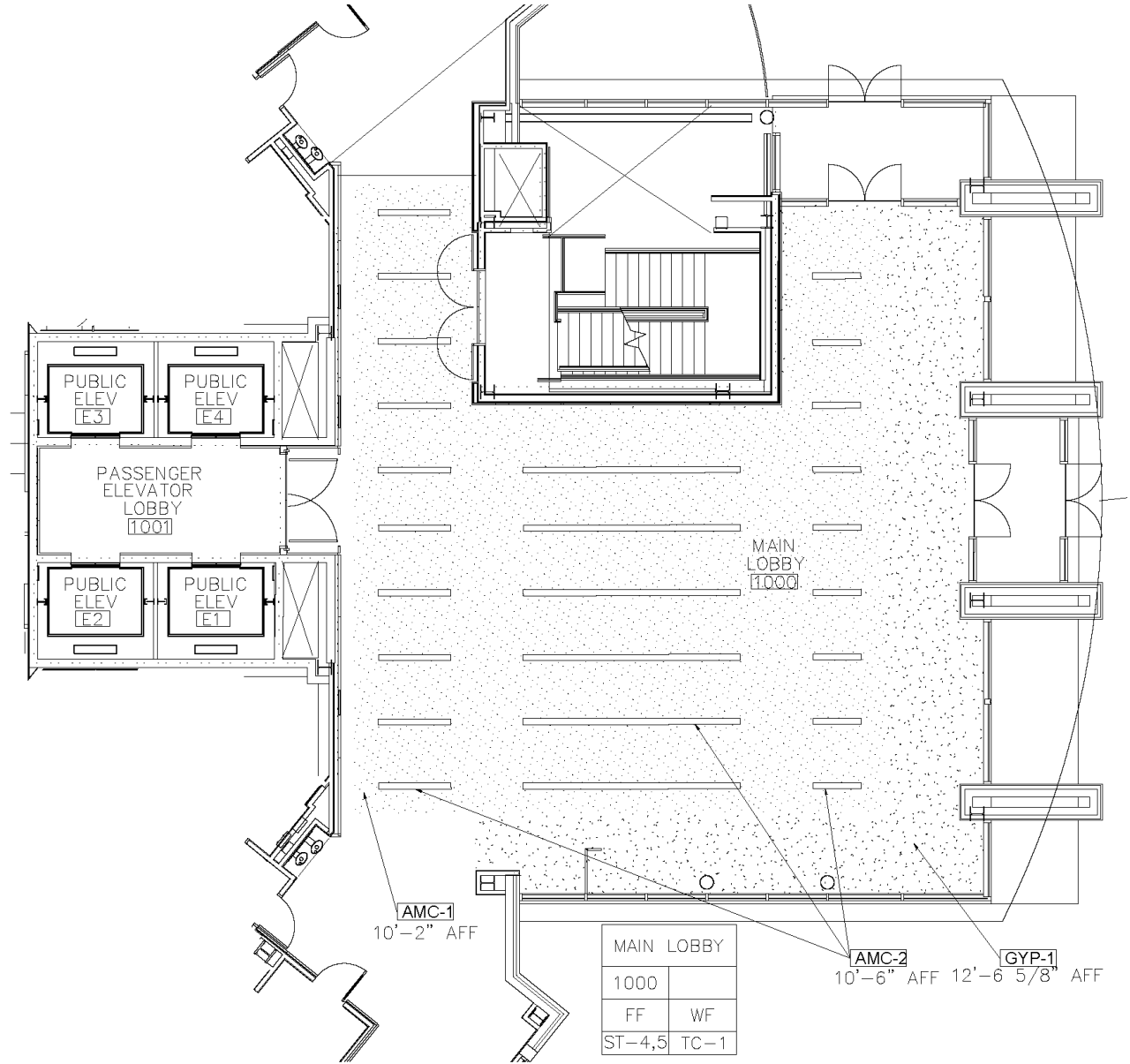


Table 11 – Main Lobby 1000 Finish Schedule

Tag	Description	Manufacturer	Type	Color	Reflectance
AMC-1	Acoustical Metal ceiling 24" x 24"	Armstrong	Metalworks	-	>0.60
AMC-2	Acoustical Metal ceiling 6" wide	Armstrong	Metalworks	-	>0.60
PT-1	Paint	Sherwin Williams	Eggshell	Pure White (7005)	0.85
ST-3	Stone		Granite Polished	Pennsylvanian Black	
ST-4	Handset Stone	Coldspring	Granite	Mountain Green	0.22*
TC-1	Terracotta Wall Tile	Boston Valley		Custom	

*denotes reflectances that were calculated by AGI32 based on the manufacturers image

Figure 19 and Table 12 on the next page show the glazing types that are utilized on the front of Main Lobby 1000.

