



Stephanie Deckard | Final Thesis Presentation | Lighting/Electrical

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Lighting Concept

South Façade and Grounds

Lighting Design

Atrium

Architectural Breadth: Daylight/Circulation

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Electrical Depth: Dual Bus System

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HISTORICAL

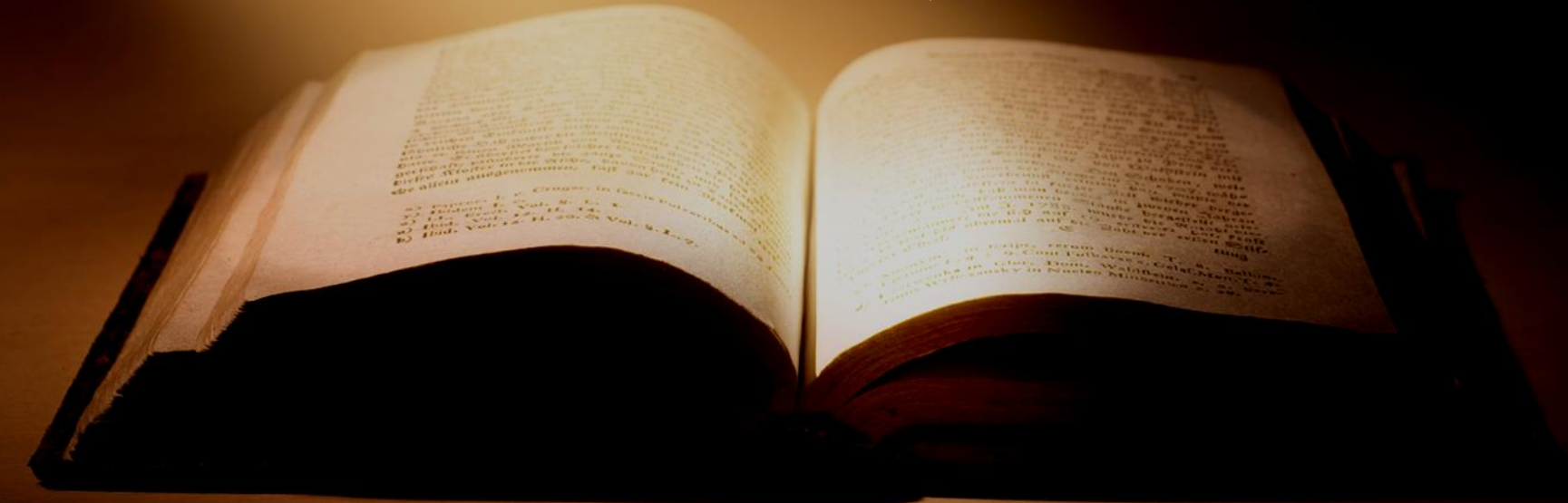
DAYLIGHT

FUNCTIONAL

Jesus spoke to them saying:

“I am the **light** of the
world.”

John 8:12



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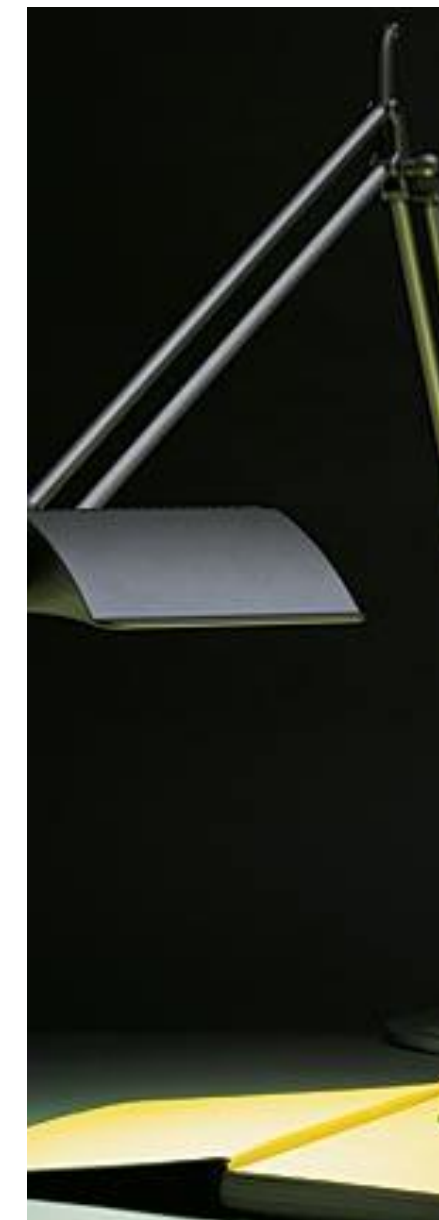
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ICONIC

SPARKLE

TASKS

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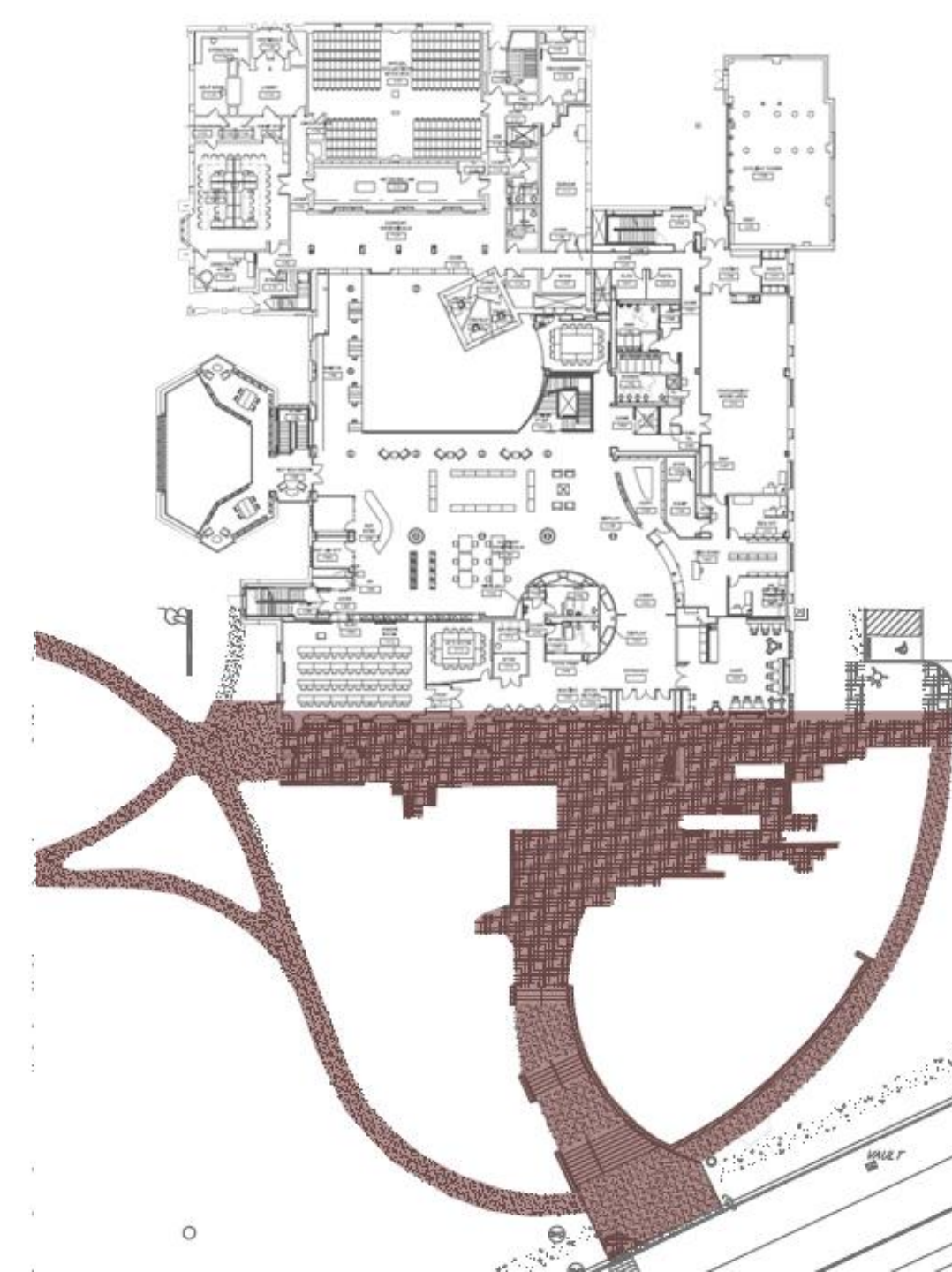
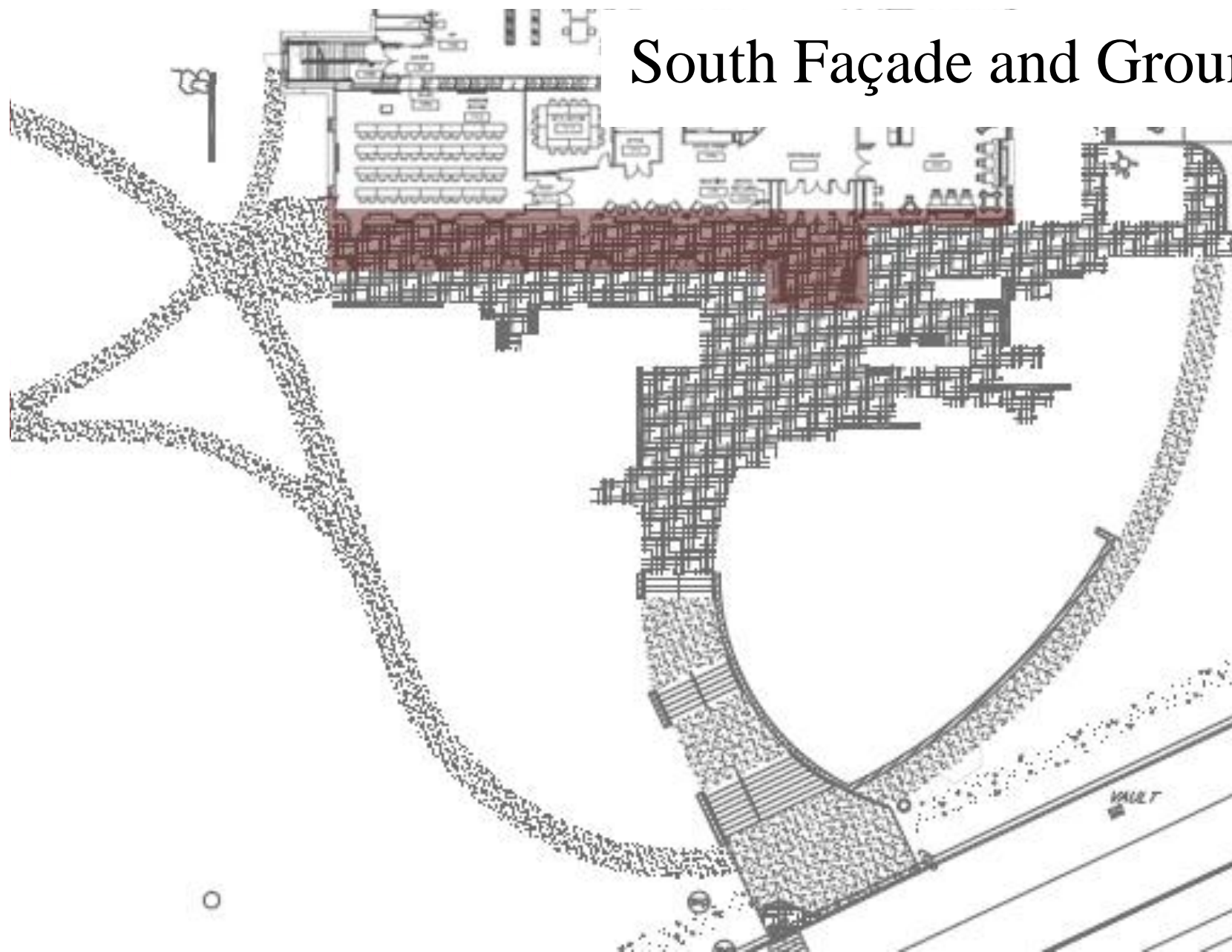
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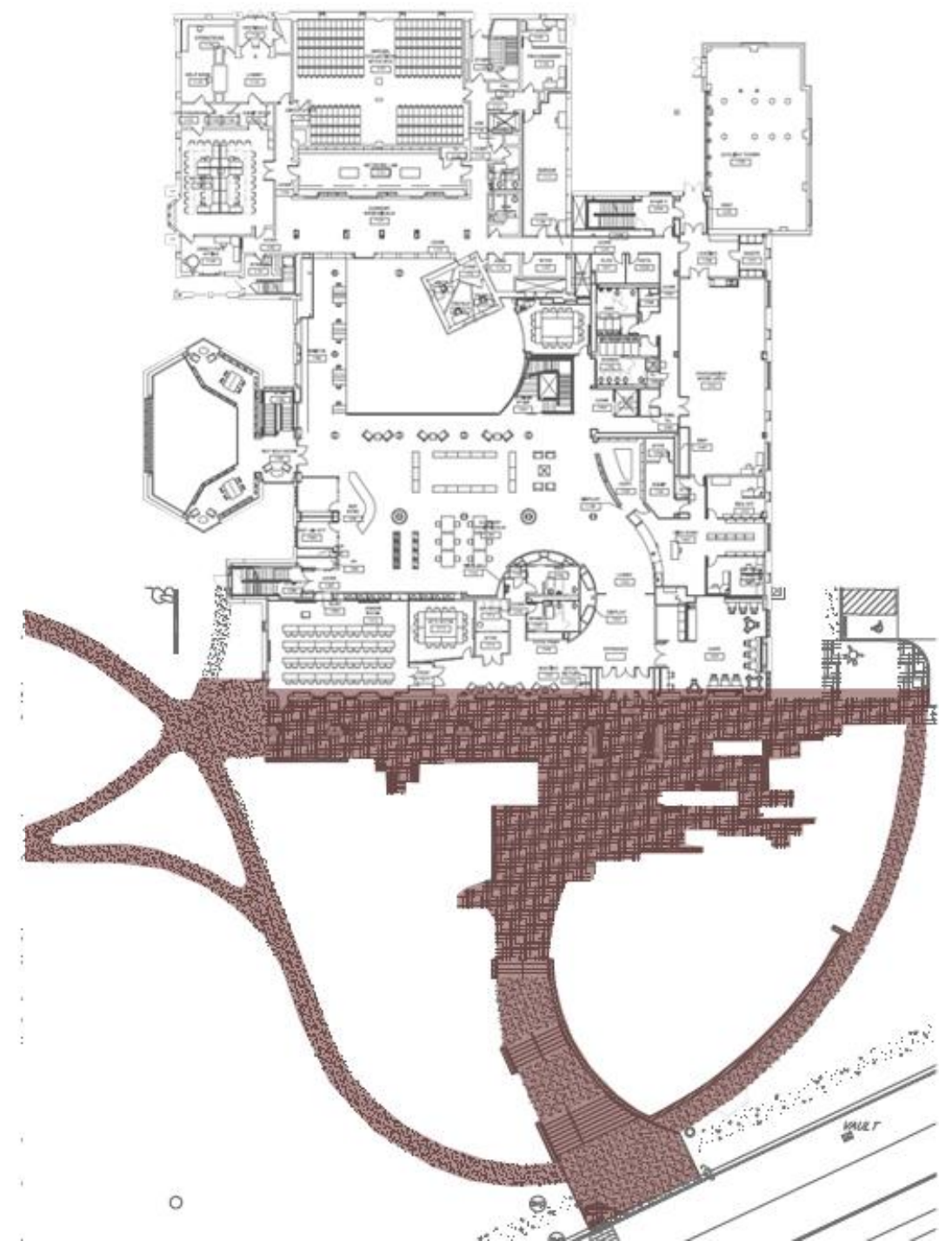
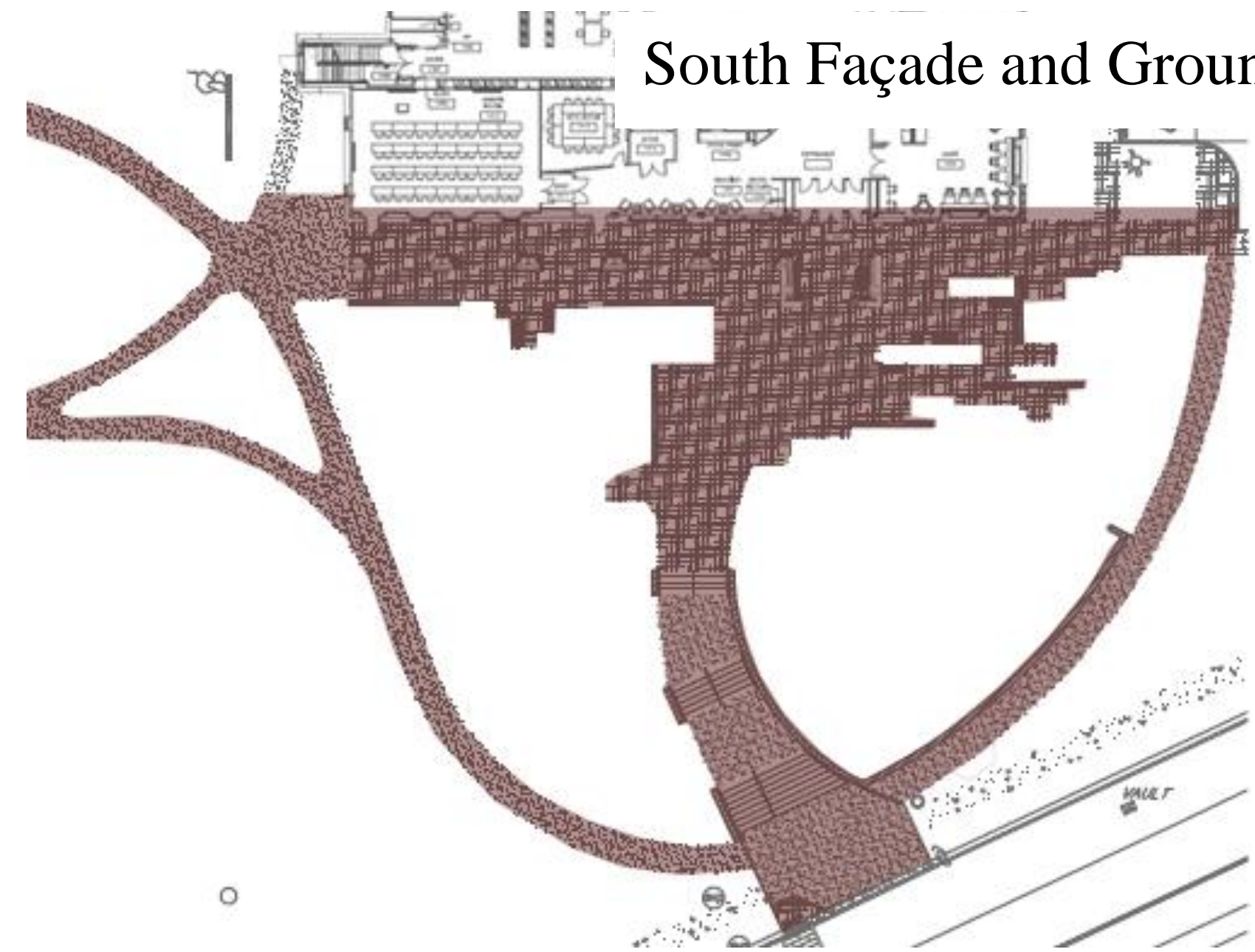
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ICONIC

WAYFINDING

SAFETY

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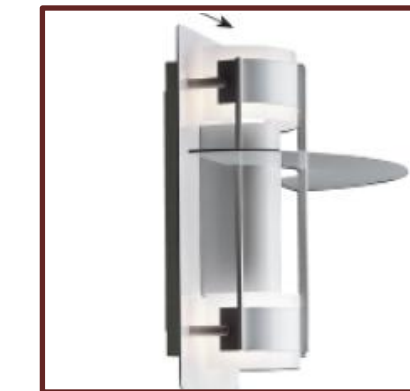
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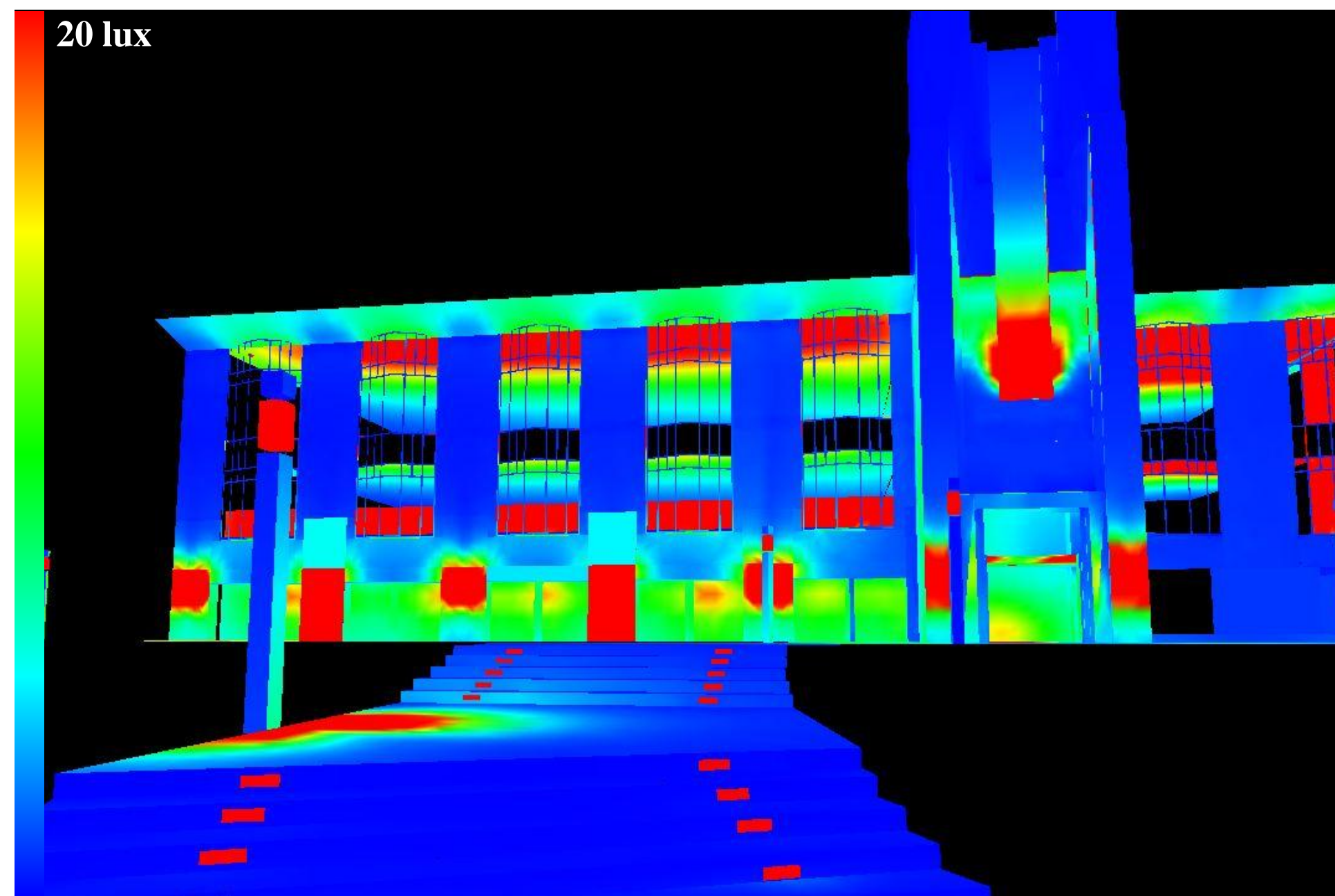
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MEDIUM ACTIVITY LZ2

