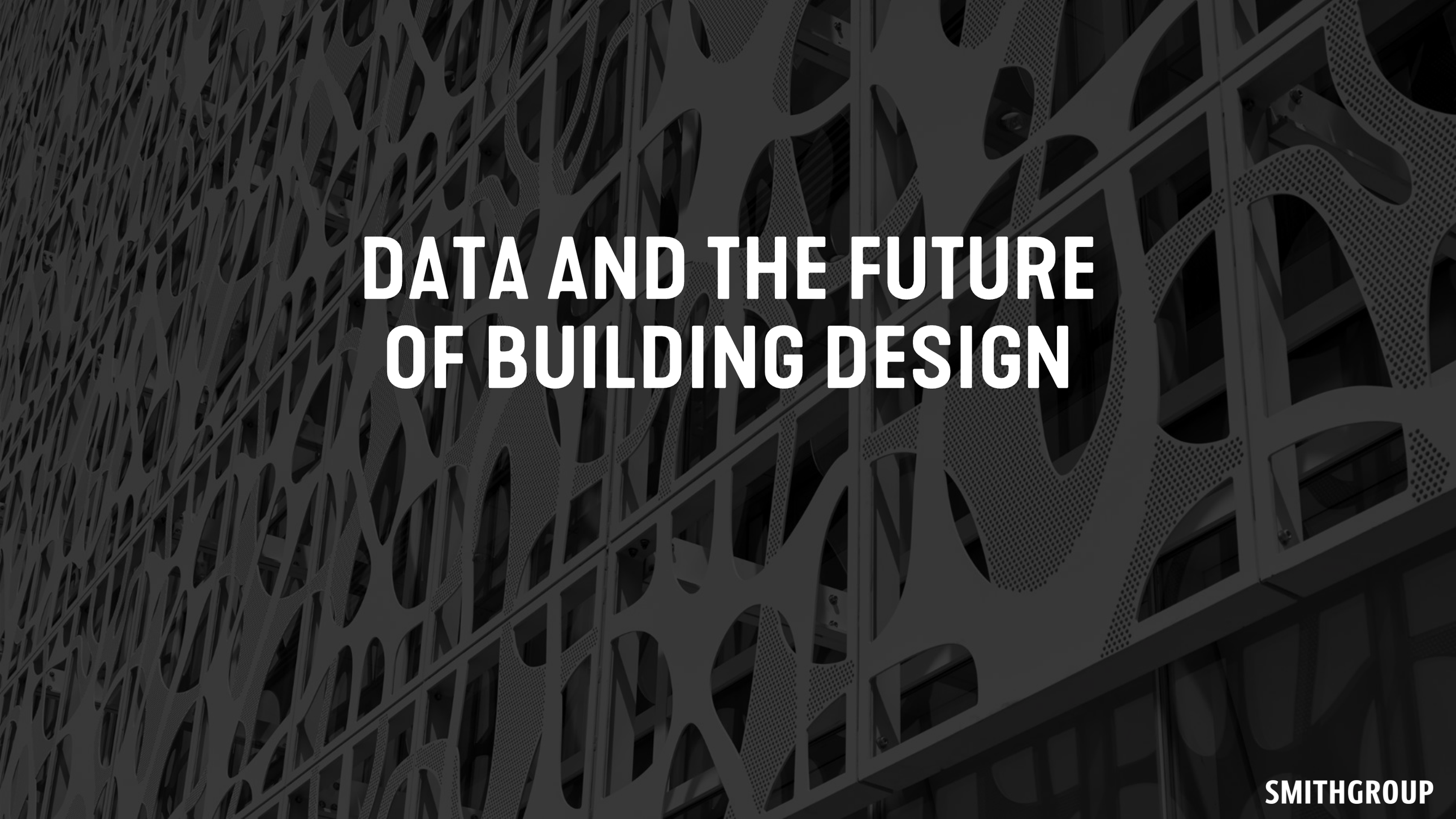