Figure 19 – Mani Lobby 1000 Exterior Elevation

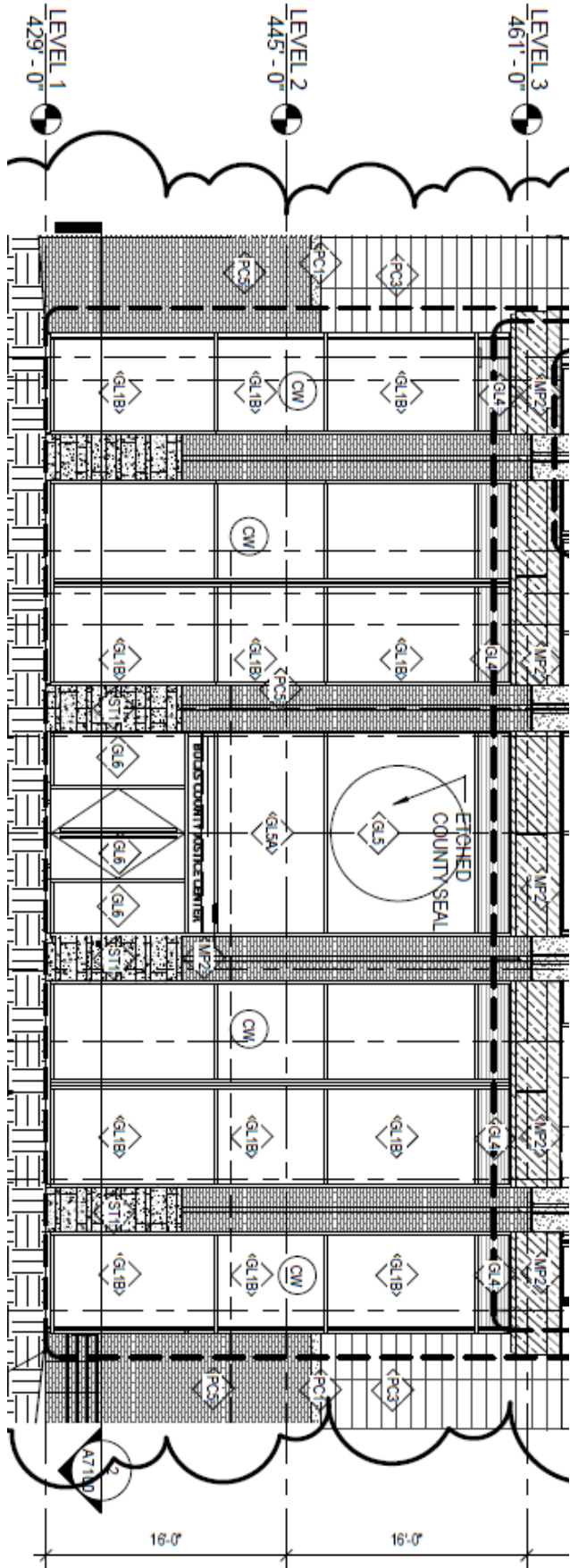


Table 12 - Main Lobby 1000 Glazing Schedule

Tag	Description	Manufacturer	Type	P-EXT	P-INT	P-SOL	VLT
GL-1B	Vision glass	Viracon	VUE 1-50	0.11	0.11	0.26	0.49
GL-5	Vision glass	Interpane	iplus neutral E	0.12	0.12	0.24	0.78
GL-5A	Vision glass	Interpane	iplus neutral E	0.12	0.12	0.24	0.78
GL-6	Vision glass	Interpane	iplus neutral E	0.12	0.12	0.24	0.78

3.1.3 Equipment

Main Lobby 1000 uses a variety of lighting fixtures; the majority of the illuminance is provided by recessed linear fluorescent fixtures while decorative accents are handled mainly by LED fixtures. Figure 20 below and Figure 21 on the next page show the lighting layout for this space. A bid alternate for the project proposed replacing the fluorescent fixtures with LED fixtures. The LED fixtures are designated by parentheses on the lighting plans. Table 13 on page 33 shows the lighting fixture schedule for Main Lobby 1000. The controls for the lighting fixtures in Lobby 1000 are non-accessible to the public. There are only occupancy sensors located under the second floor balcony, but no in the double height area.

Figure 20 – Main Lobby 1000 Lighting Plan (first level)