Façade	$E_v = 60 \text{ lux}$
Paths to Curb	$E_h = 7 \text{ lux}$ $E_v = 1.1 \text{ lux}$
Canopied Entry	$E_h = 12.6 \text{ lux}$ $E_v = 7.7 \text{ lux}$

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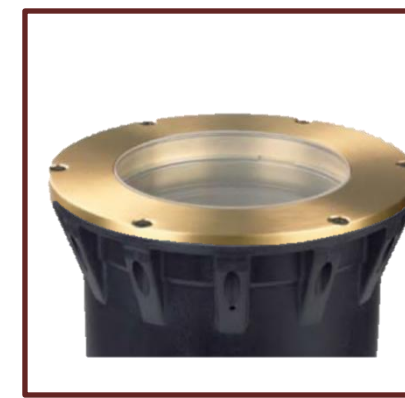
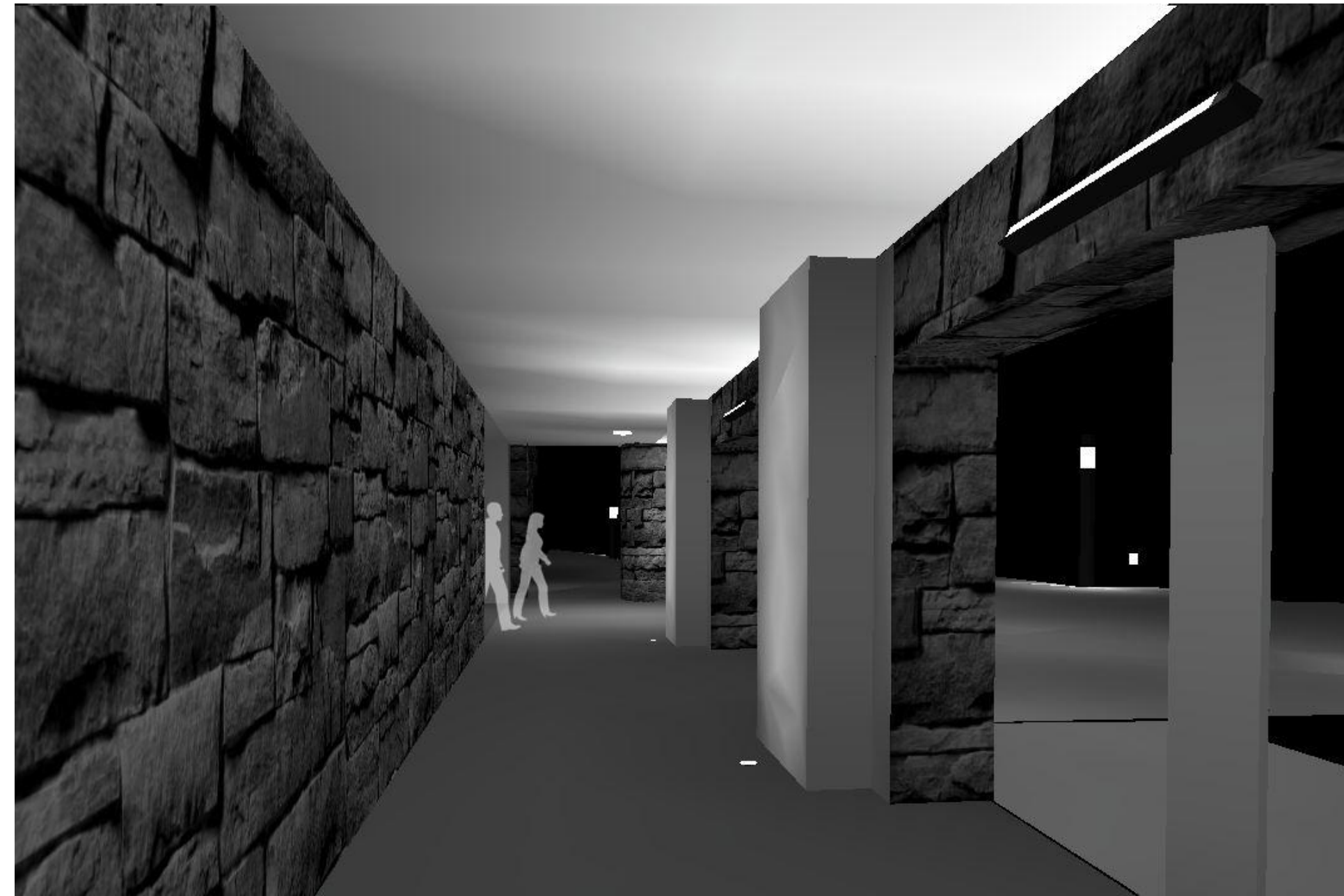
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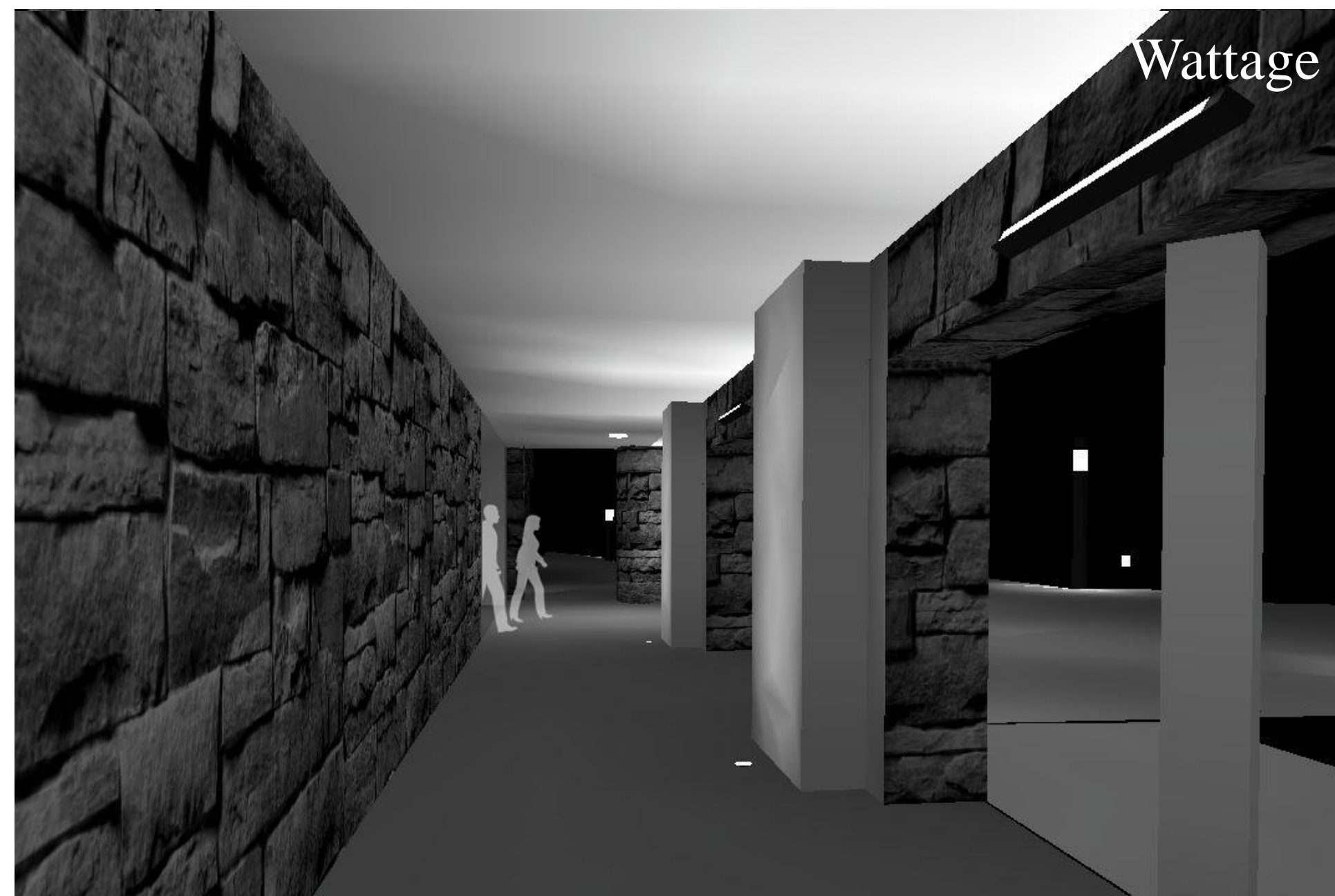
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GROUND

Walkways < 10ft wide		0.7 W/lf
Walkways >= 10ft wide		0.12 W/sqft
Pedestrian tunnels		0.14 W/sqft

FACADE

Facade | 0.1 W/sqft

ENTRANCE

Main Entries | 10.8 W/sqft

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Controls

LUTRON ENERGI SAVR NODE

LUTRON GRAFIK EYE

LUTRON XPJ SWITCHING CONTROL

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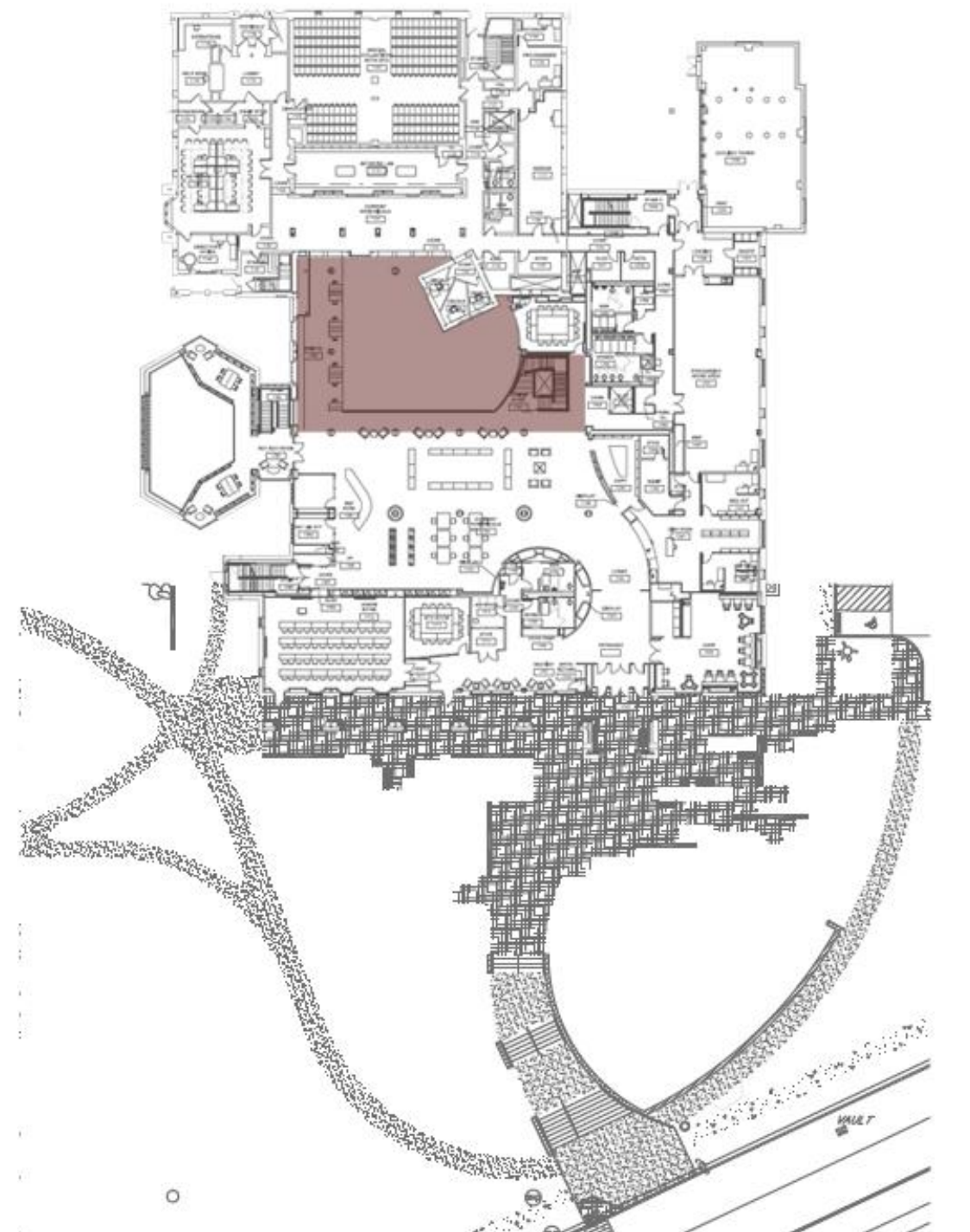
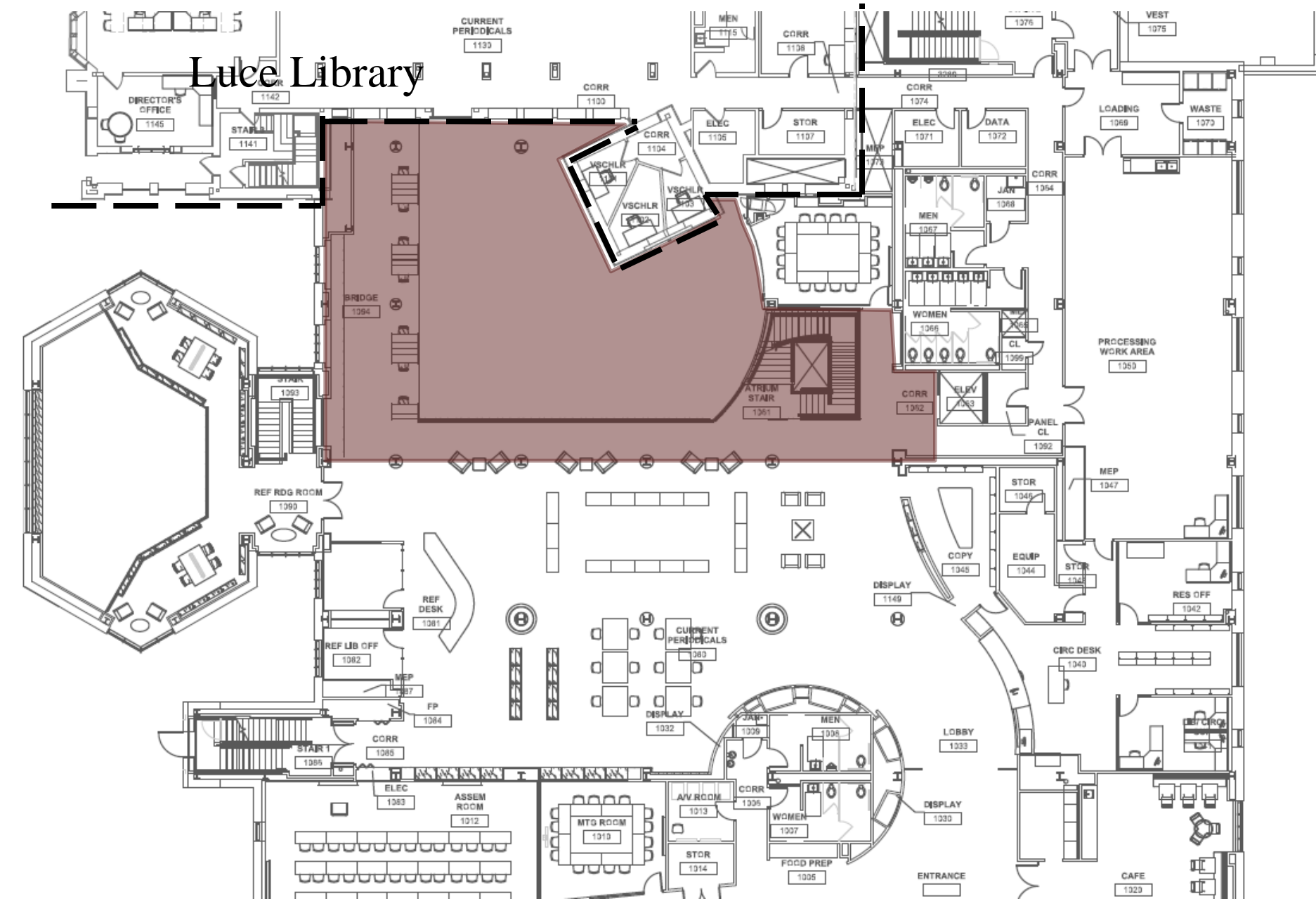
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FUNCTIONAL

MEMORABLE

EFFICIENT

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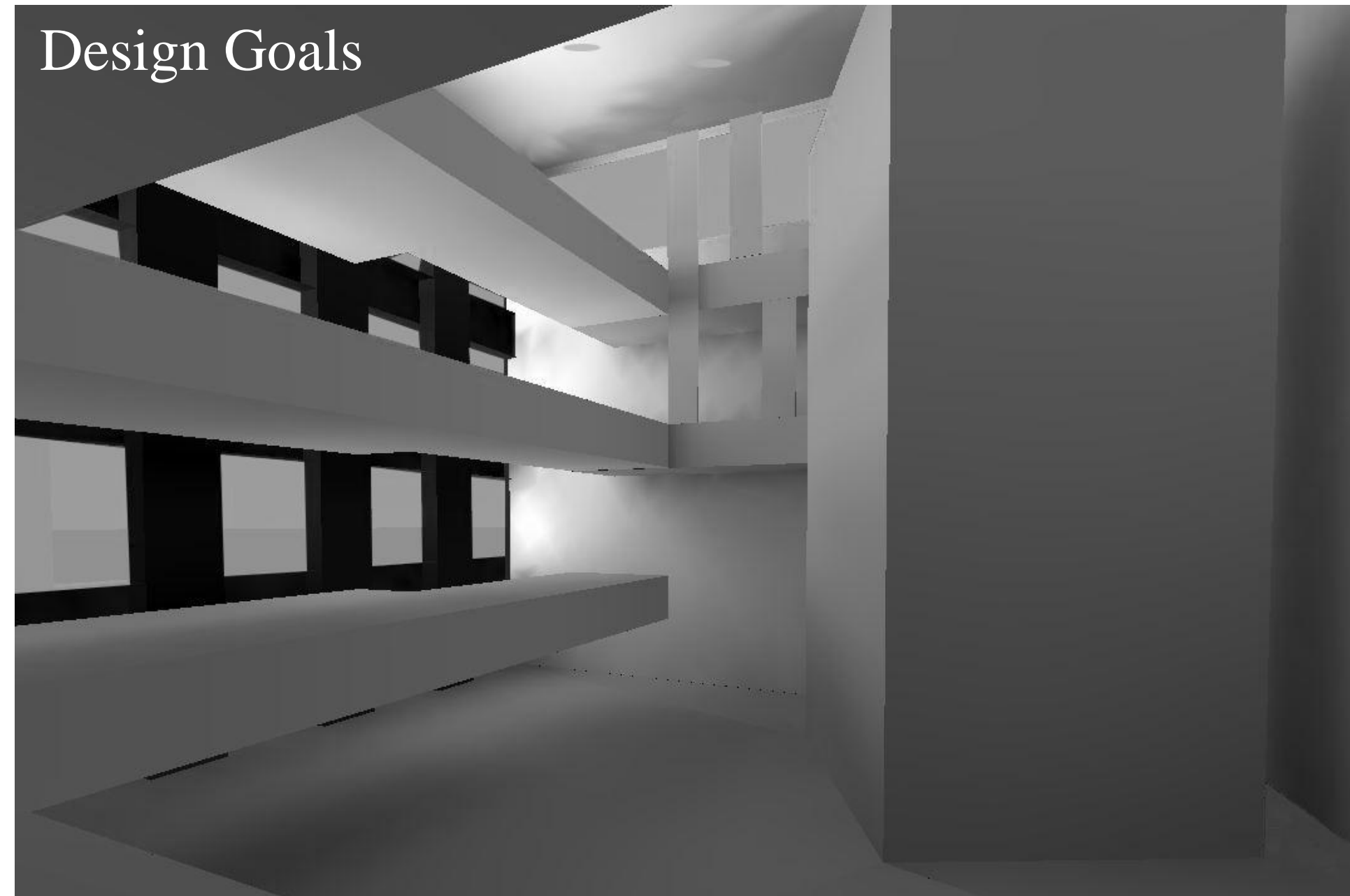
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MAXIMIZE DAYLIGHT