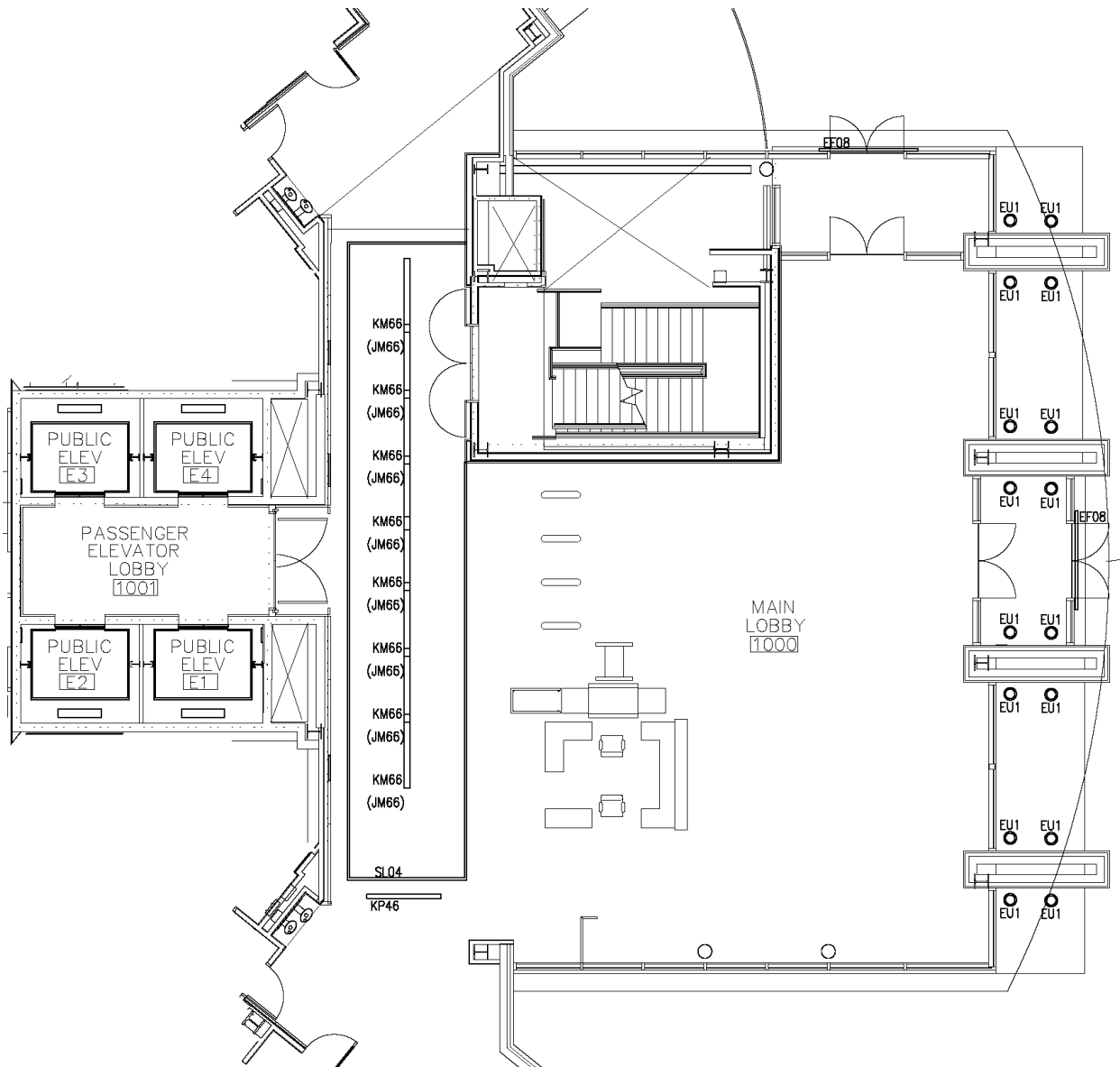


Figure 21 – Main Lobby 1000 Lighting Plan (second level)

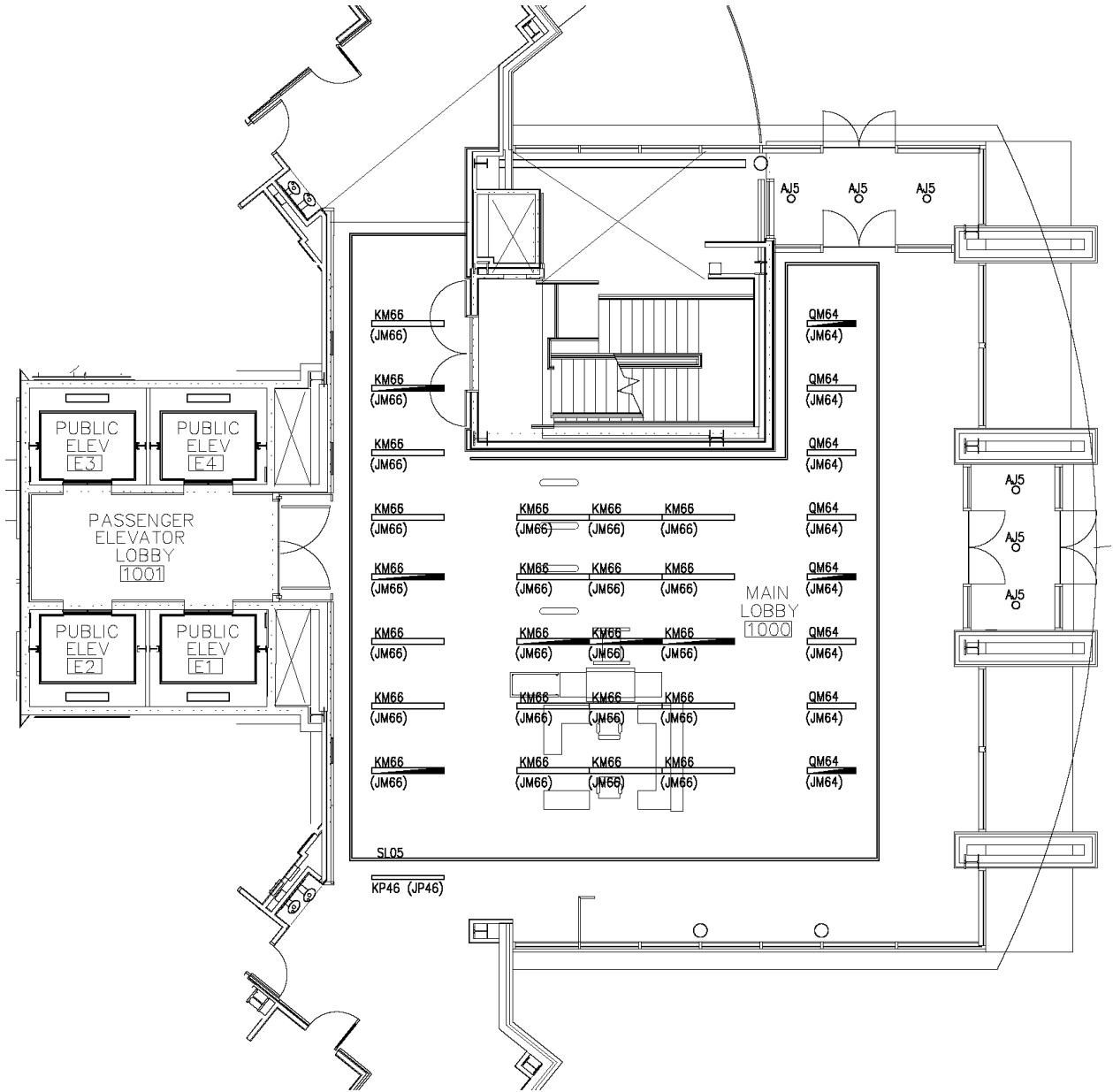


Table 13 – Main Lobby 1000 Lighting Fixture Schedule

Type	Description	Manufacturer	Model	Lamp	Input Watts	Voltage
(JM64)	RECESSED 4'-0" LONG LINEAR LED FIXTURE WITH INTEGRAL DRIVER, FROSTED LENS AND WHITE FINISH. RECESSED IN METAL PAN CEILING.	ZUMTOBEL	SLR2LED-075-K35-04-ZFL-XGU	INCLUDED	56.4	277
(JM66)	RECESSED 6'-0" LONG LINEAR LED FIXTURE WITH INTEGRAL DRIVER, FROSTED LENS AND WHITE FINISH. RECESSED IN METAL PAN CEILING.	ZUMTOBEL	SLR2LED-075-K35-06-ZFL-XGU	INCLUDED	84.6	277
AJ5	RECESSED LED DOWNLIGHT WITH INTEGRAL 277V/24V DRIVER, SOFT HAZE TRIM AND WHITE TRIM RING.	PEACHTREE	PSB-553-SH-TR-W	INCLUDED	53	277/24
EU1	EXTERIOR IN-GRADE ROUND METAL HALIDE UP/LIGHT WITH UNIVERSAL INTEGRAL BALLAST, SPOT LAMP, STAINLESS STEEL FACEPLATE, FLAT CLEAR LENS AND INTERNAL HONEYCOMB LOUVER.	HYDREL	M8720-SS-P38100M-MMVOLT-SP-FLOC5-34S-IHL	(1) PHILLIPS 100W/PAR38SP MH	125	120/277
EF8	EXTERIOR MULLION MOUNTED LINEAR LED FIXTURE IN (2) 6' LENGTHS W/ REMOTE DRIVER AND CUSTOM COLOR KIMAR FINISH. DAMP LOCATION.	MP LIGHTING	(2)L121-6-S3-W305-120-CUSTOM TLDDL.V100W/4100(Driver)	INCLUDED	96	277/24
KM66	RECESSED 6'-0" LONG LINEAR FLUORESCENT FIXTURE WITH INTEGRAL ELECTRONIC BALLAST, REGRESSED SATIN ACRYLIC LENS AND WHITE FINISH, RECESSED IN MTL PAN CEILING. COORDINATE EDGE TRIM WITH FINAL CEILING SPECIFICATION. REGRESS PROFILE TO MATCH KL44 FIXTURE.	GAMMALUX	GB6610RC-13278-UNV-ERS-6-REC/METAL-PAN-ASLMD-WSG	(2) PHILLIPS F25T8/TL835/AL TO	46	120/277
KP46	RECESSED 6'-0" LONG LINEAR FLUORESCENT FIXTURE WITH INTEGRAL ELECTRONIC BALLAST, REGRESSED SATIN ACRYLIC LENS AND WHITE FINISH, LOCATED IN GYP. BD. CEILING, MODIFIED FOR TRIMLESS DETAIL.	GAMMALUX	GB45RC-13278-UNV-ERS-6-REC/GMR-ASLMD-WSG	(2) PHILLIPS F25T8/TL835/AL TO	46	120/277
SL04	106'-0" LONG CONTINUOUS LED COVE WITH ANGLED HOUSING, REMOTE DRIVERS FOR EVERY 12' OF FIXTURE, LEDS AT 2' O.C., FROSTED LENS AND MATTE CLEAR FINISH.	MP LIGHTING	L101A-205-S2-W365-277-F-MA (9)TLDDL.V100W/4100(Driver)	INCLUDED	420	277/24
SL05	205'-0" LONG CONTINUOUS LED COVE WITH ANGLED HOUSING, REMOTE DRIVERS FOR EVERY 12' OF FIXTURE, LEDS AT 2' O.C., FROSTED LENS AND MATTE CLEAR FINISH.	MP LIGHTING	L101A-205-S2-W365-277-F-MA (17)TLDDL.V100W/4100(Driver)	INCLUDED	990	277/24
QM64	RECESSED 4'-0" LONG LINEAR FLUORESCENT FIXTURE WITH INTEGRAL LUTRON 0-10V DIMMING BALLAST, REGRESSED SATIN ACRYLIC LENS AND WHITE FINISH, RECESSED IN MTL PAN CEILING.	GAMMALUX	GB6610RC-13278-277V-0-10V DIM" SYSTEM-4-REC/METAL PAN-ASLMD-WSG	(1) PHILLIPS F25T8/TL835/AL TO	28	277

3.2 Criteria

Main Lobby 1000 is probably the most visible and traversed part of the entire building. This space should leave instill a sense of grandeur and authority on its patrons. The space must not only be designed for those within the building, but because the space is highly visible from the outside it must these impressions through the façade and into the passerby.