CENTRALIZE CIRCULATION

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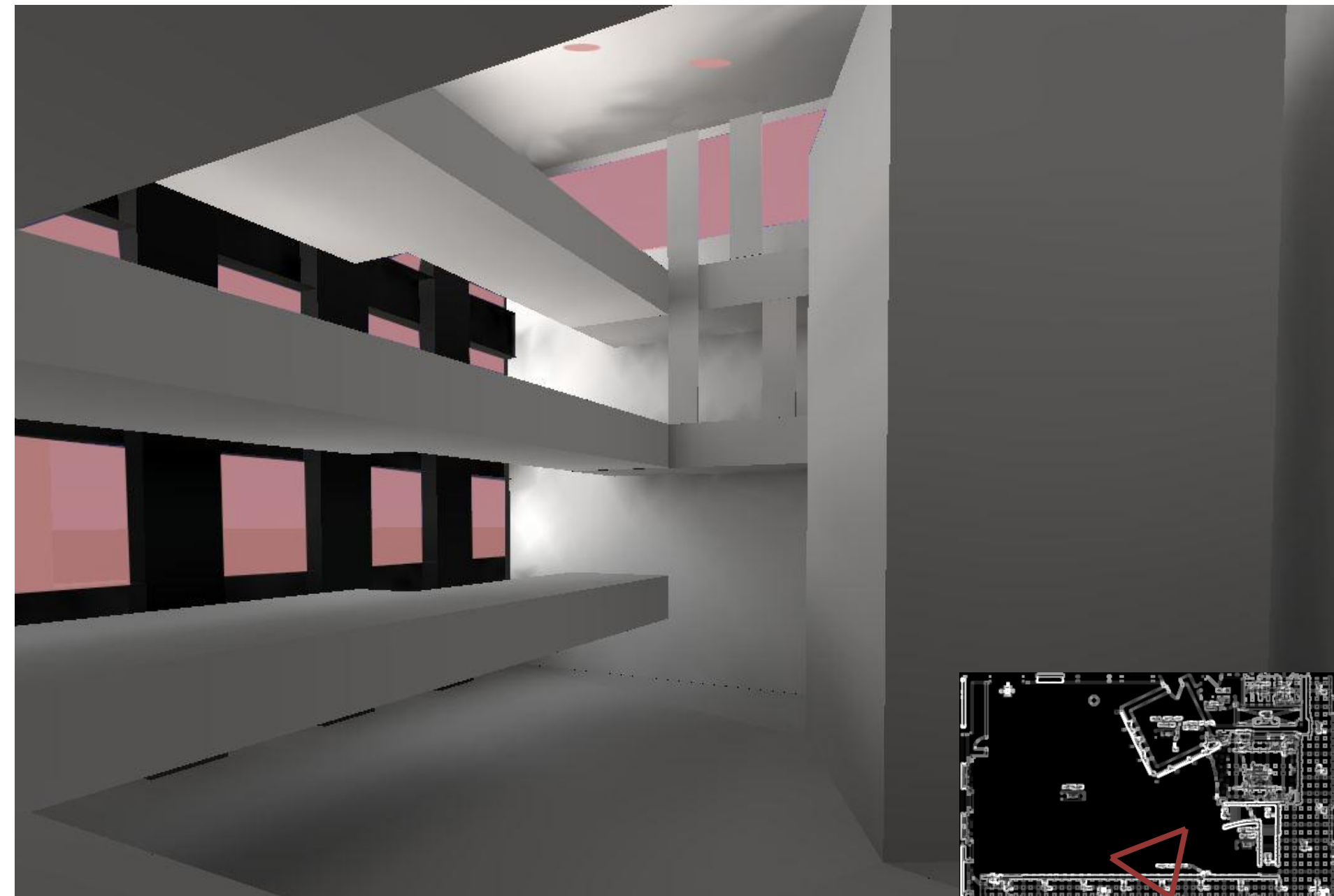
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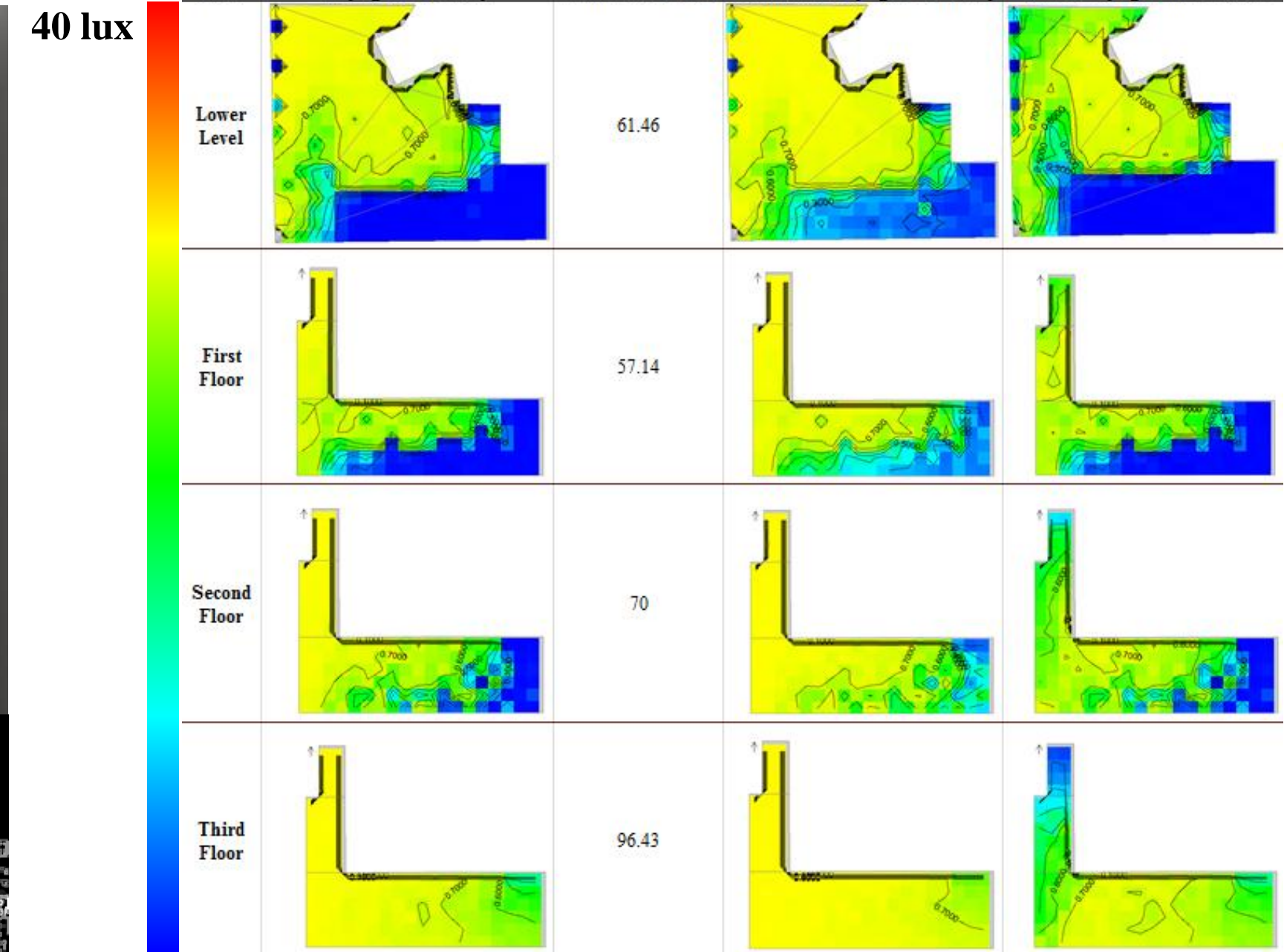
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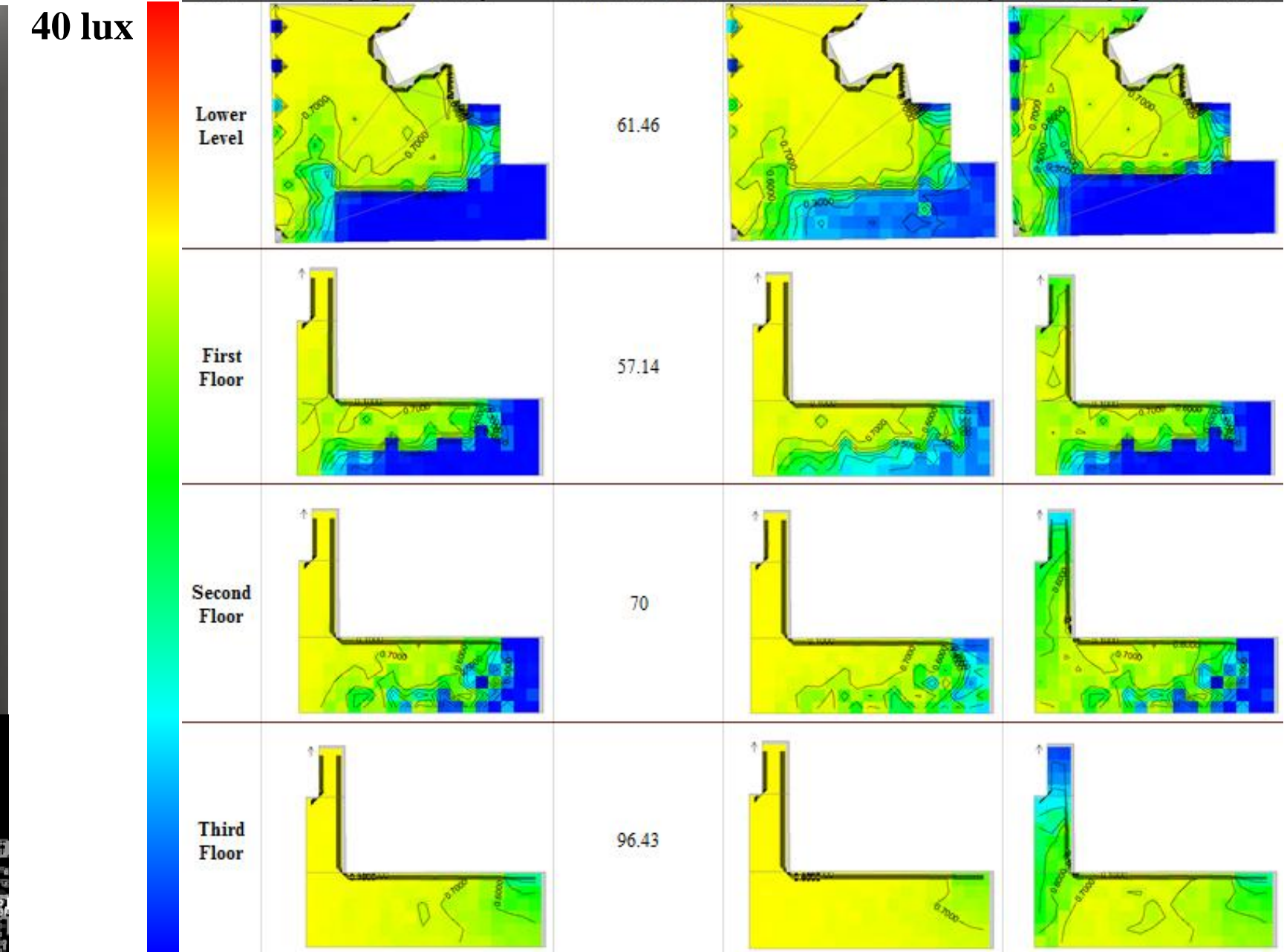
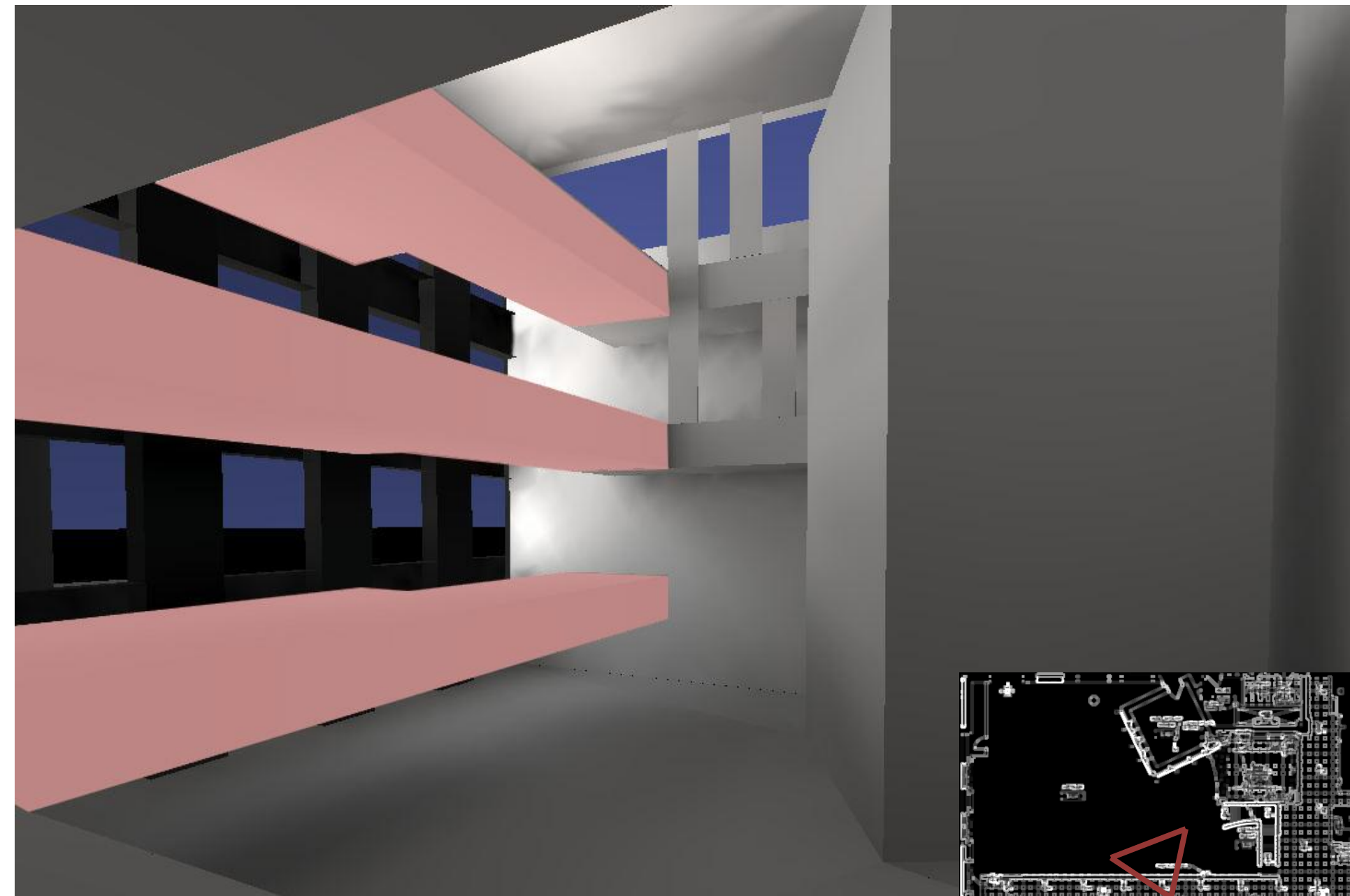
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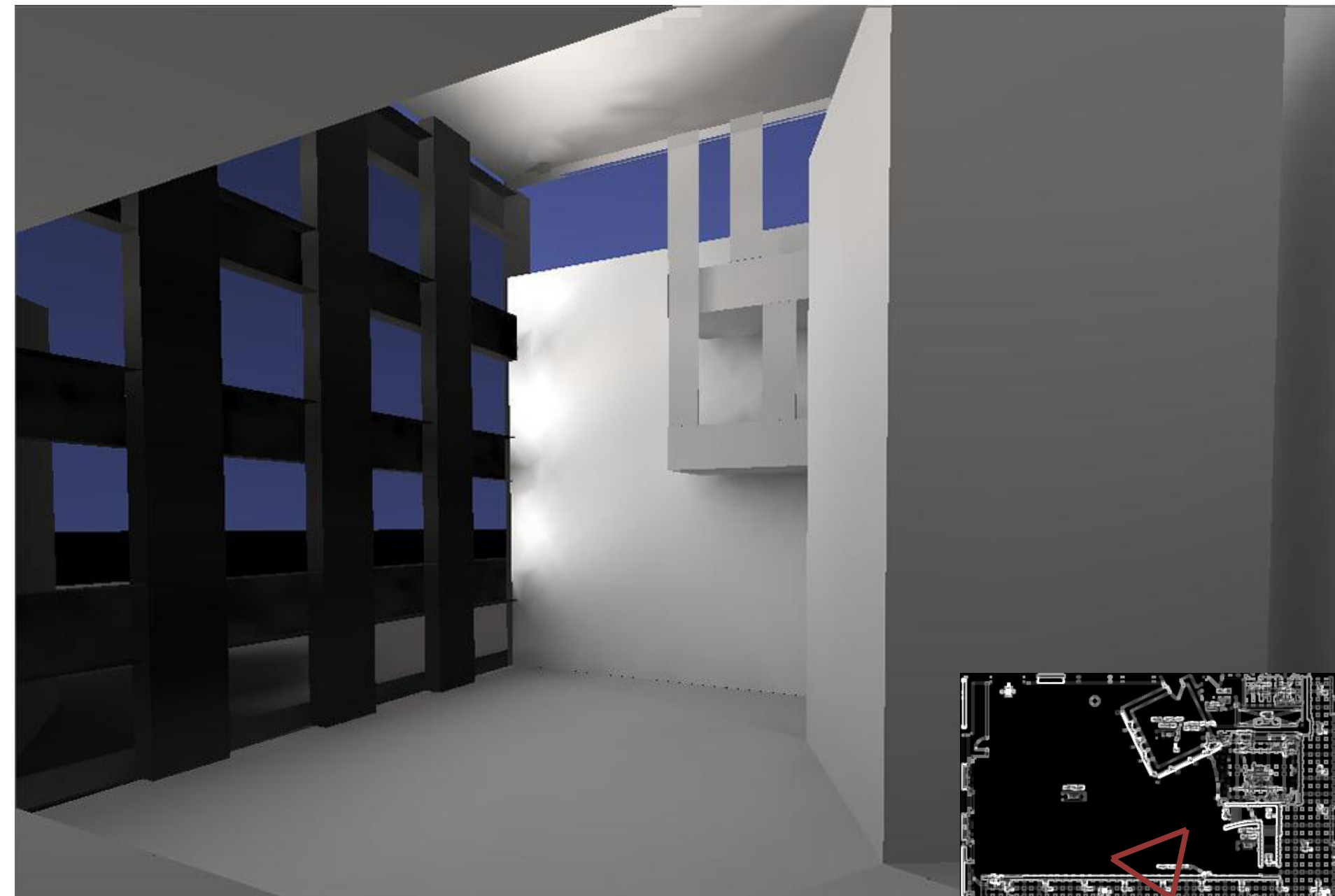
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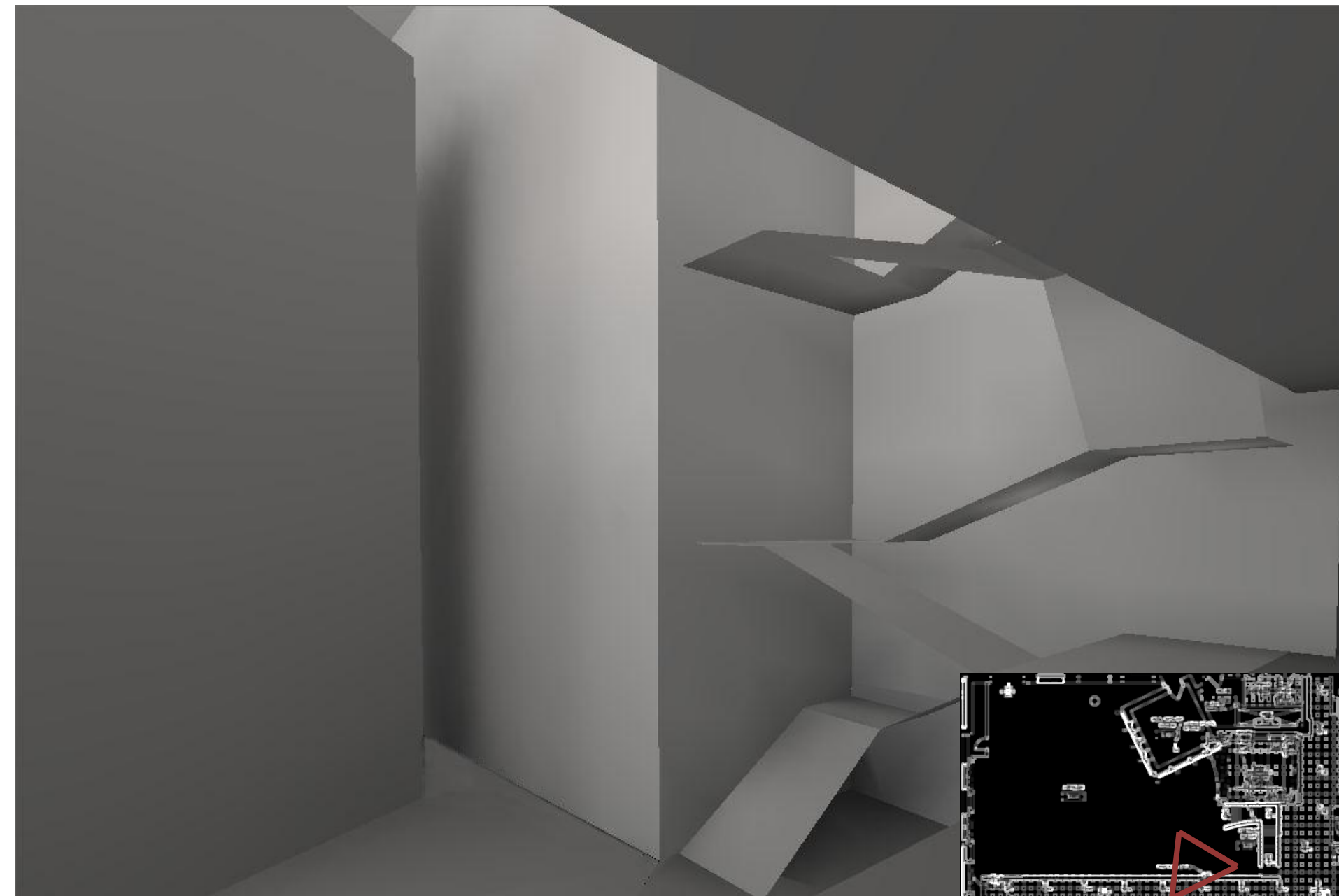