High efficiency fixtures with high efficacy lamps should be utilized in order to minimize electricity usage. Long life lamps are particularly important in this space due to the difficulty in accessing the ceiling. The lighting fixtures should have a CRI of ≥ 80 . This space has a significant amount of exposure to daylight so lamps with a CCT of 3500K will help to blend the daylight and electric light.

3.2.1 Qualitative

The lighting of Main Lobby 1000 must give special attention to helping guests be able to successfully navigate the building. This should include highlighting the building map, security screening area, and the elevator lobby beyond. There is also a county emblem mounted on the monumental staircase that should be highlighted.

This space was selected to have specific attention applied to the lighting design in order to achieve one of the psychological impressions. The desired psychological impression is spaciousness. In order to achieve a sense of spaciousness the perimeter walls should be uniformly illuminated and the ceiling should also be somewhat illuminated.

3.2.2 Quantitative

The following quantitative criteria are listed in the order of importance.

ASHRAE 90.1 2013 must be followed because it is a code and the building will not be approved without compliance. For the Space By Space method the allowed lighting power density for a lobby is 0.90 W/SF, but this value may be exceeded as long as the total building watts does not exceed the maximum allowed.

For controls, ASHRAE 90.1 2013 requires that a lobby meet all of the following requirements Automatic Daylight Responsive Controls for Sidelighting, and Automatic Daylight Responsive Controls for Toplighting. For the next control requirement there is an option of choosing one of the following Automatic Full Off or Scheduled Shutoff.

Table 14 below lists the IES Lighting Handbook recommendations for lobbies near building entrances and for lobbies that are used for security screenings.

Table 14 – Main Lobby 1000 Illuminance Recommendations

Location	Eh (lux)	Elevation Eh	Ev (lux)	Elevation Ev	Avg:Min
Security screening	200	3'-0"	100	5'-0"	2:1
Lobbies near entries (day)	100	Floor	30	5'-0"	4:1

3.3 Evaluation

The calculated LPD for Main Lobby 1000 is 0.99 W/SF, see Table 15 below, which is about 10% greater than the maximum allocated by ASHRAE. As with the other spaces this difference is okay as long as the total building watts are below the maximum allowed.

Table 15 – Main Lobby 1000 LPD

Space	Fixture	Quantity	Lamps per fixture	Watts per lamp	Watts per fixture	Total watts	Room Area	LPD (W/SF)	Space Type	Allowed LPD	Allowed Watts
Main Lobby 1000						3478	3500	0.99	Lobby, all others	0.9	3150
	AJ5	6			53	318					
	EF8	2			96	192					
	KM66	28	2	25	46	1288					
	KP46	1	2	25	46	46					
	SL04	1			420	420					
	SL05	1			990	990					
	QM64	8	1	25	28	224					

The design documents indicated that the lighting in Main Lobby 1000 is tied into the building’s lighting control system and are scheduled for automatic shutoff which means that the space complies with ASHRAE’s requirement for automatic shutoff. The design documents do not indicate that daylight sensors are included in Main Lobby 1000 which means that the lighting controls do not fully comply with ASHRAE 90.1 2013.

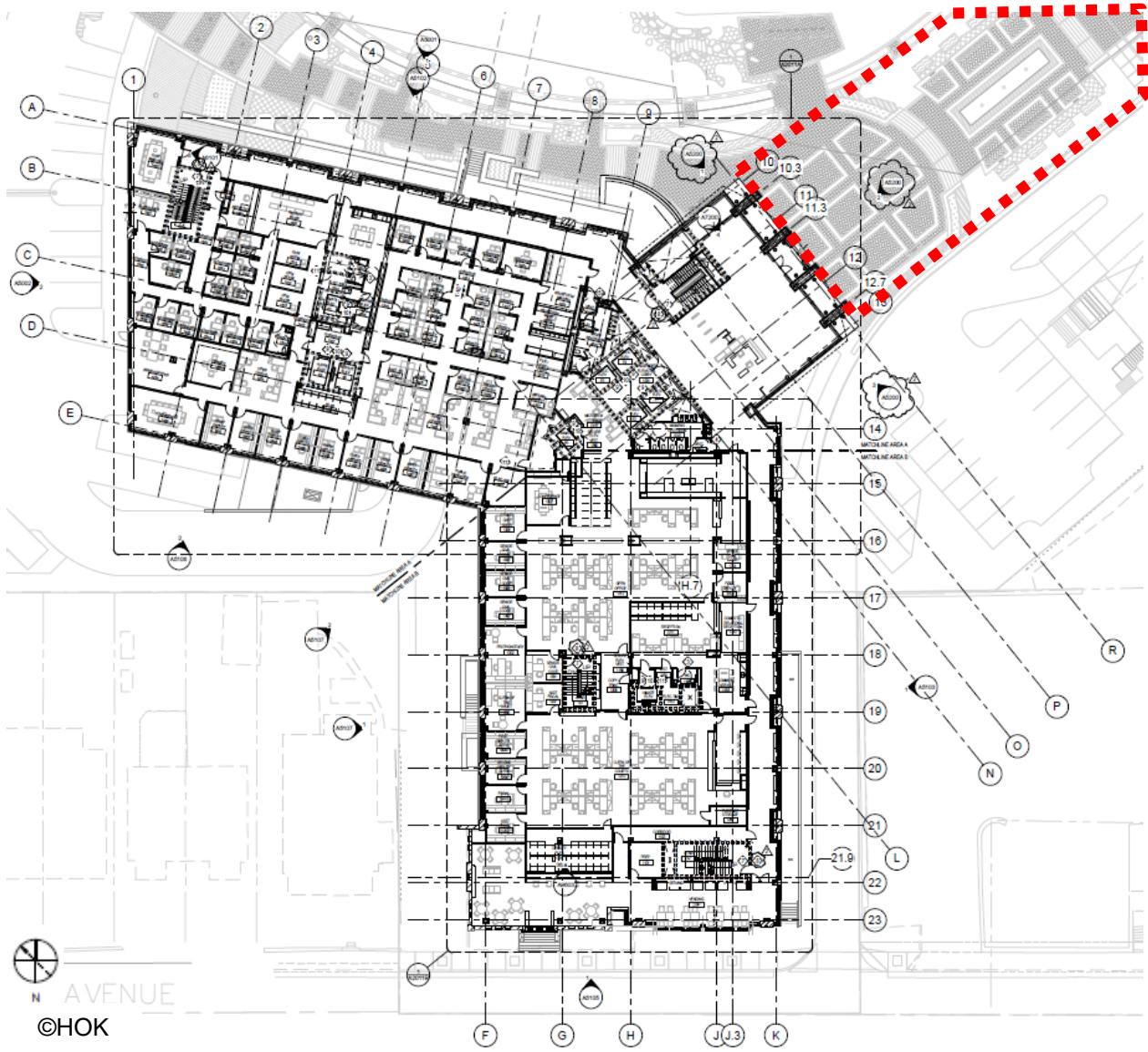
Main Lobby 1000 was modeled in AGI32. For the LED fixture an LLF of 0.7 was used and for the fluorescent fixtures an LLF of 0.8 was used. All of the walls were modeled with a reflectance of 0.5, the ceiling with a reflectance of 0.6, the floor with a reflectance of 0.3, and the glass with a reflectance of 0.12. An illuminance calculation was performed with a 2’ x 2’ grid that was 3’-0” AFF. The results of the calculation showed that the average illuminance for the security screening area was 210 lux and the average for the rest of the room was 170 lux. The calculated illuminance for the security screening area is very close to the criteria of 200 lux. The calculated illuminance level for the rest of the space is nearly double the criteria of 100 lux.

4. Outdoor Space – Main Plaza

4.1 Existing Conditions

For the outdoor space the plaza outside of Main Lobby 1000 was selected. This space connects the main entrance of the new justice center to the old courthouse located across the street.

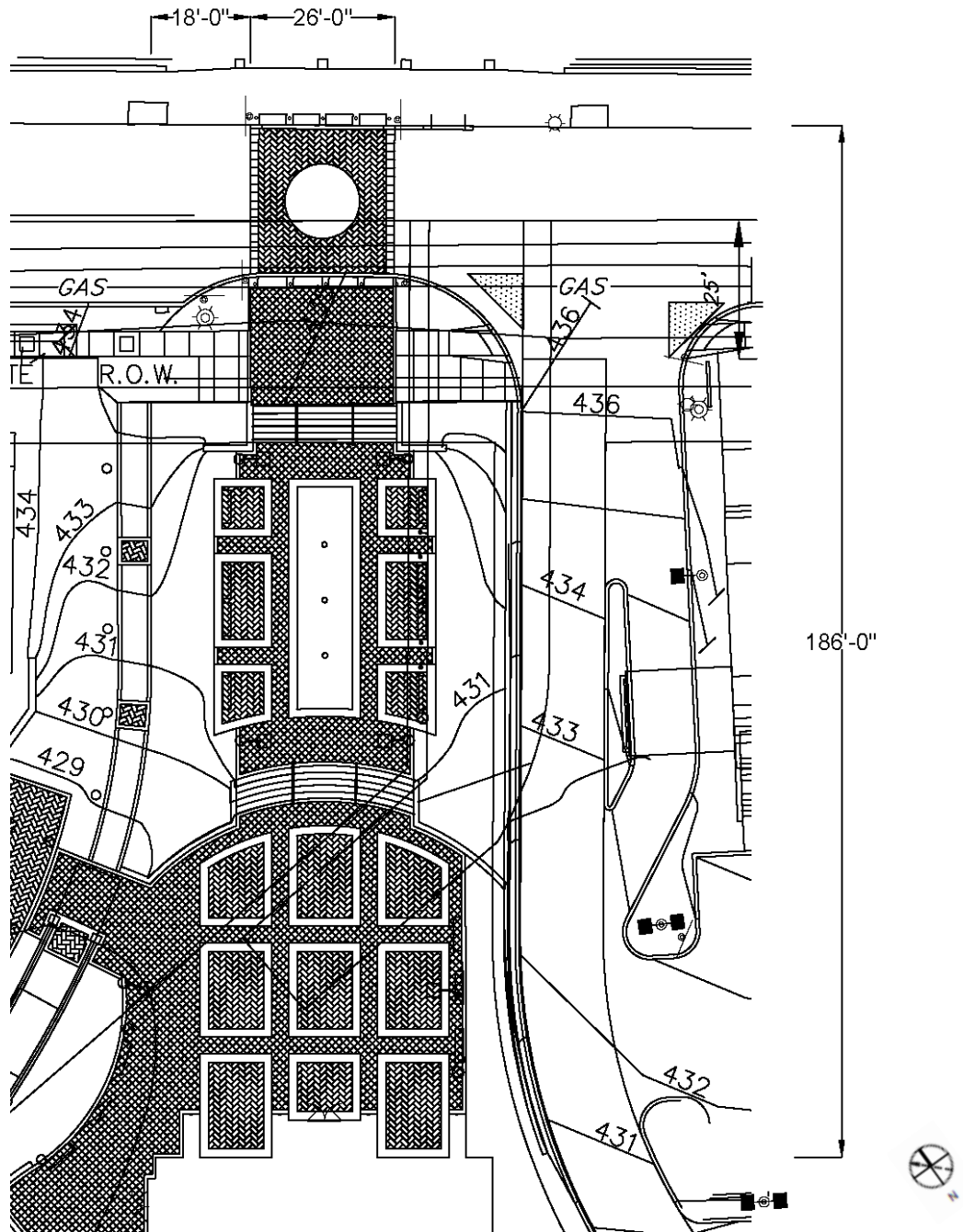
Figure 22 – Main Plaza Location



4.1.1 Dimensions

The main plaza consists of large paved walking surfaces with two staircases as well as sitting areas and several featured items. Figure 23 below shows the dimensions and layout of the space.

Figure 23 – Main Plaza Dimensions



4.1.2 Materials

The primary materials used in this space are granite stone pavers 6" x 6", brick pavers in a herringbone pattern, granite stone paving bands 18" x 24", and stone steps. There are deep brown wooden benches located throughout the area. Located in the center of the plaza are three 30'-0" flagpoles. There are also various plantings throughout the space.

4.1.3 Equipment

The lighting fixtures for the main plaza are a mixture of pole mounted, in-grade, and pole mounted metal halide fixtures. Figure 24 below and Table 16 on the next page show the lighting layout and lighting fixture schedule for the main plaza respectively. Additionally, the in grade fixtures shown in Figure 21 – Main Lobby 1000 Lighting Plan (second level) are included in the lighting for the main plaza.