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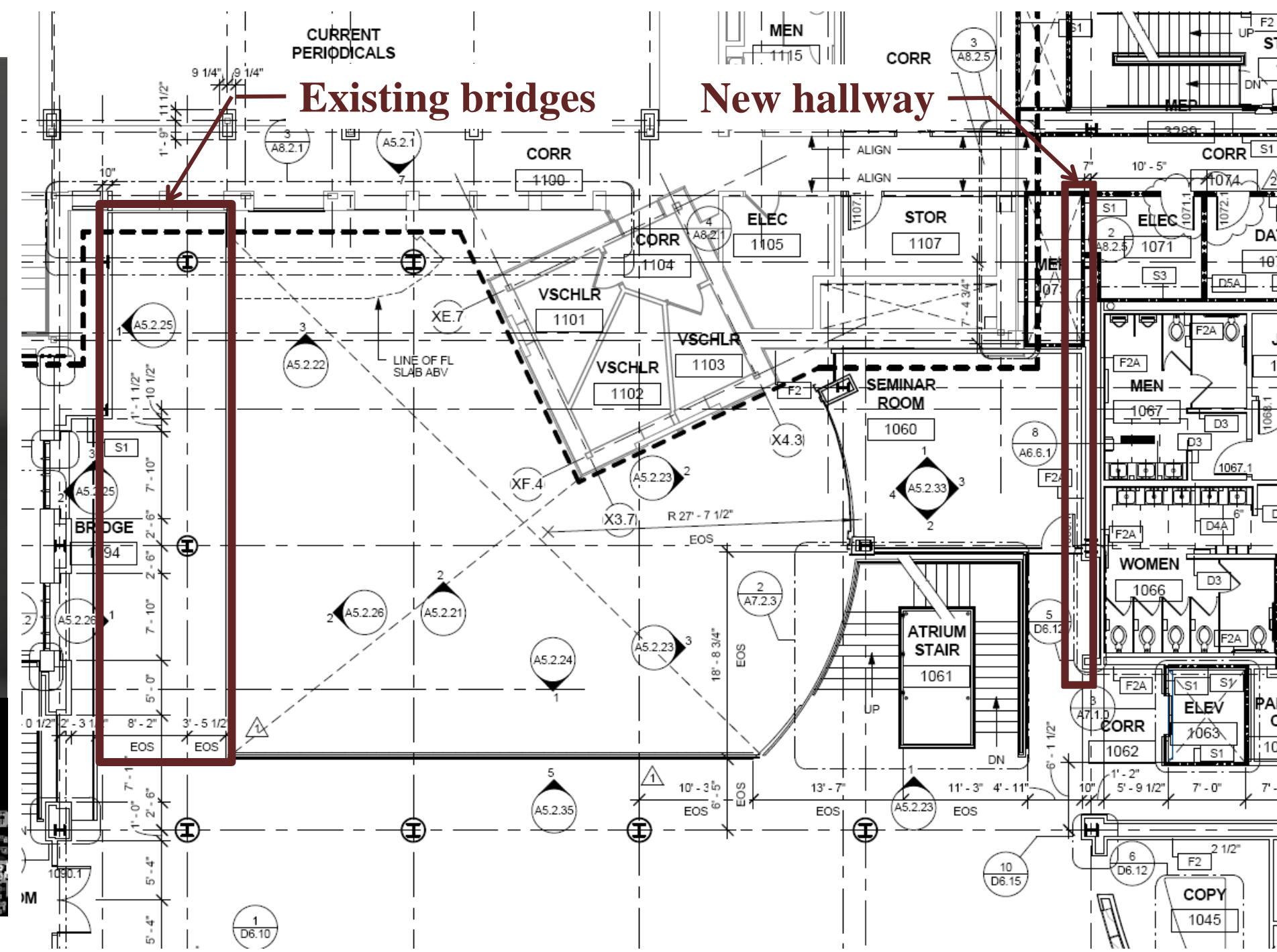
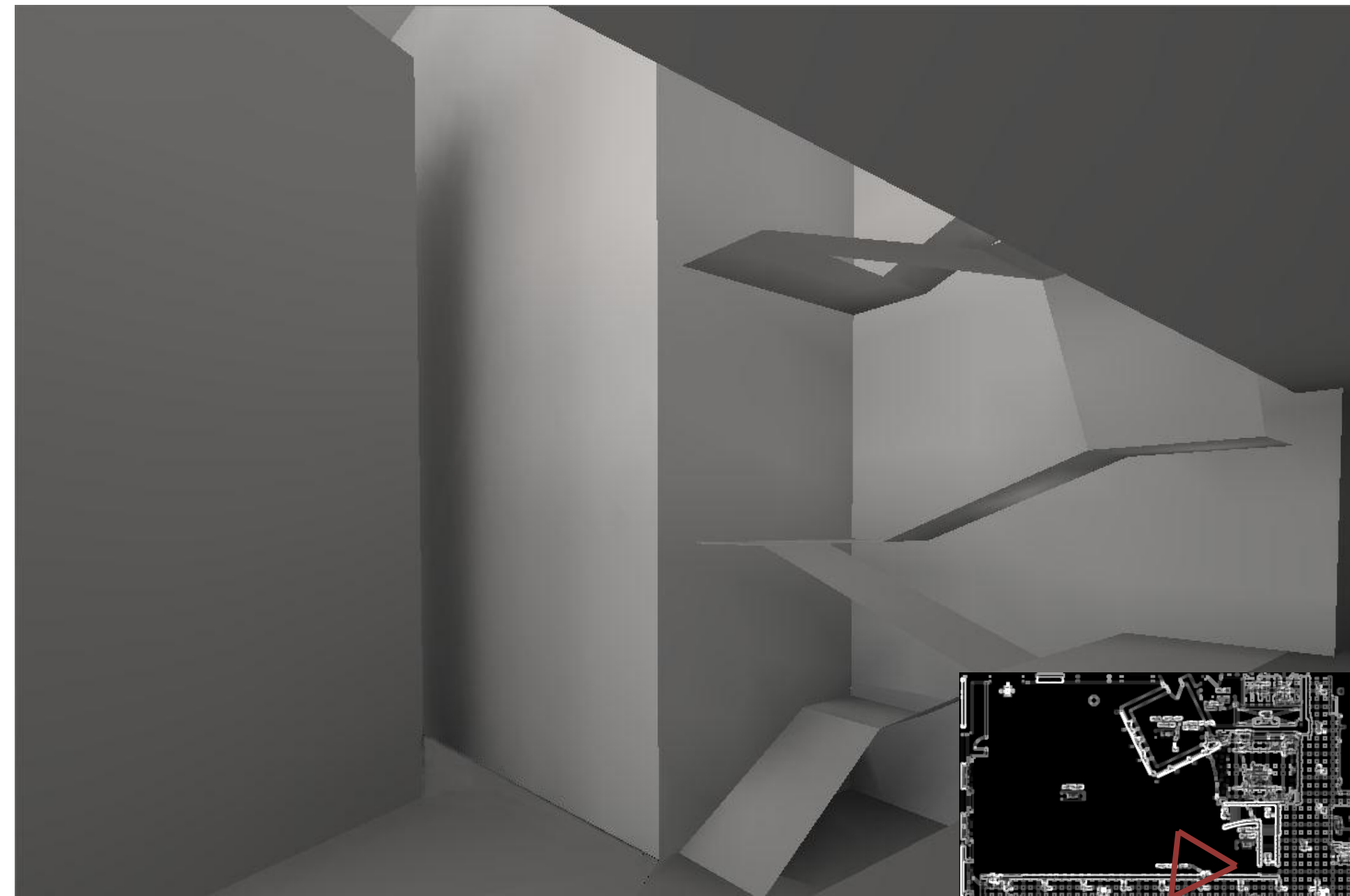
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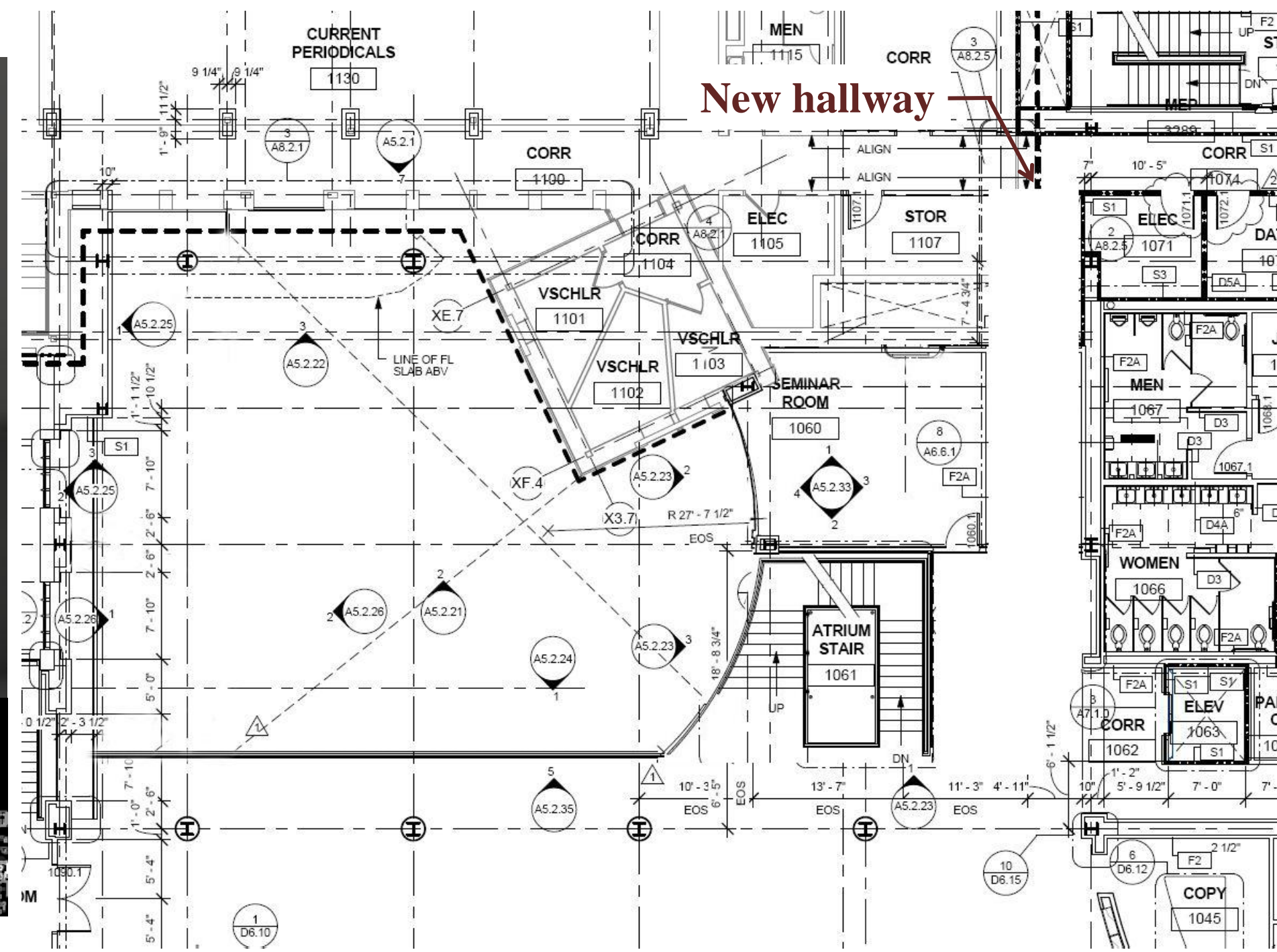
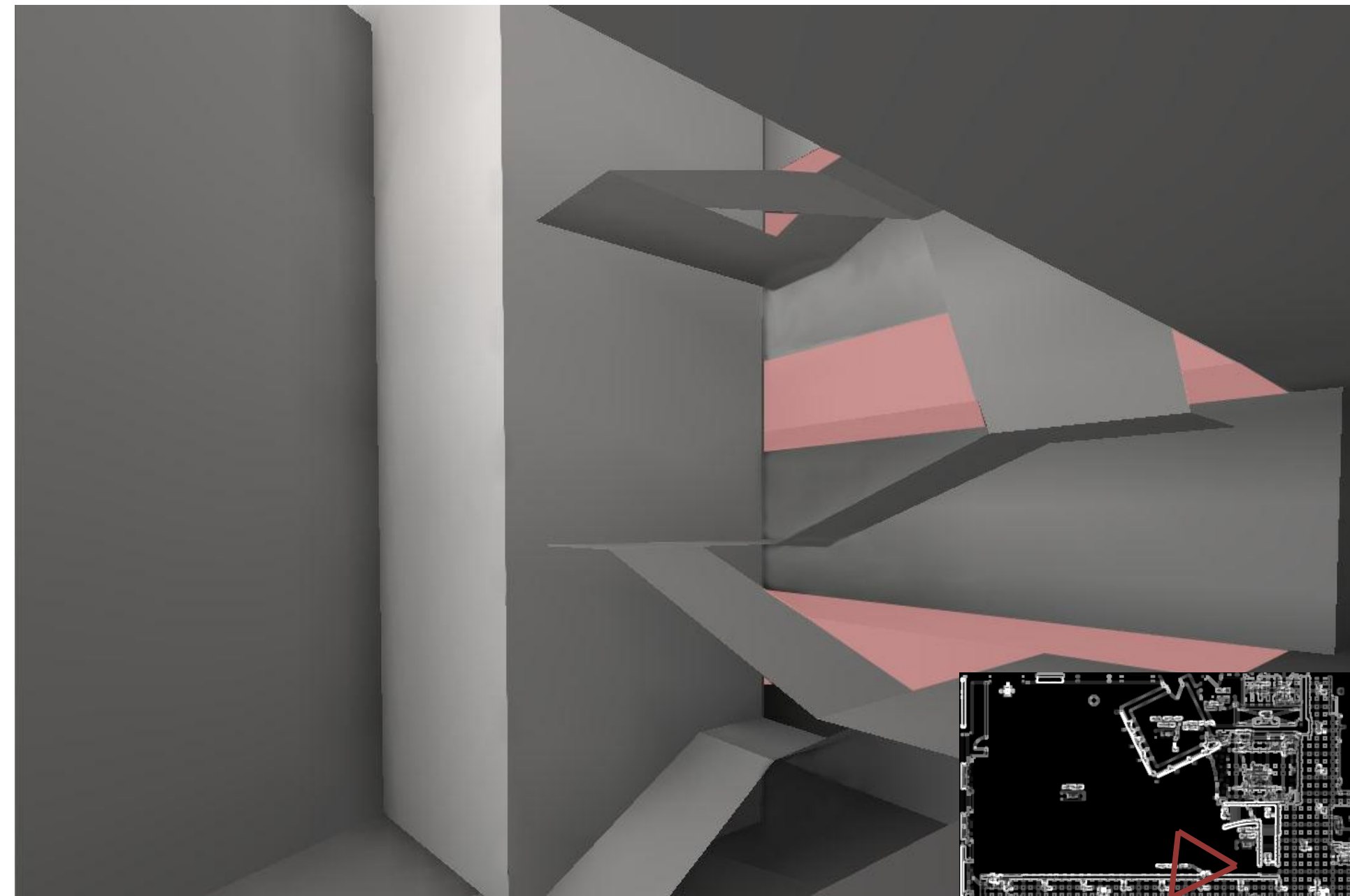
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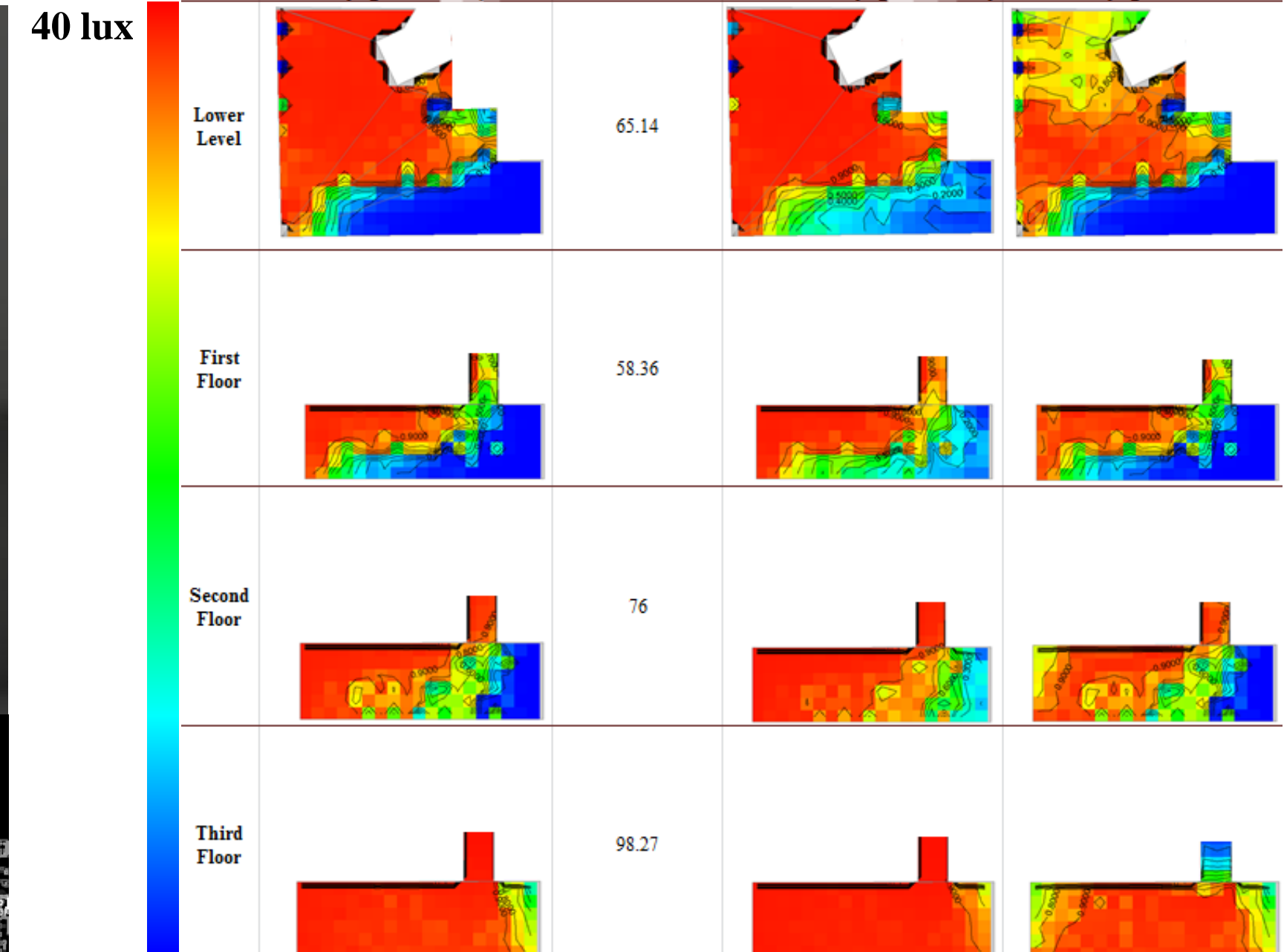
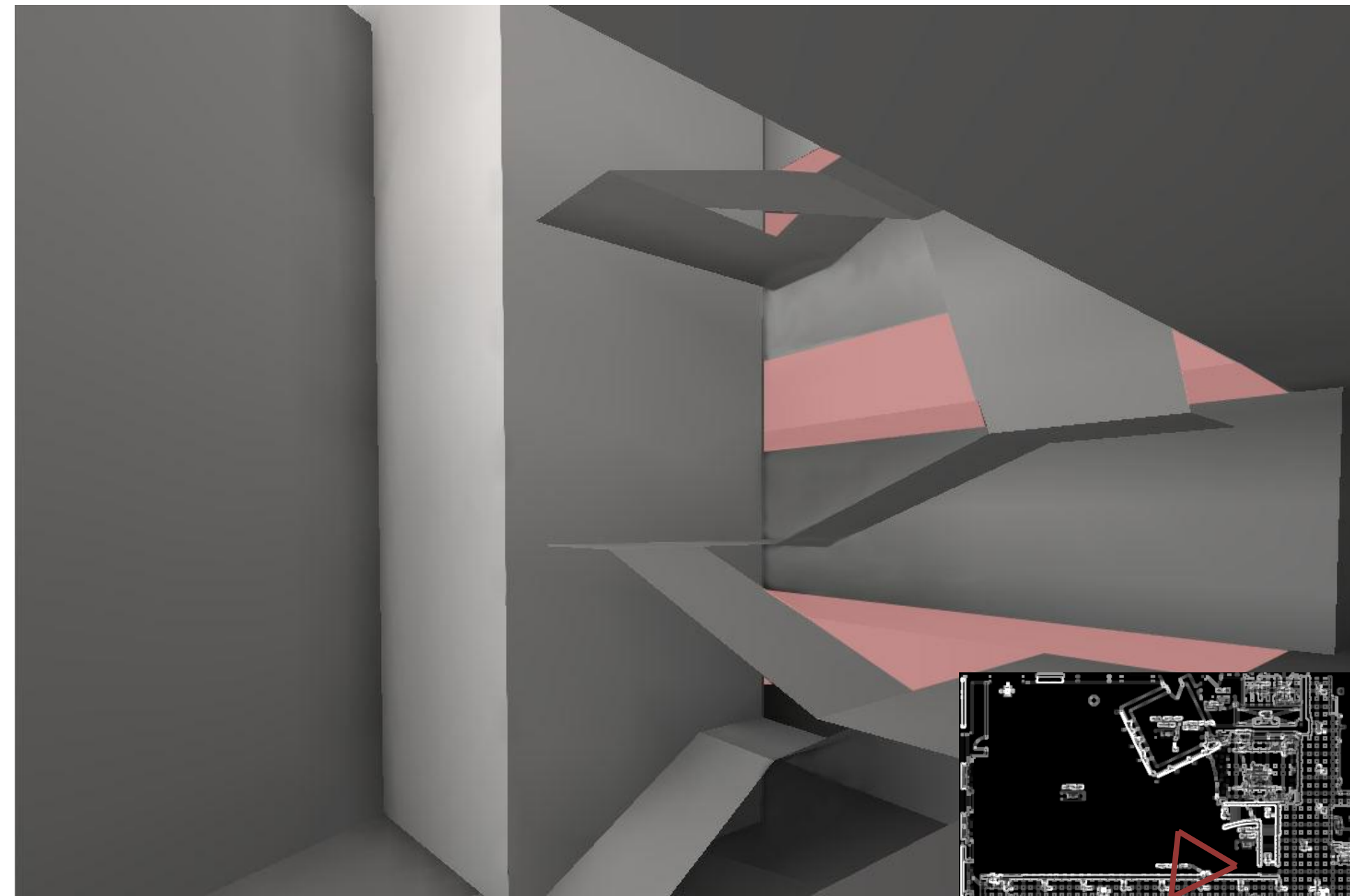
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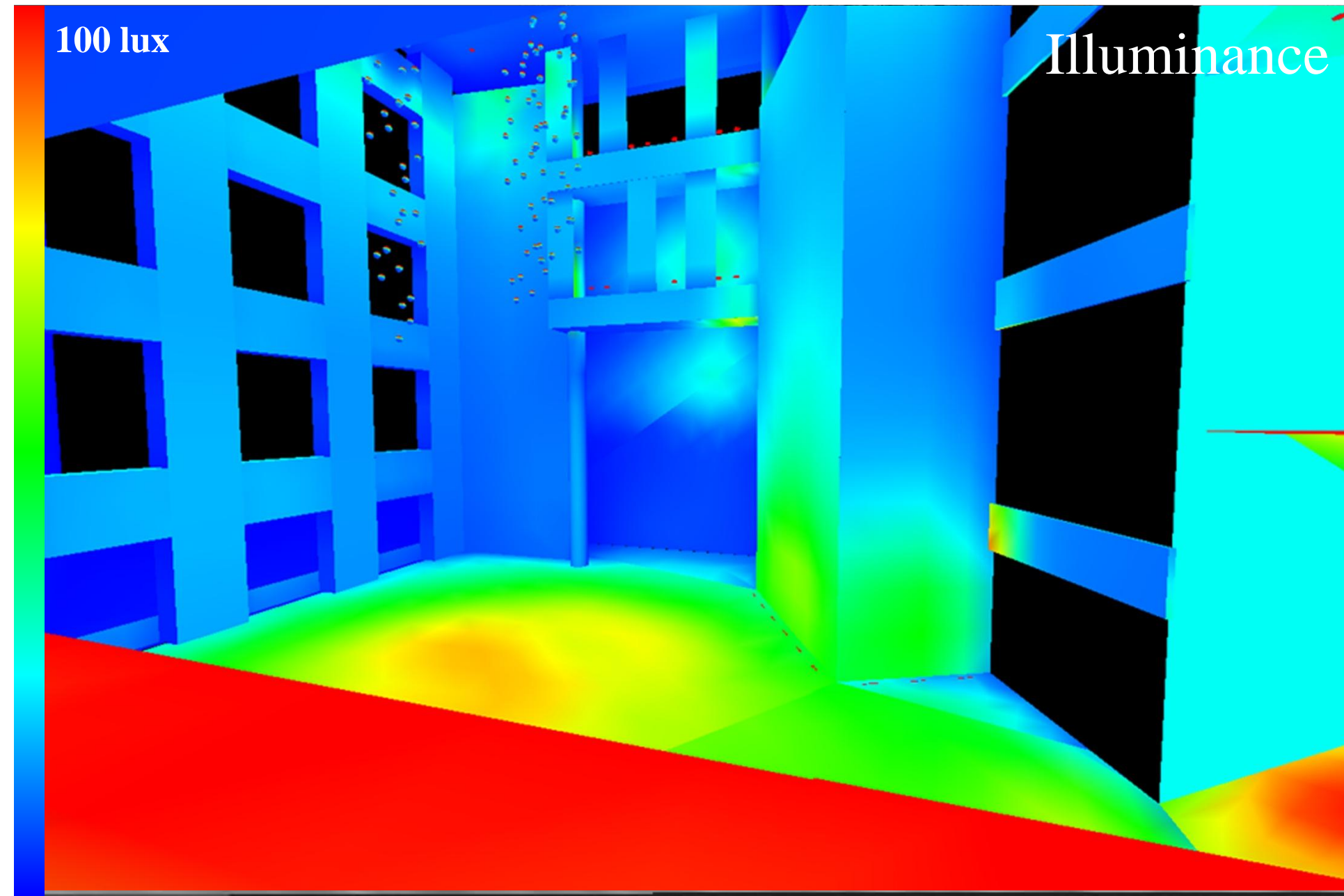
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READING AREAS