Figure 24 – Main Plaza Lighting Plan

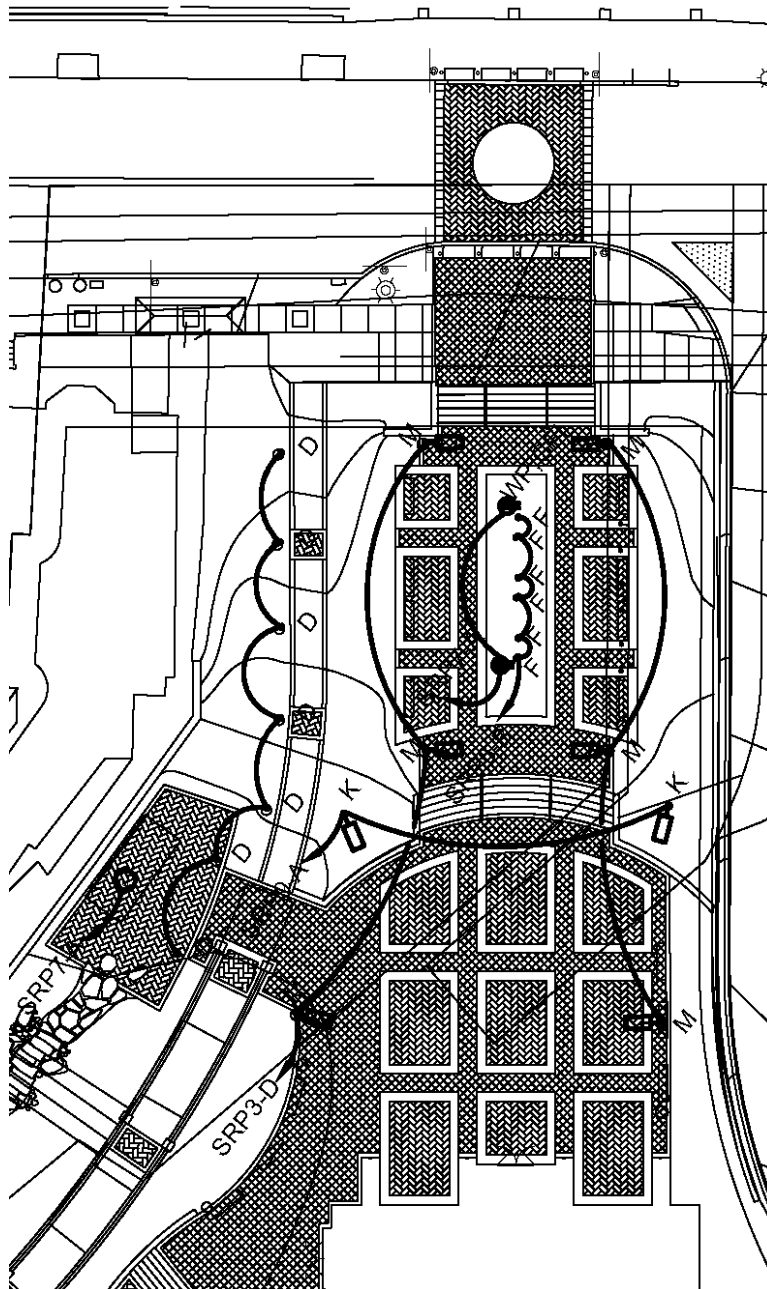


Table 16 - Main Plaza Lighting Fixture Schedule

Type	Description	Manufacturer	Model	Lamp	Input Watts	Voltage
D	8" DIA X 42" HIGH METAL HALIDE BOLLARD W/ INTEGRAL ELECTRONIC BALLAST & CONICAL LOUVERS. PROVIDE FORWARD THROW DISTRIBUTION.	HOLOPHANE	H101-42-39CMT6-277-FT-GEB-LPIC-CUSTOM FINISH	(1) GENERAL ELECTRIC 39WT6 COATED CMH	42	277
F	RECESSED IN-GRADE BRONZE METAL HALIDE UPLIGHT WITH MULTI-TAP VOLTAGE, MEDIUM FLOOD DISTRIBUTION, CLEAR FLAT LENS, INTERNAL HONEYCOMB LOUVER AND INTEGRAL ELECTRONIC BALLAST.	HOLOPHANE	H670-B-70CMT6-MVOLT-MFL-FLC-34B-IHL-GER-LP	(1) PHILIPS 70W CM T6	79	277
K	POLE MOUNTED METAL HALIDE SPOT REFLECTOR WITH INTEGRAL ELECTRONIC BALLAST, SPOT LAMP ON 5" DIAM. 10' HIGH STRAIGHT GALVANIZED ALUMINUM POLE, WITH CAST SHOE BASE AND NUT COVERS WITH CUSTOM FINISH ON ALL ITEMS.	ERCO BEAMER II PROJECTOR MAVERICK	34005.023 (FIXTURE) RNAP-10-50-A9-AB-GPSPCO10S5-CA/CC-TLR	(1) GENERAL ELECTRIC 70W MH	80	277
M	SINGLE PENDANT MTD 100W METAL HALIDE LUMINAIRE W/ BOWL GLASS, NARROW ASYMMETRIC DISTRIBUTION (49095.IES), DOME SHAPED CUT-OFF REFLECTOR, & LADDER BRACKET ON SINGLE BRACKET ARM & 10' POLE.	HOLOPHANE GLASSWERKS II BERN	GB-10DMH-27-1-A-S-72-N VL27/1- CA/CC FGIUL-SXXH(RECEPTACLE) COLORADO POLE CO10S5/10-CA/CC-TLR	(1) GENERAL ELECTRIC 100W MH	125	277

4.2 Design Criteria

The main plaza is the path that leads to the main entrance of the building. This area should be attractive while keeping efficiency and security as high as practical.

4.2.1 Qualitative

This space should be inviting and provide a sense of safety.

4.2.2 Quantitative

The ASHRAE requirements for an exterior located in Lighting Zone 2 are listed in Table 17 below.

Table 17 – Main Plaza LPD Requirements

Base	Plaza Areas	Main Entries	Building Facades (non tradable)
600 W	0.14 W/SF	20 W/lin ft of door width	0.1 W/SF

The IES Lighting Handbook illuminance recommendations for plazas located in Lighting Zone 2 are given in Table 18 below.

Table 18 – Main Plaza Illuminance Recommendations

Eh (lux)	Ev (lux)	Max:Avg	Avg:Min
4	2	4:1	5:1