Tables and Chairs | $E_h = 474 \text{ lux}$
 $E_v = 276 \text{ lux}$

CIRCULATION CORRIDOR

Public Adjacency Passageways | $E_h = 90 \text{ lux}$
 $E_v = 71 \text{ lux}$
Atrium Passageway | $E_h = 41 \text{ lux}$
 $E_v = 28 \text{ lux}$

STAIRS

Typical | $E_h = 85 \text{ lux}$
 $E_v = 26 \text{ lux}$

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ATRIUM
40 ft and above in height | 0.23 W/sqft

TRANSITION
Corridor | 0.66 W/sqft

LIBRARY
Stacks | 1.26 W/sqft

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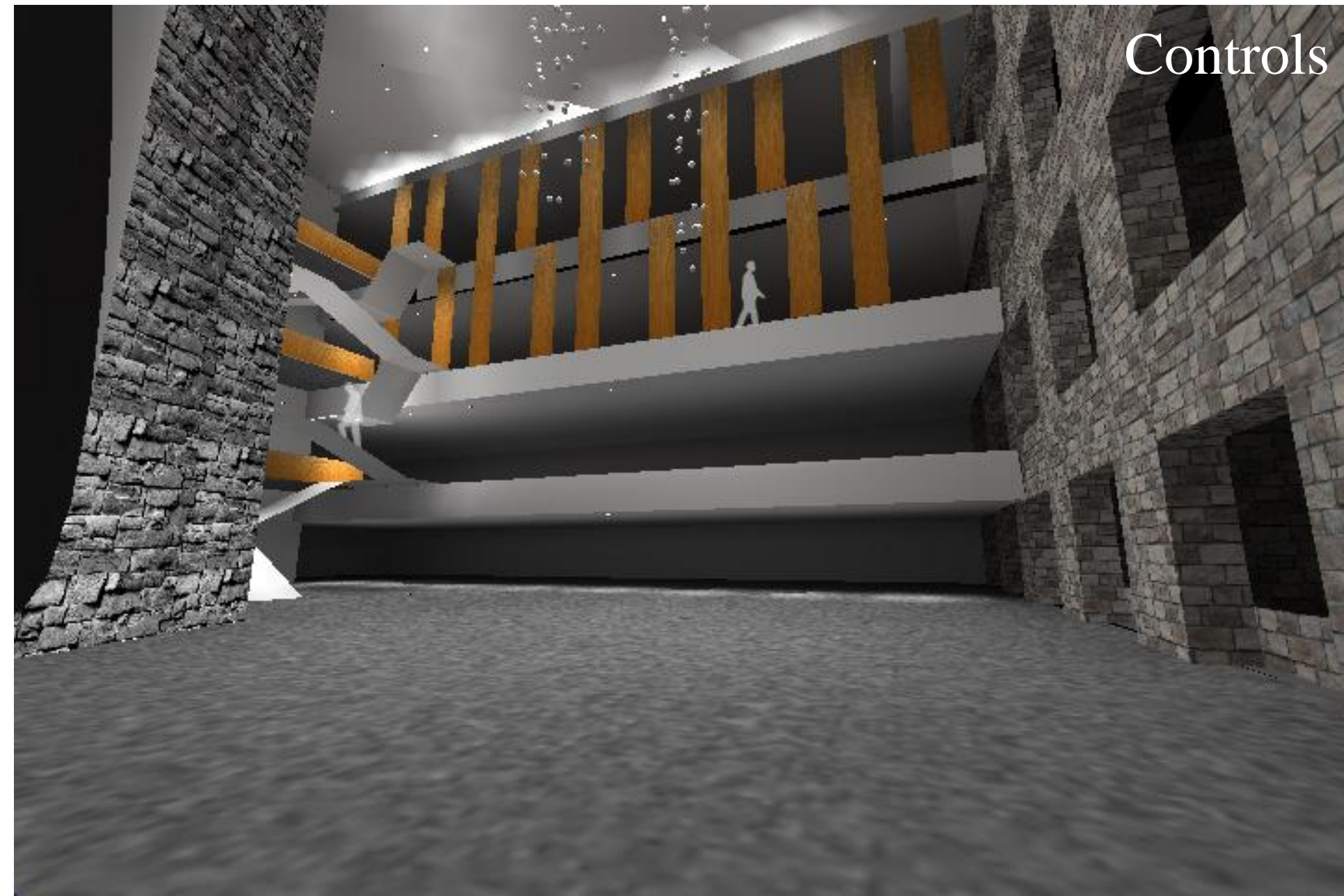
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LUTRON XPJ SWITCHING CONTROL

LUTRON RADIO POWR SAVR WIRELESS
DAYLIGHT SENSOR

LUTRON LOS C SERIES VACANCY SENSOR

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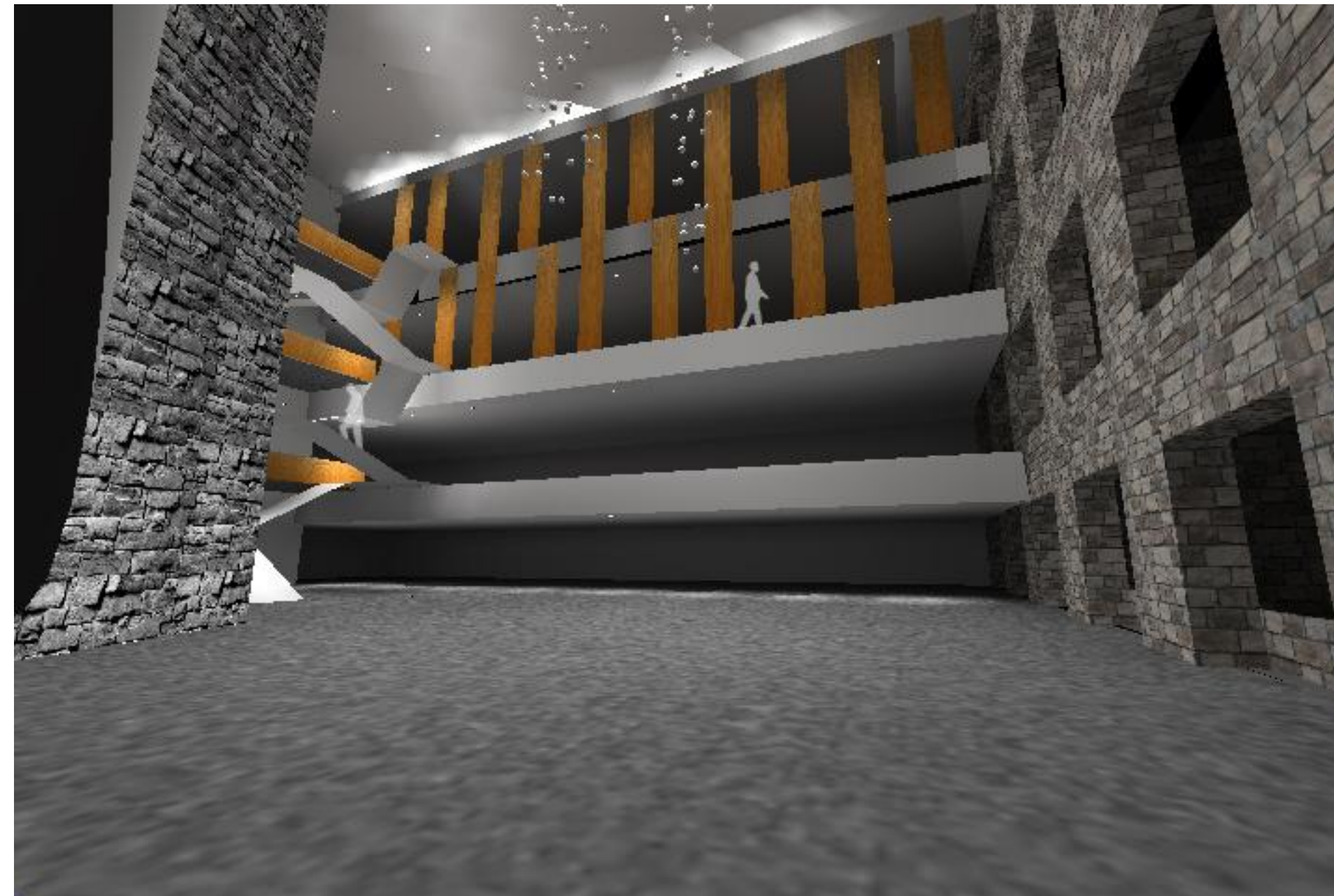
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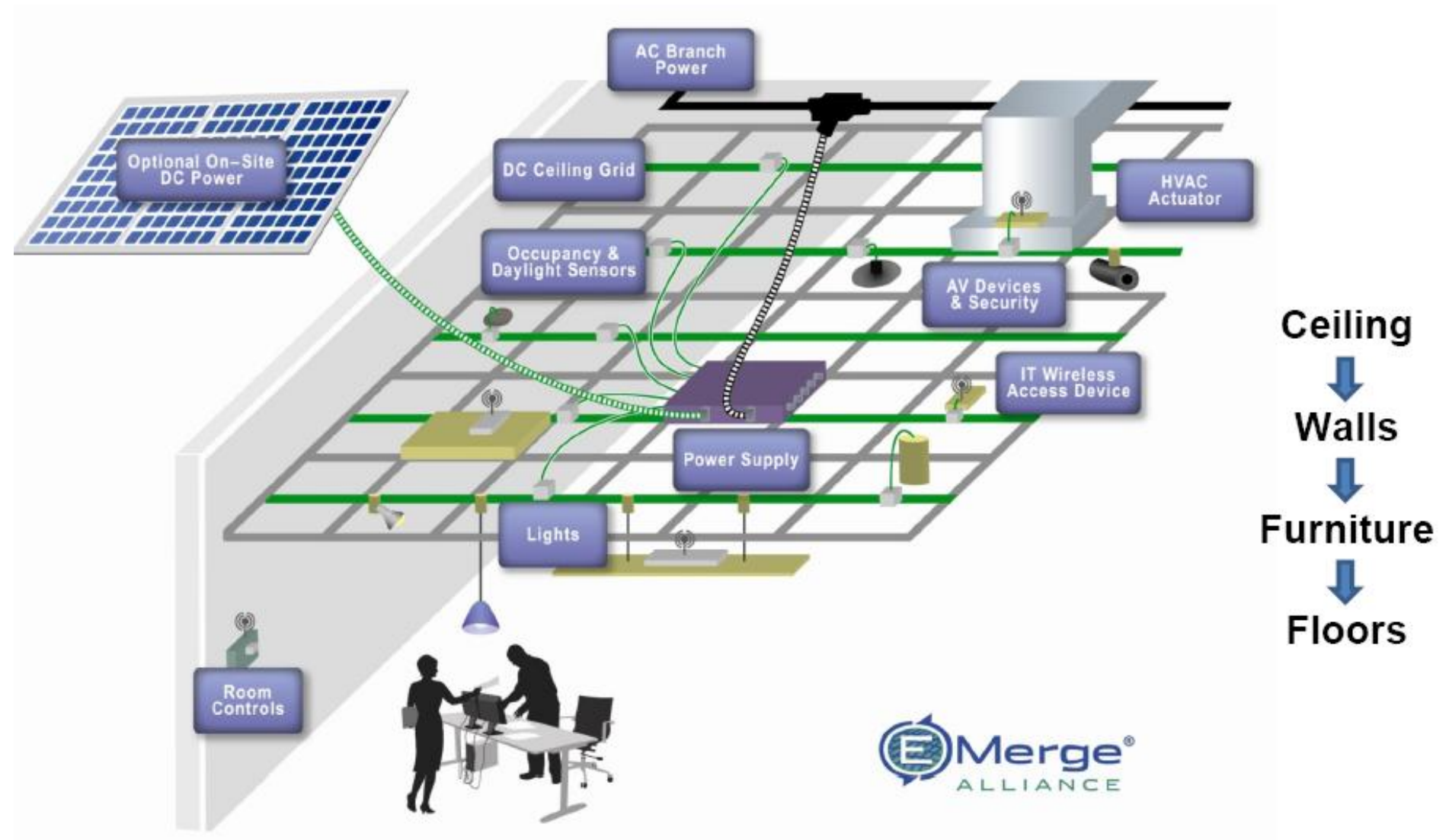
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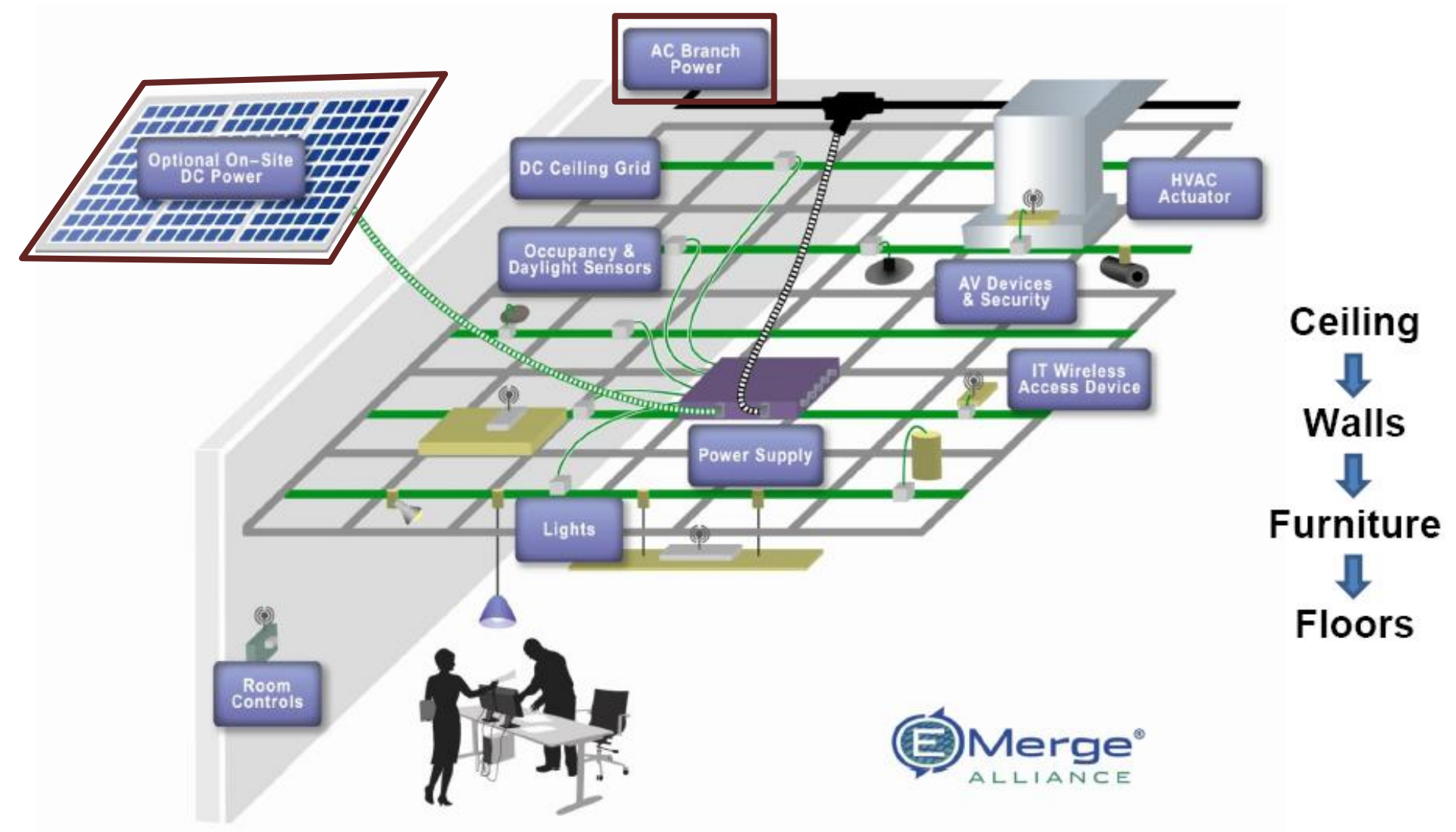
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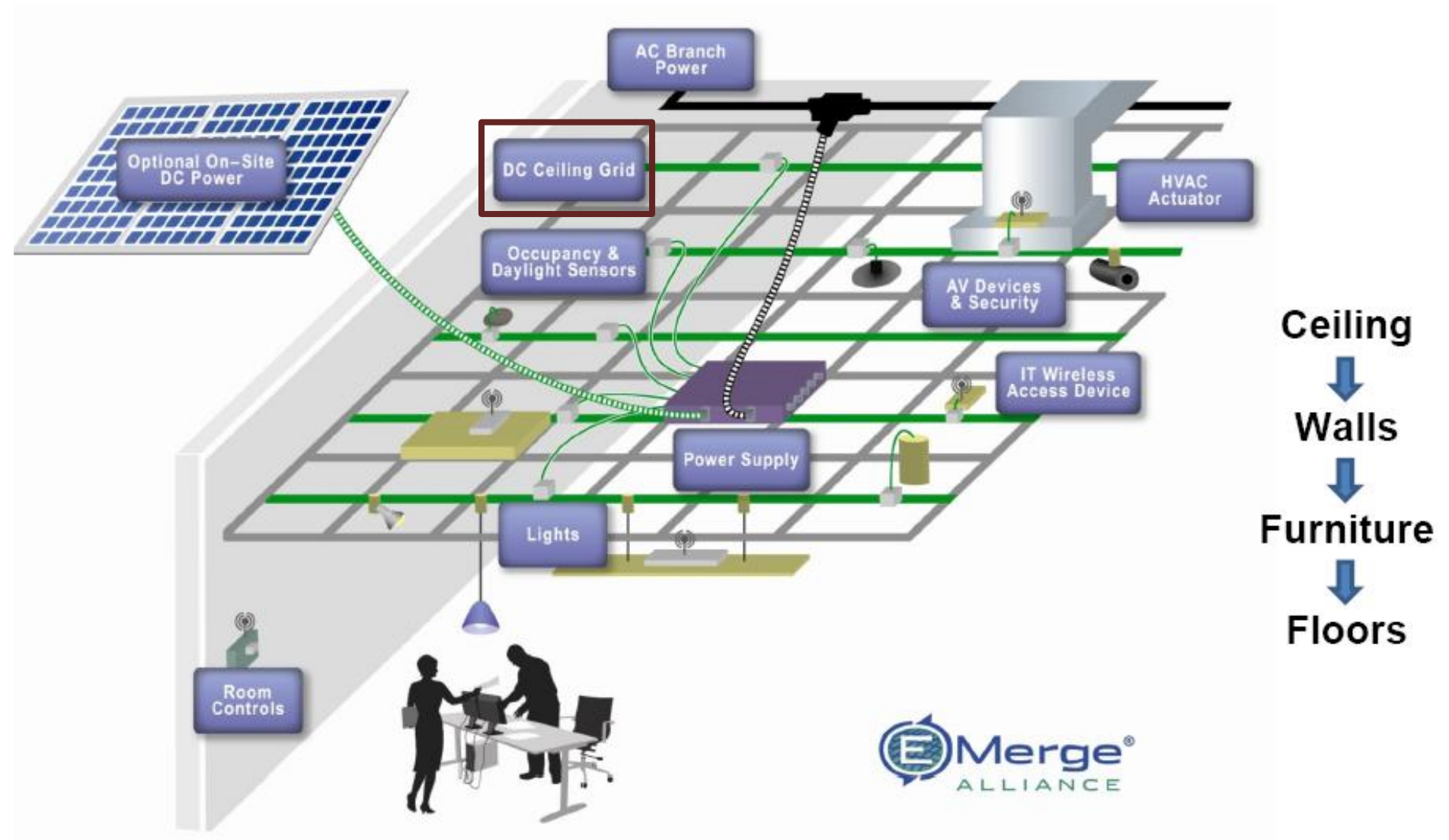
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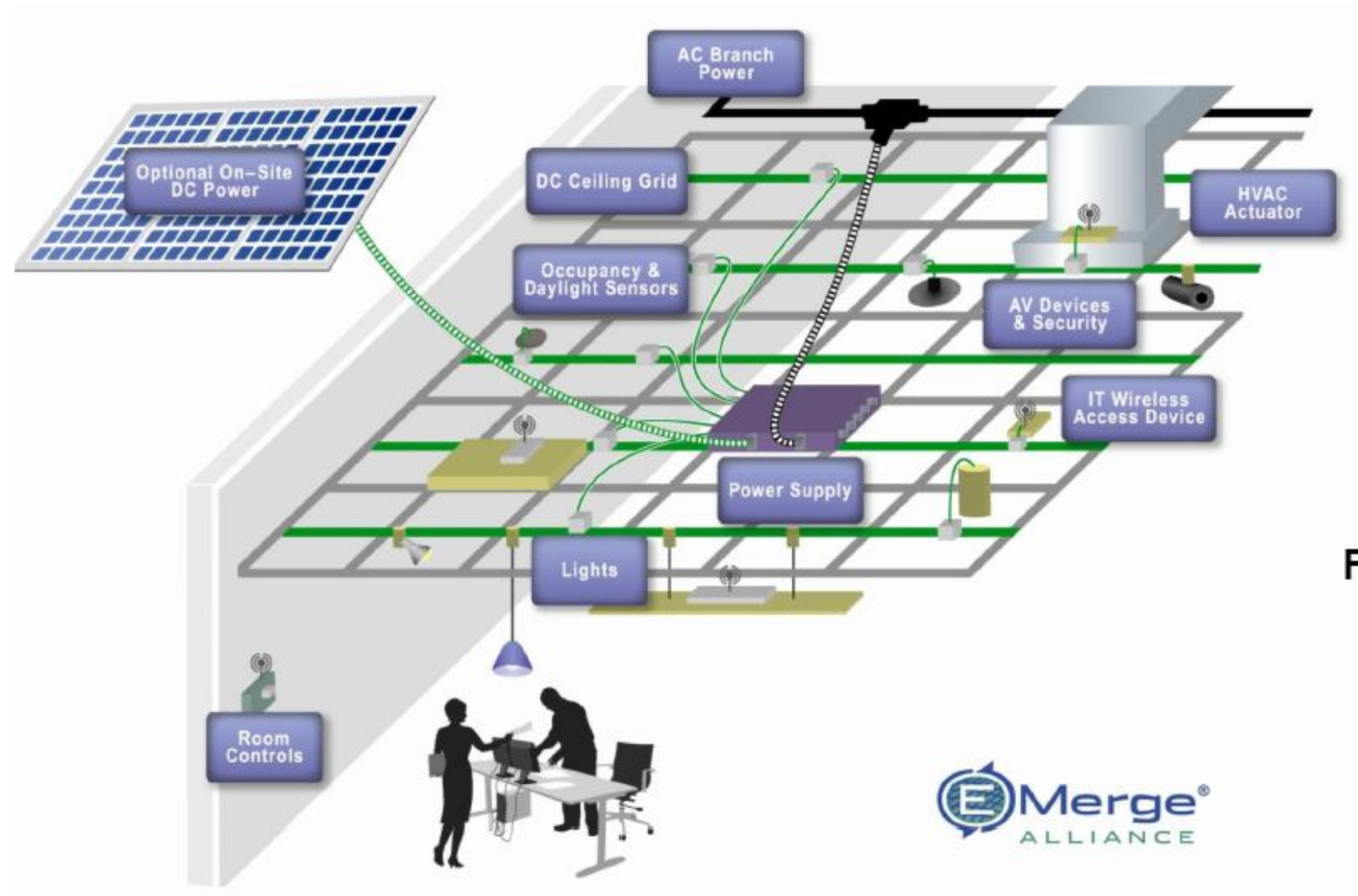
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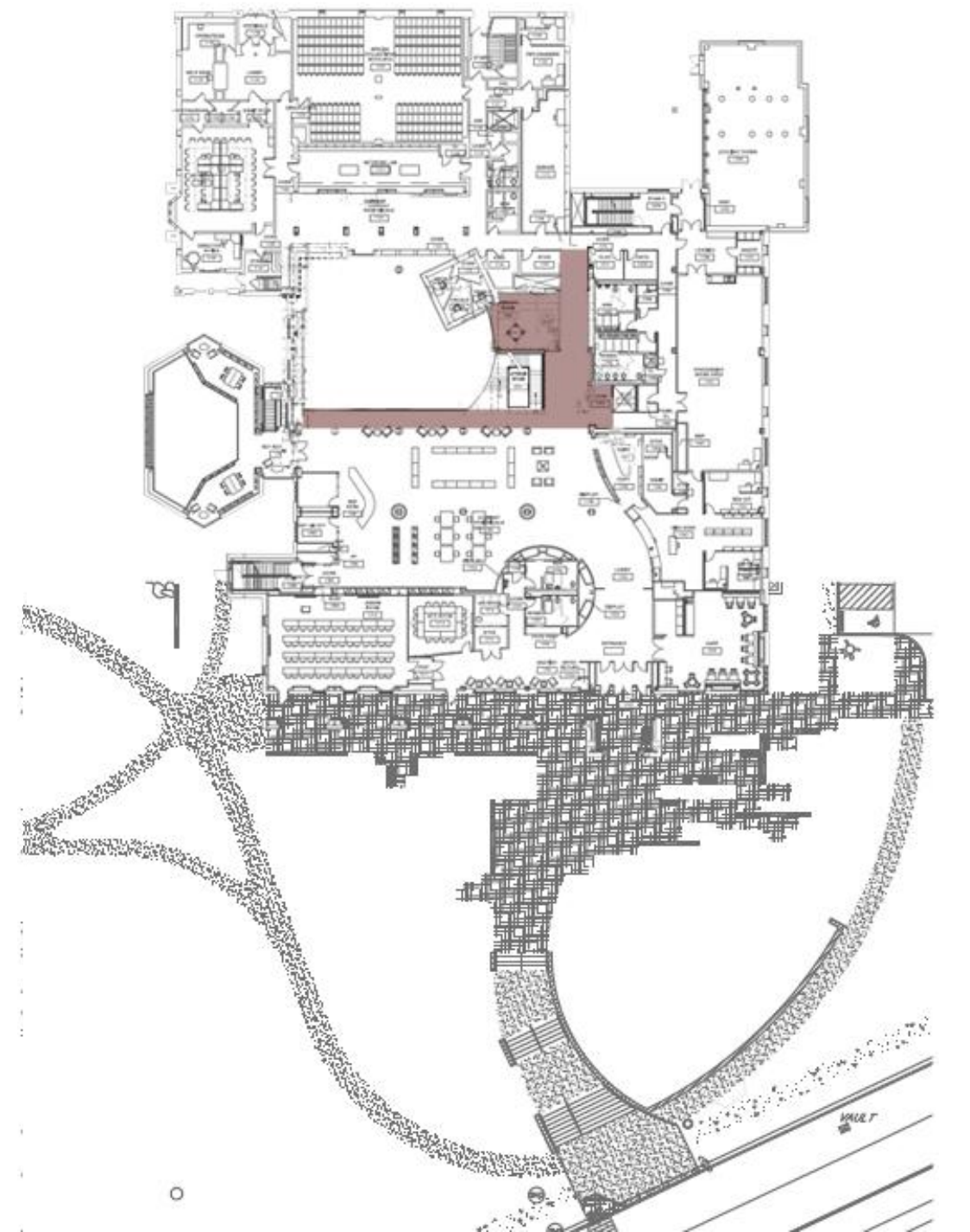
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Ceiling
↓
Walls
↓
Furniture
↓
Floors



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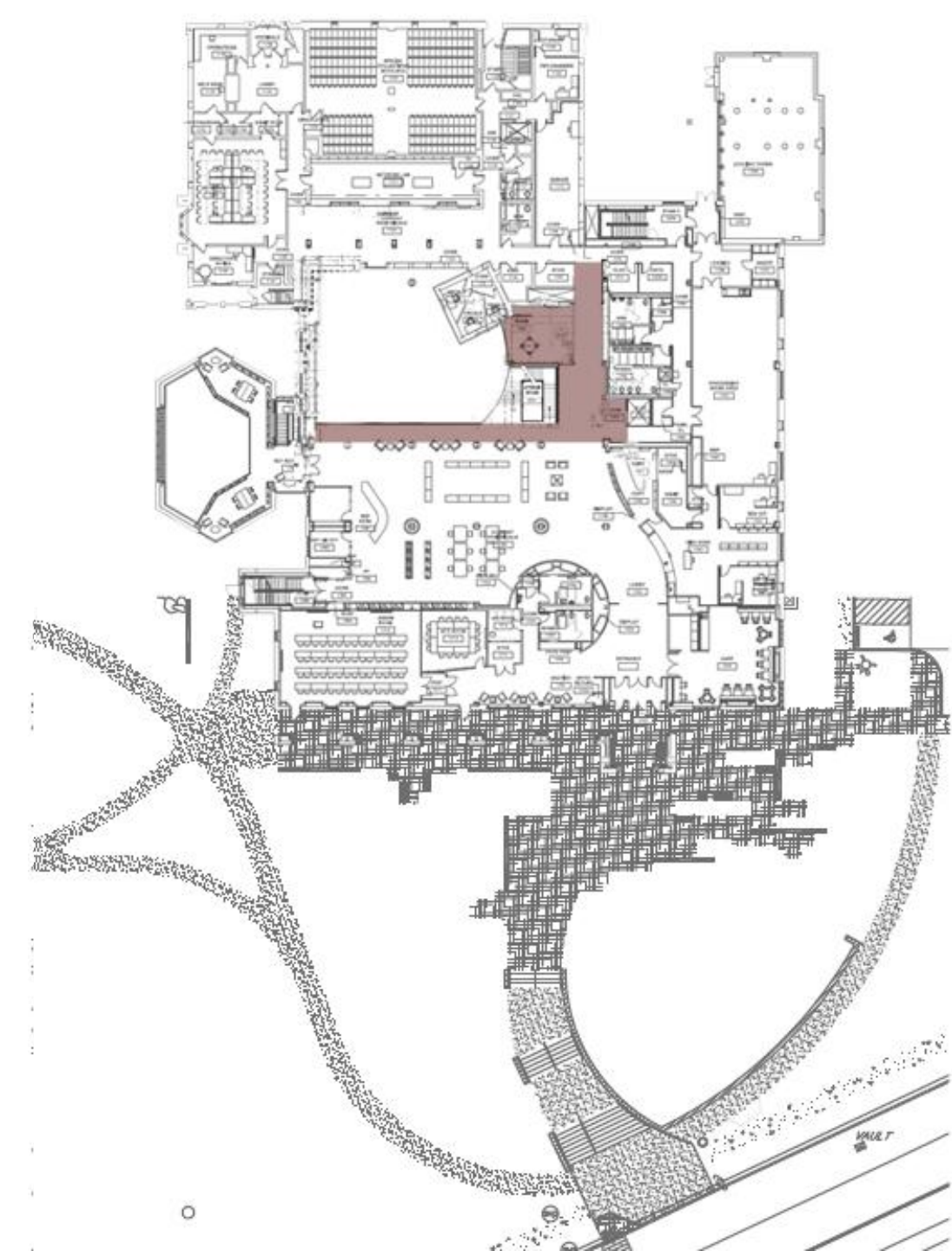
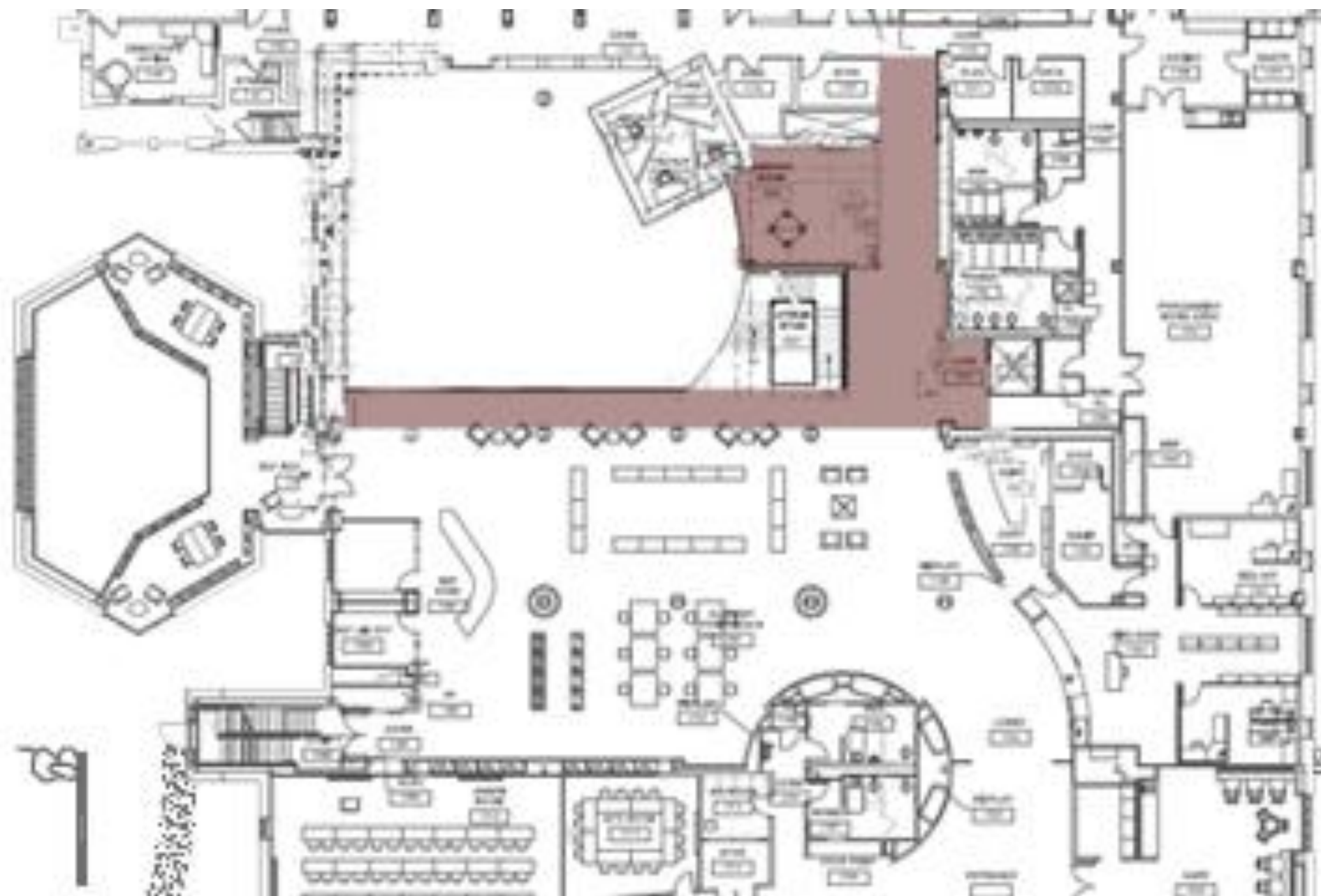
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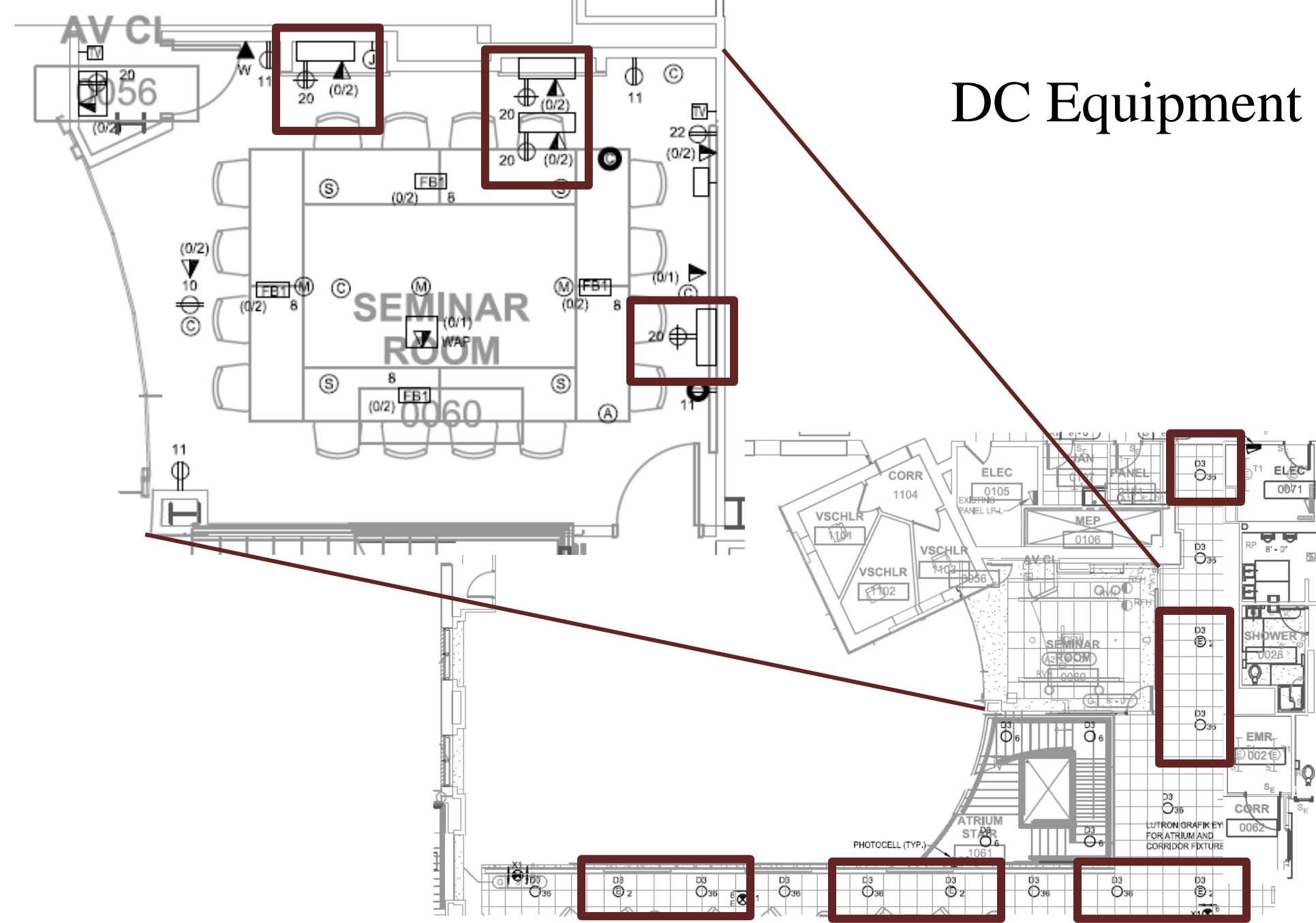
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DC Equipment