The IDA and the IES jointly produced Model Lighting Ordinance (MLO) 2011 provides recommendations to achieve in order to limit light trespass and sky glow. These recommendations should be followed in order to keep the negative impacts of the site on the neighbors to a minimum. The performance method for complying with the MLO limits the site lumens for Lighting Zone 2 to 7,000 base lumens plus 2.5 lumens per square foot. Additionally, the performance method of the MLO requires a model of the site lighting to be developed with zero reflectance boundaries at the property lines and at least 33 feet above the tallest luminaire. The total lumens on the enclosing surface must be no more than 15% of the total site lumens and the single point illuminance on the enclosing surface must not be greater than 3.0 LUX.

4.3 Evaluation

The allowed lighting power for the main plaza according to AHSRAE 90.1 2013 was calculated to be 2896 watts, see Table 19 below. The lighting power for the design was calculated to be 3678 watts, see Table 20 below. This difference can be made up for by trading watts with other locations. Additionally, the remaining façade is not nearly as illuminated as the front façade so the remaining façade will probably account for the overage in this area. Building façade lighting power is not tradable.

Table 19 – Main Plaza Allowed Lighting Power

Main Entry			Plaza Areas		
Allowance (W/lin FT of door)	Door width (FT)	Total (W)	Allowance (W/SF)	Area (SF)	Total (W)
20	12	240	0.14	8000	1120

Walkway <10 FT wide			Building Facades		
Allowance (W/lin FT)	Length (FT)	Total (W)	Allowance (W/SF)	Area (SF)	Total (W)
1	80	80	0.1	14560	1456

Table 20 – Main Plaza Lighting Power

Space	Fixture	Quantity	Lamps per fixture	Watts per lamp	Watts per fixture	Total watts	Space Type	Allowed Watts
Main Plaza						3678	Lighting Zone 2	2896
	D	7	1	39	42	294		
	F	6	1	70	79	474		
	K	2	1	70	80	160		
	M	6	1	100	125	750		
	EU1	16	1	100	125	2000		

5. References

ASHRAE. (2013). *Standard 90.1-2013 Energy Standard for Buildings Except Low-Rise Residential Buildings*.

DiLaura, D. L., Mistrick, R. G., Houser, K. W., & Steffy, G. R. (2011). *Illuminating Engineering Society The Lighting Handbook: Reference and Application Tenth Edition*. New York, NY: Illuminating Engineering Society of North America.

IDA-IES. (2011). *Model Lighting Ordinance*. Illuminating Engineering Society and International Dark Sky Association.

Plans and details Courtesy of HOK
AGI renders and calculations by Joshua Lange