SEMILNAR ROOMS | A/V EQUIPMENT

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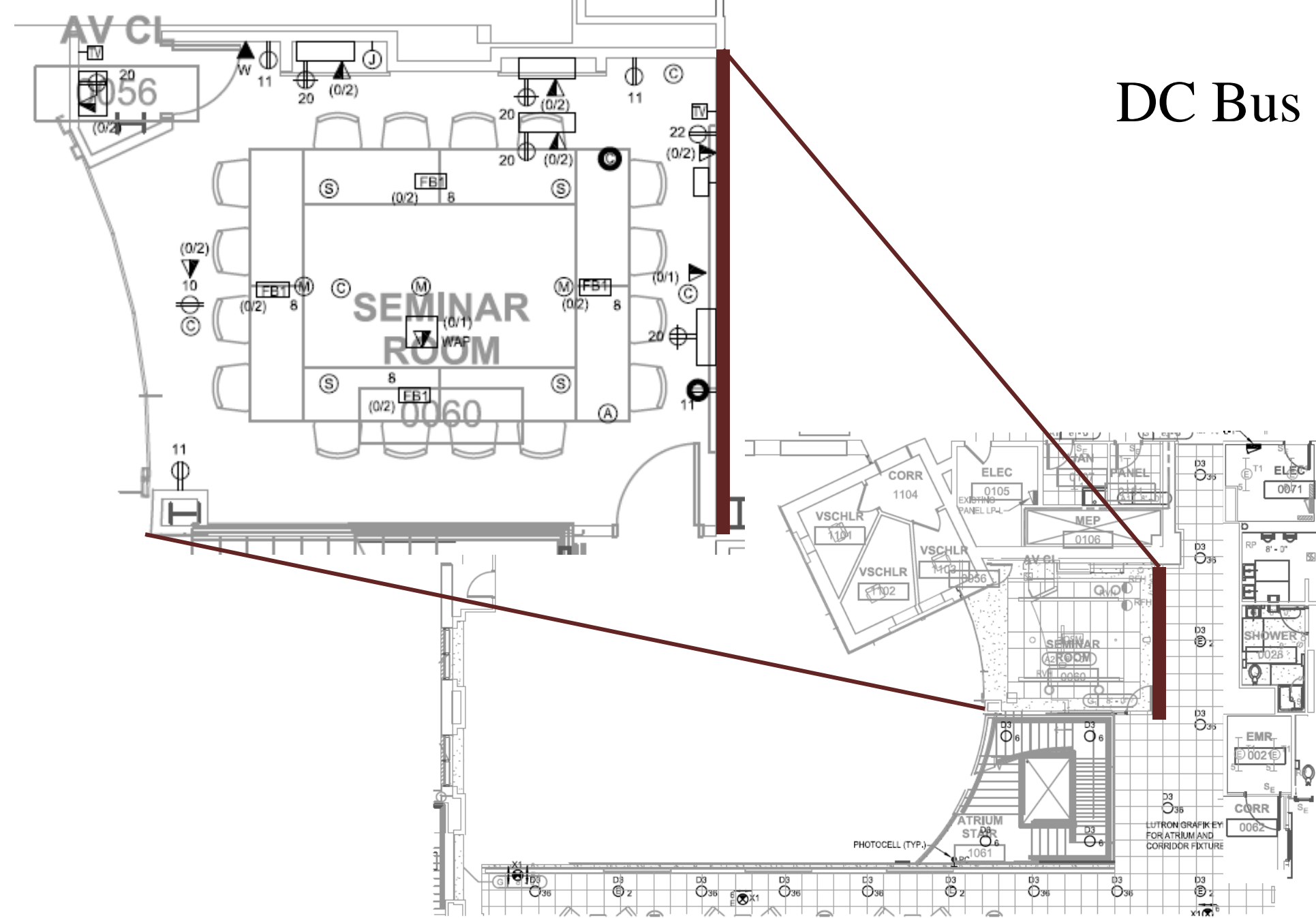
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DC Bus

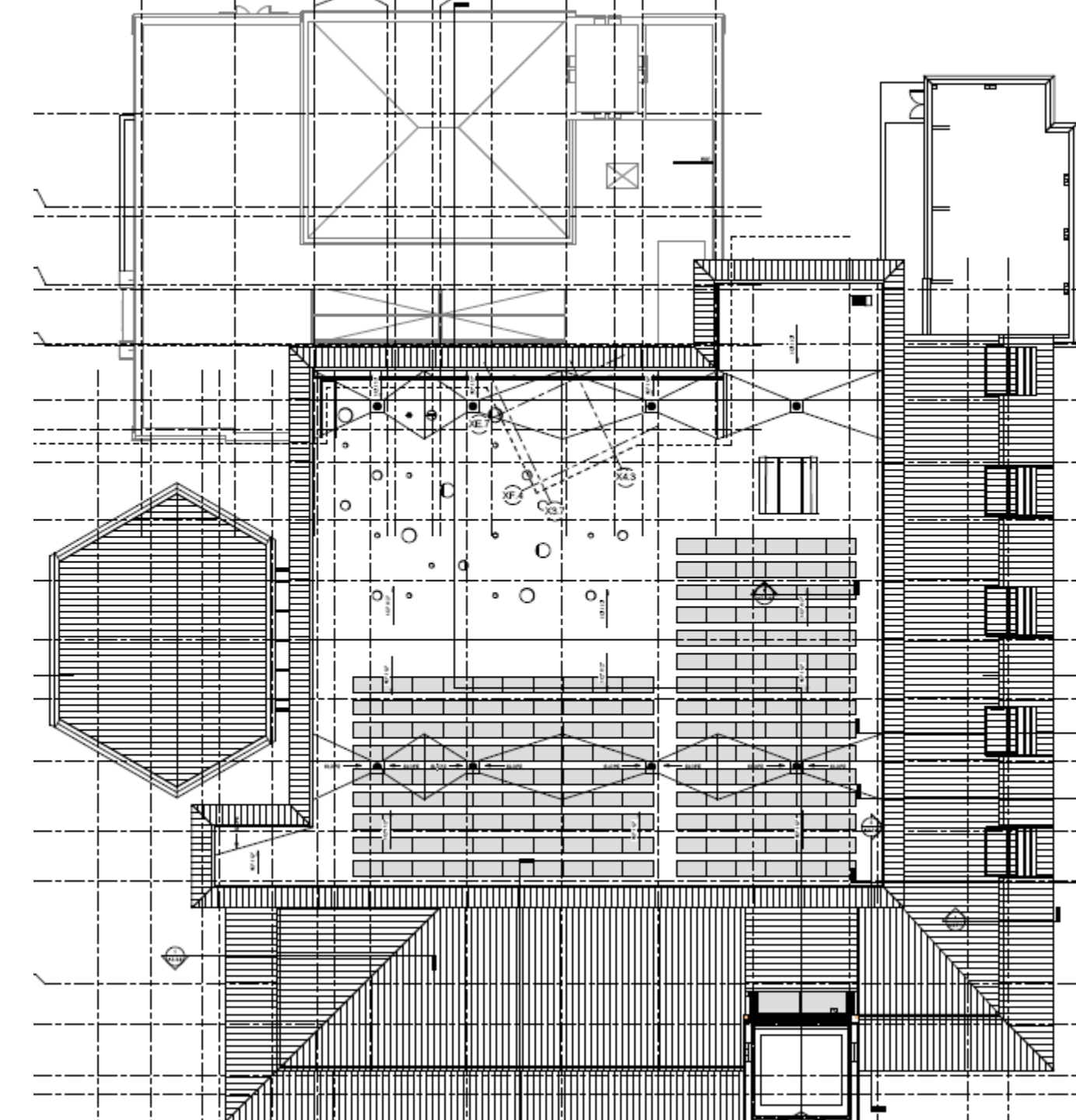
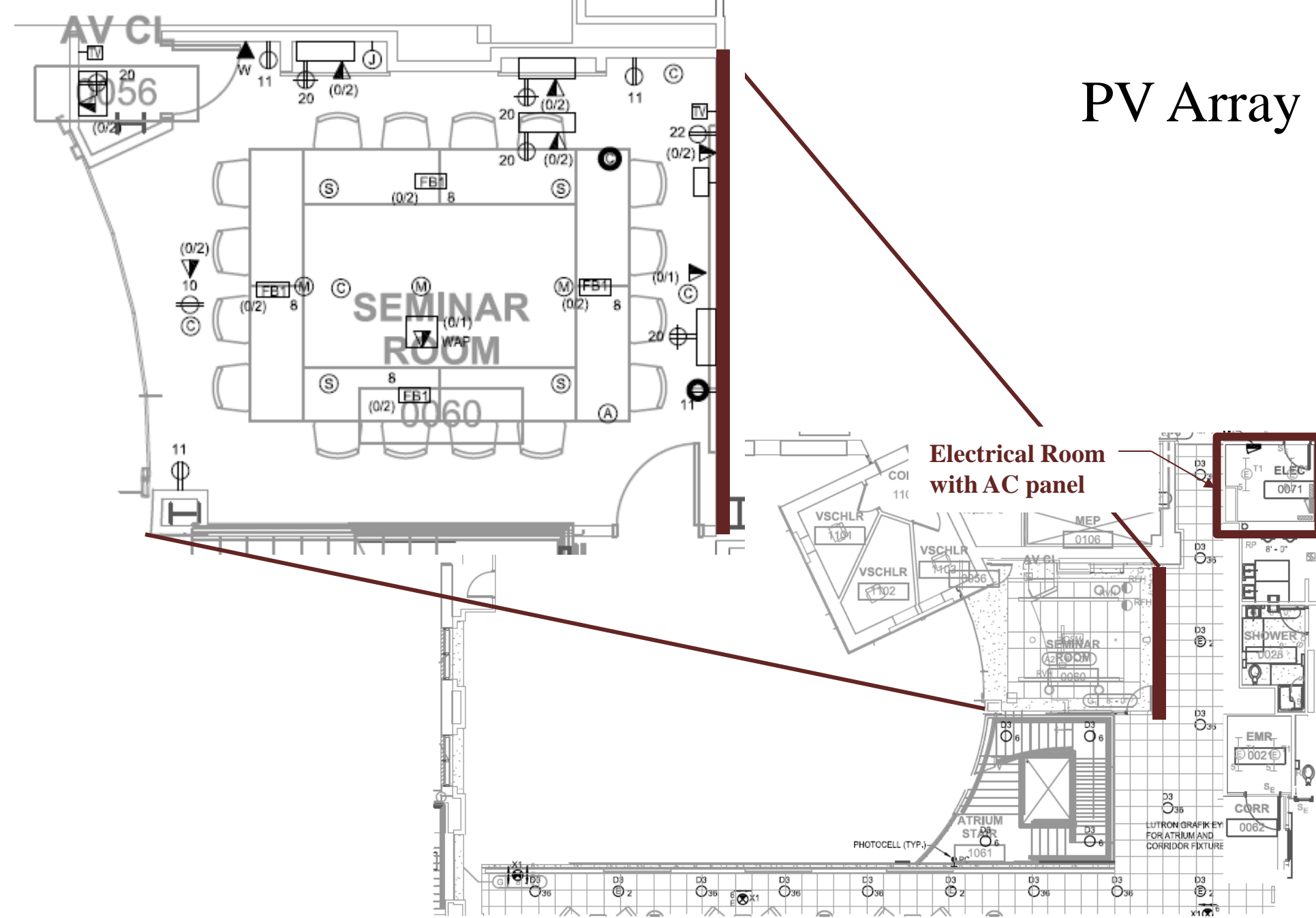
SEMINAR ROOMS | A/V EQUIPMENT

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BENEFITS OF THIS SYSTEM

Minimize energy losses

Flexible layout

Cheaper fixtures

Less supplemental equipment

Safer Installation

Less installation time

DRAWBACKS OF THIS SYSTEM

Voltage drop issues

Additional transfer switches

Not an industry standard

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ACKNOWLEDGEMENTS

Family

AE Professors

EwingCole

All AE students, especially those in the lighting option

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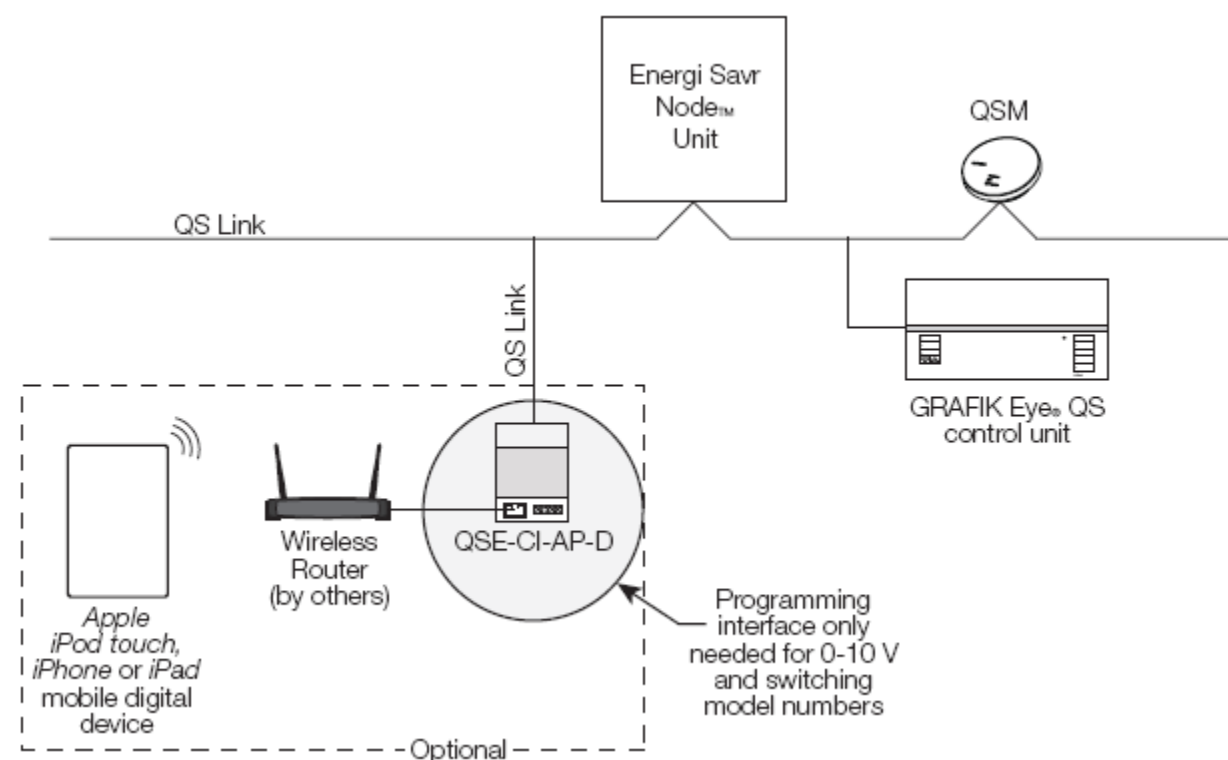
Illuminance Recommendations		
Task	Illuminance (lux)	
	Horizontal	Vertical
Façade		
-Medium Activity LZ2		
Apply to <=15% of building façade		100 (max)
Canopied Entry		
-Medium Activity LZ2		
Eh@grade; Ev @5' AFG	10	6
Paths to Curb		
-Medium Activity LZ		
Eh@grade; Ev@5' AFG	4	1

Power Allowances for Building Exteriors	
Task	Allowance
Building Grounds	
-Walkways less than 10 ft wide	0.7 W/linear foot
-Walkways 10 ft wide or greater	0.14 W/ft ²
-Pedestrian tunnels	0.15 W/ft ²
Building Entrance	
-Main entries	20 W/linear foot of door width
	0.1 W/ft ² for each illuminated wall or surface of
	2/5 W/linear foot for each illuminanted wall or surface length
Building Façade	

Light Loss Factors (P2)	
LDD	0.85
-Dirty Environment	
-Open/Unventilated	
-Direct	
-12 month cleaning cycle	
LLD	0.80
-Initial Lumens	6300
-Mean Lumens	5040
BF	1
Total LLF:	0.68

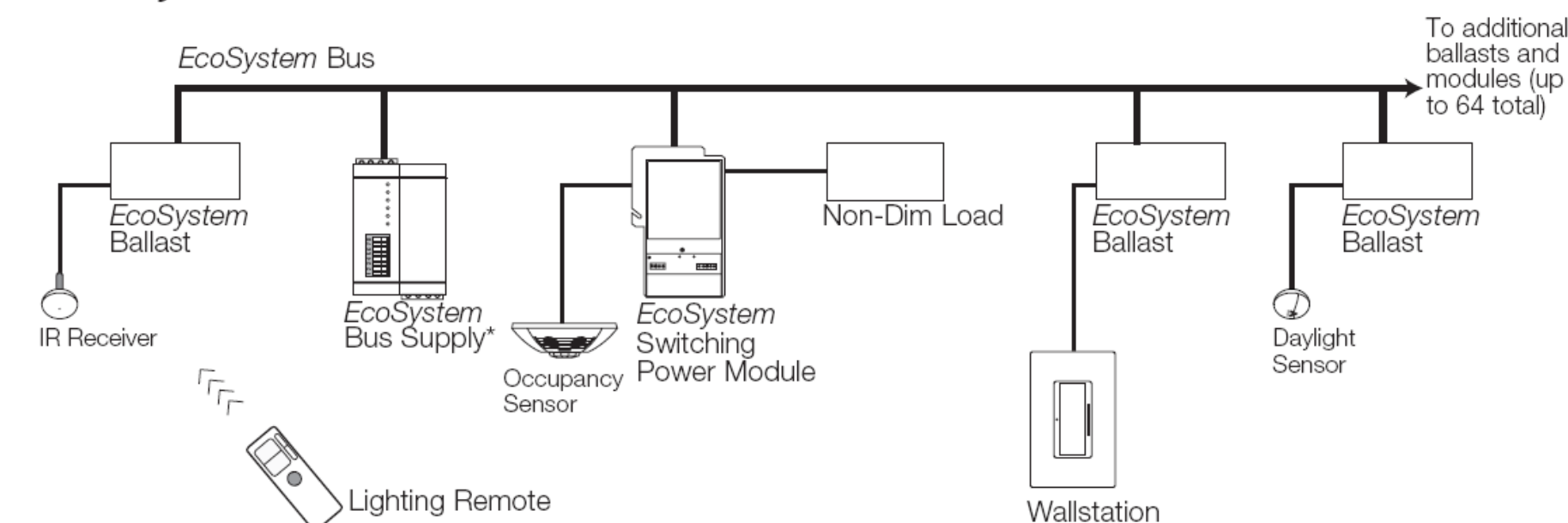
Light Loss Factors (WS1)	
LDD	0.85
-Dirty Environment	
-Open/Unventilated	
-Direct/Indirect	
-12 month cleaning cycle	
LLD	0.86
-Initial Lumens	1710
-Mean Lumens	1470
BF	1
Total LLF:	0.73

APPENDIX



Wiring Diagram - Lutron Energi Savr Node

EcoSystem One-Line



Wiring Diagram - Lutron XPJ Switching Control

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Illuminance Recommendations

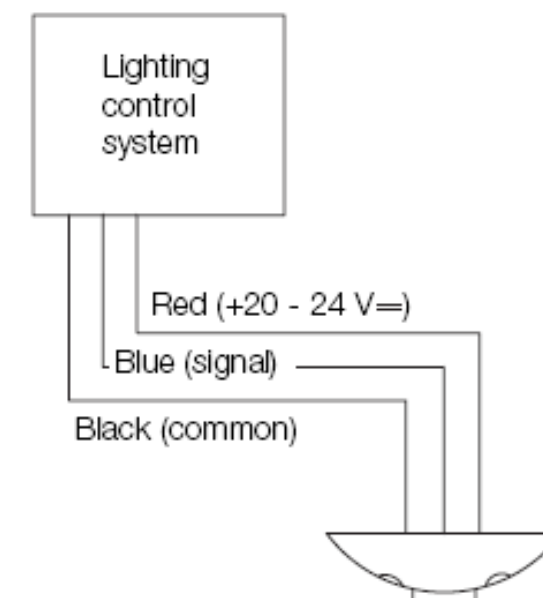
Task	Illuminance (lux)	
	Horizontal	Vertical
Reading Areas		
-Tables and Chairs Eh @2" AFF; Ev @4'0" AFF	500	200
Circulation Corridor		
-Public Adjacency Passageways Eh @floor; Ev @5'0" AFF	Avg >= 0.2x task Eh of adjacent space, min >= 10lux	Avg >= 0.2x task Ev of adjacent space
Stairs		
-Typical Eh @floor; Ev @5'0" AFF	50	30

Power Allowance

Space Type	LPD, W/ft2
Atrium	
-First 40 ft in height	0.03 per ft (height)
-height above 40 ft	0.02 per ft (height)
Corridor/Transition	0.66
Library Stacks	1.71

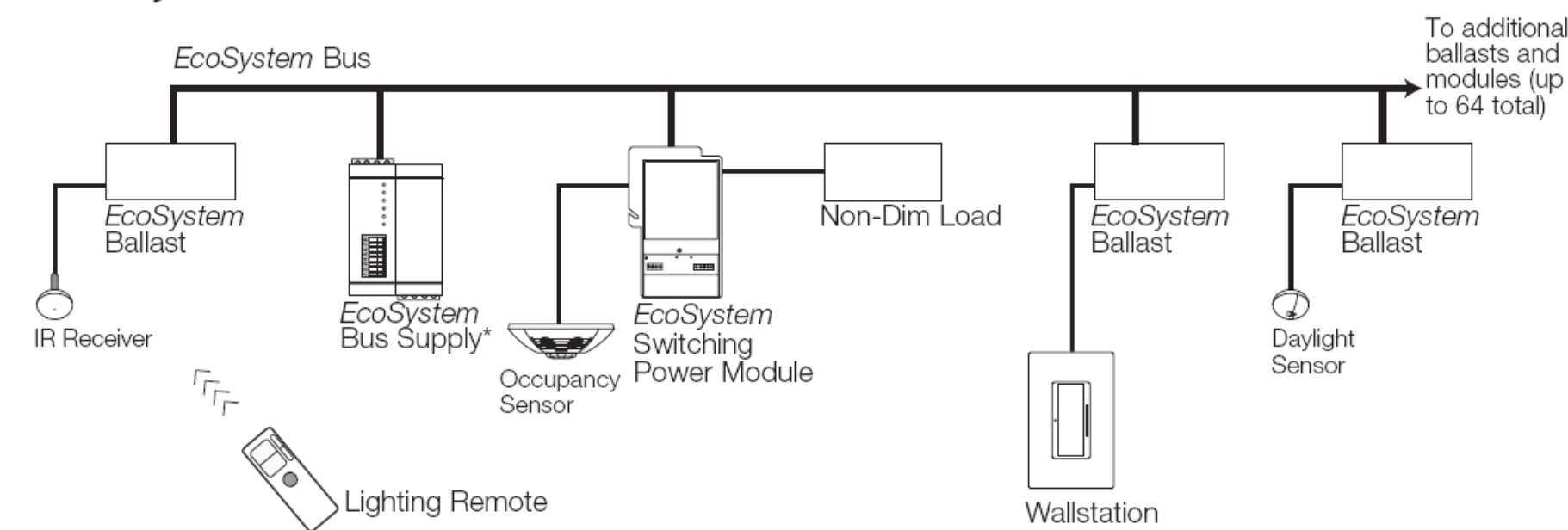
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Single Sensor to System



Wiring Diagram - Lutron LOS C Series Occupancy Sensor

EcoSystem One-Line



Wiring Diagram – Lutron XPJ Switching Control

Dual Bus System

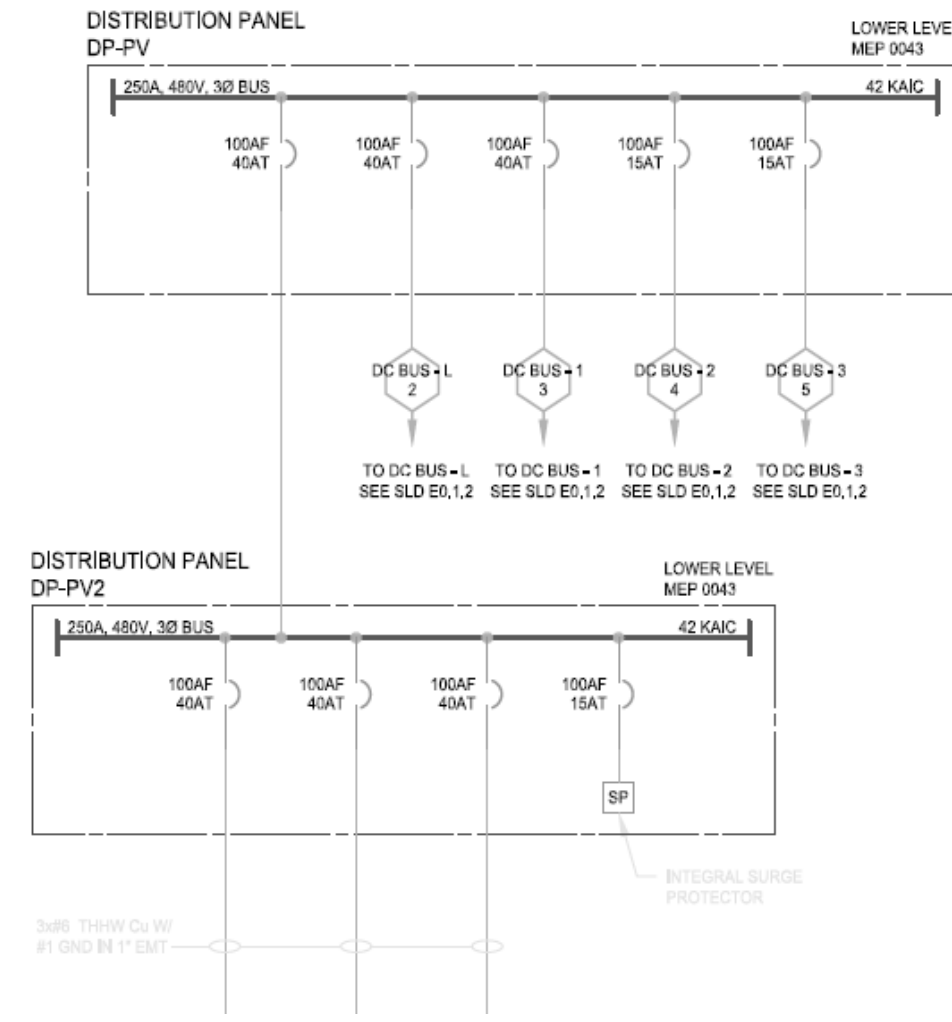
PANEL: AP-L-1 VOLTAGE: 208/120V <input checked="" type="checkbox"/> NORMAL <input checked="" type="checkbox"/> NEW													
SECTION: 1 OF 1 PHASE & WIRE: 3PH 4W <input type="checkbox"/> EMERGENCY <input type="checkbox"/> EXISTING													
LOCATION: ELEC RM 0071 MAIN (AMPS): 150A, M.C.B. CAIC RATING: 10													
1ST FLOOR POLES: 42													
NOTES	CKT NO.	C.B. A P	DESCRIPTION	LOAD (KVA)			DESCRIPTION	C.B. A P	CKT NO.	LOAD (KVA)			NOTES
				A	B	C				A	B	C	
	1	20 1	REC - ATRIUM 0001	0.36	1.98		FLOOR BOXES - ATRIUM 0001	20 1	2	1.62			
	3	20 1	REC - ATRIUM 0001	0.72		2.16	FLOOR BOXES - ATRIUM 0001	20 1	4	1.44			
	5	20 1	REC - MEP 0043	0.54		1.98	FLOOR BOXES - SEMINAR ROOM 0060	20 1	6	1.44			
	7	20 1	FLOOR BOXES - ATRIUM 0001	1.26	1.62		REC - TV AND CAMERA - SEMINAR 0060	20 1	8	0.36			
	9	20 1	FLOOR BOXES - ATRIUM 0001	1.08		2.52	FLOOR BOXES - ATRIUM 0001	20 1	10	1.44			
	11	20 1	REC - SEMINAR ROOM 0060	0.72		1.22	PLUMBING ACTUATORS	20 1	12	0.50			
	13	20 1	REC - MEN 0067, WOMEN 0066	1.26	2.44		FAN COIL UNIT FCU-L-1	20 1	14	1.18			
	15	20 1	REC - CORRIDOR 0064, 0074	0.72		1.44	EQUIPMENT ACCESS RACK - SEMINAR 0060	20 1	16	0.72			
	17	20 1	UNIT HEATER CUH-L4 - STAIR #1	0.26		0.36	FIXTURE DPEH WINCH CONTROLLERS	20 1	18	0.1			
	19	20 1	JB - MOTOR OPERATED DAMPERS		2.68		LTG AND A/V - CORR, 0060	30 1	20	2.682			
	21	20 1	HOT WATER RECIRC - HWRP-1	0.35	0.35		SPARE	20 1	22				
	23	20 1	LIGHTING - SEMINAR RM. 0060	0.19		0.19	SPARE	20 1	24				
	25	20 1	TRANSFER FAN TF-L-1	0.90	0.90		SPARE	20 1	26				
	27	20 1	SPARE		0.00		SPARE	20 1	28				
	29	20 1	SPARE		0.00		SPARE	20 1	30				
	31	20 1	SPARE		0.00		SPARE	20 1	32				
	33	20 1	SPARE		0.00		SPARE	20 1	34				
	35	20 1	SPARE		0.00		SPARE	20 1	36				
	37	20 1	SPARE		10.06		PANEL AP-L-2	90 3	38				SEE SLD
	39	20 1	SPARE		9.32			40					
	41	20 1	SPARE		8.02			42					E0.1,2
LOAD SUMMARY PER PHASE (KVA)				19.68	15.79	11.77							
TOTAL CONNECTED LOAD (KVA)				47.24									
OPTIONS AND ACCESSORIES - (X) INDICATES SELECTION													
<input type="checkbox"/>	<input checked="" type="checkbox"/>	MULTIPLE SECTION PANEL		<input type="checkbox"/>	CONTACTOR CONTROLLED		<input type="checkbox"/>			<input type="checkbox"/>			
<input type="checkbox"/>	<input type="checkbox"/>	RECESSED		<input type="checkbox"/>	FEED THRU LUGS		<input checked="" type="checkbox"/>			<input type="checkbox"/>			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	SURFACE		<input type="checkbox"/>	SUB FEED MAIN LUGS (DOUBLE LUGS)		<input type="checkbox"/>			<input type="checkbox"/>			
<input type="checkbox"/>	<input type="checkbox"/>	200% RATED NEUTRAL		<input type="checkbox"/>	CONTROLLABLE CIRCUIT BREAKER PANEL		<input type="checkbox"/>			<input type="checkbox"/>			
<input type="checkbox"/>	<input type="checkbox"/>	ISOLATED GROUND BUS		<input type="checkbox"/>	INTEGRAL TUSS DEVICE		<input type="checkbox"/>			<input type="checkbox"/>			
ISSUE DATE: 9/21/2010 REVISION DATE: RFP NO. 036. 03/28/2012													

PANEL: AP-1-1 VOLTAGE: 208/120V <input checked="" type="checkbox"/> NORMAL <input checked="" type="checkbox"/> NEW													
SECTION: 1 OF 2 PHASE & WIRE: 3PH 4W <input type="checkbox"/> EMERGENCY <input type="checkbox"/> EXISTING													
LOCATION: ELEC RM 1071 MAIN (AMPS): 250A, M.C.B. CAIC RATING: 10													
1ST FLOOR POLES: 42													
NOTES	CKT NO.	C.B. A P	DESCRIPTION	LOAD (KVA)			DESCRIPTION	C.B. A P	CKT NO.	LOAD (KVA)			NOTES
				A	B	C				A	B	C	
	1	20 1	REC - EXTERIOR	0.54	1.44		REC - ROOMS 1066, 1067, 1068	20 1	2	0.90			
	3	20 1	REC - COOLING TOWER 1078	0.90		1.40	PLUMBING ACTUATORS	20 1	4	0.50			
	5	20 1	REC - LOADING 1069, RECYCLE 1070	0.54		1.26	REC - CORRIDOR 1064, 1074	20 1	6	0.72			
	7	20 1	REC - PROCESSING WORK AREA 1050	1.08	1.44		REC - TV AND CAMERA - SEMINAR 1060	20 1	8	0.36			
	9	20 1	REC - SEMINAR ROOM 1060	0.72		2.16	REC - PROCESSING WORK AREA 1050	20 1	10	1.44			
	11	20 1	FLOOR BOXES - SEMINAR ROOM 1060	1.44		2.88	REC - PROCESSING WORK AREA 1050	20 1	12	1.44			
	13	20 1	TRANSFER FAN TF-1-1	0.90	2.10		PROJECTOR - SEMINAR 1060	20 1	14	1.20			
	15	20 1	REC - PROCESSING WORK AREA 1050	1.44		1.74	INTERCOM SYSTEM - RM 1050	20 1	16	0.30			
	17	20 1	REC AND FLOOR BOXES - RM 1050	0.90		1.20	UNIT HEATER CUH-1-1 - RM. 1075	20 1	18	1.20			
	19	20 1	FAN COIL UNIT FCU-1-1	0.58	1.78		REC - COPY 1045	20 1	20	1.20			
	21	20 1	REC - RMS. 1044, 1045, 1046	1.08		2.28	REC - COPY 1045	20 1	22	1.20			
	23	20 1	REC - RMS. 1042, 1043, 1044	1.44		2.64	REC - COPY 1045	20 1	24	1.20			
	25	20 1	REC - CIRC. DESK 1040	1.44	2.52		REC - LIBRARY CIRC. SUP. 1041	20 1	26	1.08			
	27	20 1	REC - CIRC. DESK 1040	0.54		1.26	REC - COPY 1045, DISPLAY 1149	20 1	28	0.72			
	29	20 1	REC - RMS. 1040, 1041	0.72		1.92	REC - COPY 1045	20 1	30	1.20			
	31	20 1	LIGHTING - SEMINAR RM 1060	0.19	0.99		REC - OFFICE 1042	20 1	32	0.80			
	33	20 1	LIGHTING - ATRIUM	0.28		1.00	EQUIP ACCESS RACK - SEMINAR 1060	20 1	34	0.72			
	35	20 1	REC AND FLOOR BOXES - RM 1050	0.90		2.68	LTG AND A/V - RM. 1062, 1060	20 1	36	1.78			
	37	20 1	SPARE		0.00		SPARE	20 1	38				
	39	20 1	SPARE		0.00		SPARE	20 1	40				
	41	20 1	SPARE		0.00		SPARE	20 1	42				
LOAD SUMMARY PER PHASE (KVA)				10.27	9.84	12.58							
TOTAL CONNECTED LOAD (KVA)				32.69									
OPTIONS AND ACCESSORIES - (X) INDICATES SELECTION													
<input type="checkbox"/>	<input checked="" type="checkbox"/>	MULTIPLE SECTION PANEL		<input type="checkbox"/>	CONTACTOR CONTROLLED		<input type="checkbox"/>			<input type="checkbox"/>			

PANEL: AP-3-1 VOLTAGE: 208/120V <input checked="" type="checkbox"/> NORMAL <input checked="" type="checkbox"/> NEW													
SECTION: 1 OF 1 PHASE & WIRE: 3PH 4W <input type="checkbox"/> EMERGENCY <input type="checkbox"/> EXISTING													
LOCATION: ELEC RM 3071 MAIN (AMPS): 350A, M.C.B. CAIC RATING: 10													
3RD FLOOR POLES: 30													
NOTES	CKT NO.	C.B. A P	DESCRIPTION	LOAD (KVA)			DESCRIPTION	C.B. A P	CKT NO.	LOAD (KVA)			NOTES
				A	B	C				A	B	C	
	1	20 1	FLOOR BOXES - WORKSTATION 3109	1.08	1.58		PLUMBING ACTUATORS	20 1	2	0.50			
	3	20 1	REC - CORR 3064, 3074	0.90		1.43	FAN COIL UNIT FCU-3-1	20 1	4	0.53			
	5	20 1	REC - RMS. 3066, 3067, 3068	0.90		1.99	LIGHTING - SEMINAR 3060	20 1	6	1.09			
	7	20 1	LIGHTING - ATRIUM	0.40	1.84		REC - DIR. INTEL PROP. 3046	20 1	8	1.44			
	9	20 1	REC - LIBRARIAN 3057	1.08		2.28	PRINTER - ADMIN. AIDE 3053	20 1	10	1.20			
	11	20 1	PRINTER - RM. 3046	1.20		2.10	REC - ADMIN AIDE 3053, STOR. 3049	20 1	12	0.90			
	13	20 1	REC - DIR. EXT. REL - 3044	0.72	2.16		REC - RMS. 3039, 3045	20 1	14	1.44			
	15	20 1	PRINTER - ASSOC. SYS. LIB. 3040	1.20		1.92	FLOOR BOX - SEMINAR 3060	20 1	16	0.72			
	17	20 1	REC - ASSOC. SYS. LIB. 3040	0.44		2.16	FLOOR BOX - SEMINAR 3060	20 1	18	0.72			
	19	20 1	TRANSFER FAN TF-3-1	0.90	1.26		REC - TV AND CAMERA - SEMINAR 3060	20 1	20	0.36			
	21	20 1	FIXTURE DPG3 WINCH MOTOR & CTRL	0.31		21.76		21		21.45			
	23	50 1	LTG AND A/V - CORR 3005, 3060	4.88		25.92	PANEL AP-3-2	150 1	24	21.04			
	25	20 1	SPARE		16.88			25		16.88			SEE
	27	20 1	SPARE		21.05			27		21.05			SLD
	29	20 1	SPARE		16.88			29		16.88			E0.1,2
LOAD SUMMARY PER PHASE (KVA)				23.72	48.44	49.05							
TOTAL CONNECTED LOAD (KVA)				121.21									
OPTIONS AND ACCESSORIES - (X) INDICATES SELECTION													
<input type="checkbox"/>	<input type="checkbox"/>	MULTIPLE SECTION PANEL		<input type="checkbox"/>	CONTACTOR CONTROLLED		<input type="checkbox"/>			<input type="checkbox"/>			
<input type="checkbox"/>	<input type="checkbox"/>	RECESSED		<input type="checkbox"/>	FEED THRU LUGS		<input checked="" type="checkbox"/>			<input type="checkbox"/>			
<input checked="" type="checkbox"/>	<input type="checkbox"/>	SURFACE		<input type="checkbox"/>	SUB FEED MAIN LUGS (DOUBLE LUGS)		<input type="checkbox"/>			<input type="checkbox"/>			
<input type="checkbox"/>	<input type="checkbox"/>	200% RATED NEUTRAL		<input type="checkbox"/>	CONTROLLABLE CIRCUIT BREAKER PANEL		<input type="checkbox"/>			<input type="checkbox"/>			
<input type="checkbox"/>	<input type="checkbox"/>	ISOLATED GROUND BUS		<input type="checkbox"/>	INTEGRAL TUSS DEVICE		<input type="checkbox"/>			<input type="checkbox"/>			
ISSUE DATE: 9/21/2010 REVISION DATE: RFP NO. 036 - 03/28/2012													

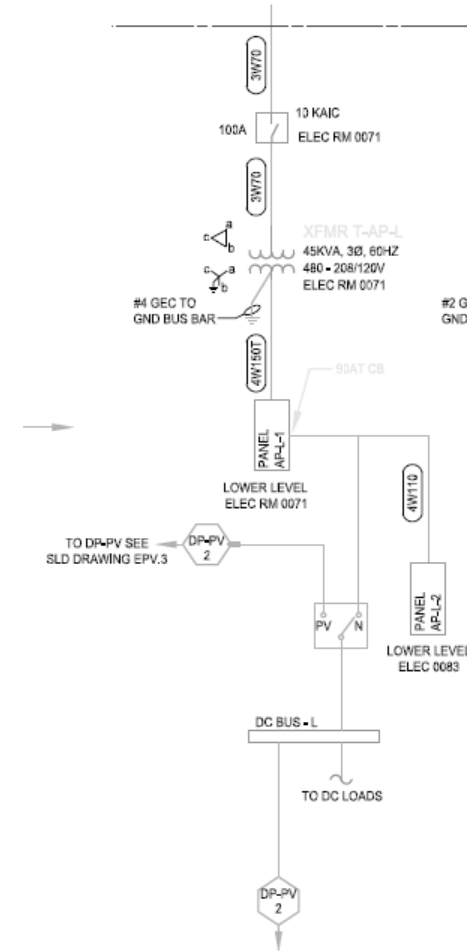
PANEL: AP-2-1 VOLTAGE: 208/120V <input checked="" type="checkbox"/> NORMAL <input checked="" type="checkbox"/> NEW													
SECTION: 1 OF 1 PHASE & WIRE: 3PH 4W <input type="checkbox"/> EMERGENCY <input type="checkbox"/> EXISTING													
LOCATION: ELEC RM 2071 MAIN (AMPS): 150A, M.C.B. CAIC RATING: 10													
2ND FLOOR POLES: 42													
NOTES	CKT NO.	C.B. A P	DESCRIPTION	LOAD (KVA)			DESCRIPTION	C.B. A P	CKT NO.	LOAD (KVA)			NOTES
				A	B	C				A	B	C	
	1	20 1	REC - BRIDGE 2006	1.44	1.80		REC - CAMERA AND TV - RM 2060	20 1	2	0.36			
	3	20 1	FLOOR BOXES - WORKSTATION 2109	1.62		2.52	REC - RMS. 2066, 2067, 2068	20 1	4	0.90			
	5	20 1	REC - CORR. 2064, 2074	0.72		1.22	PLUMBING ACTUATORS	20 1	6	0.50			
	7	20 1	REC - RMS. 2058, 2059	0.90	2.34		FLOOR BOXES - SEMINAR RM 2060	20 1	8	1.44			
	9	20 1	FLOOR BOXES - TECH WORK RM 2050	1.08		2.28	REC - TECH WORK RM 2050	20 1	10	1.20			
	11	20 1	REC - SEMINAR RM 2060	0.72		1.92	REC - TECH WORK RM 2050	20 1	12	1.20			
	13	20 1	REC - TECH WORK RM 2050	1.08	2.16		REC - TECH WORK RM 2050	20 1	14	1.08			
	15	20 1	FAN COIL UNIT FCU-2-1	0.53		1.61	REC - TECH WORK RM 2050	20 1	16	1.08			
	17	20 1	LIGHTING - SEMINAR 2060	0.19		0.47	LIGHTING - ATRIUM	20 1	18	0.28			
	19	20 1	TRANSFER FAN TF-2-1	0.90	1.98		EQUIP ACCESS RACK - SEMINAR 2060	20 1	20	1.08			
	21	30 1	LTG AND A/V - CORR 2005, 2060	3.22		3.22	SPARE	20 1	22				
	23	20 1	SPARE			0.00	SPARE	20 1	24				
	25	20 1	SPARE		0.00								

Dual Bus System



One Line Diagram – Drawing EPV.3

APPENDIX



One Line Diagram – Drawing E0.1.2