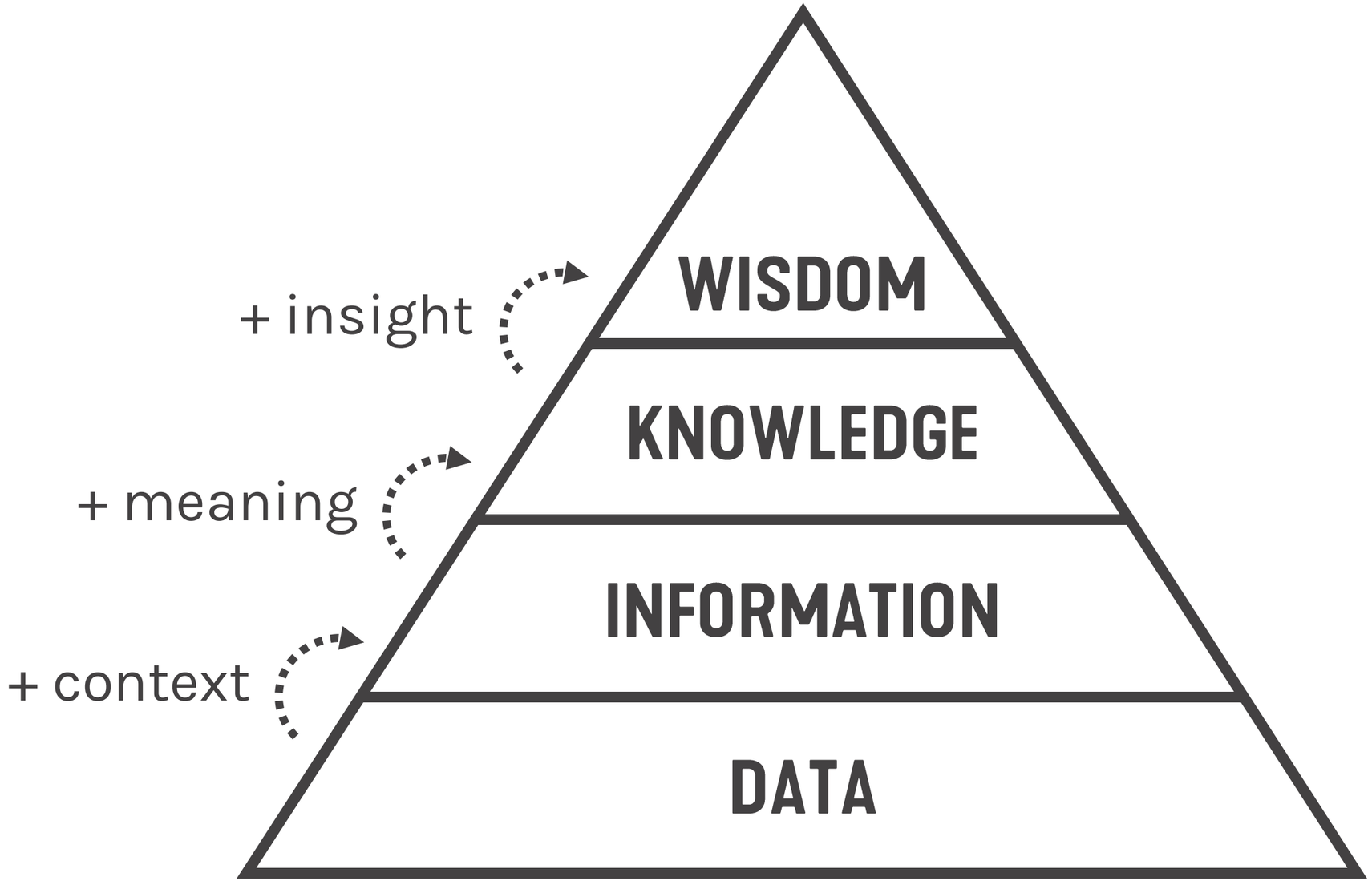
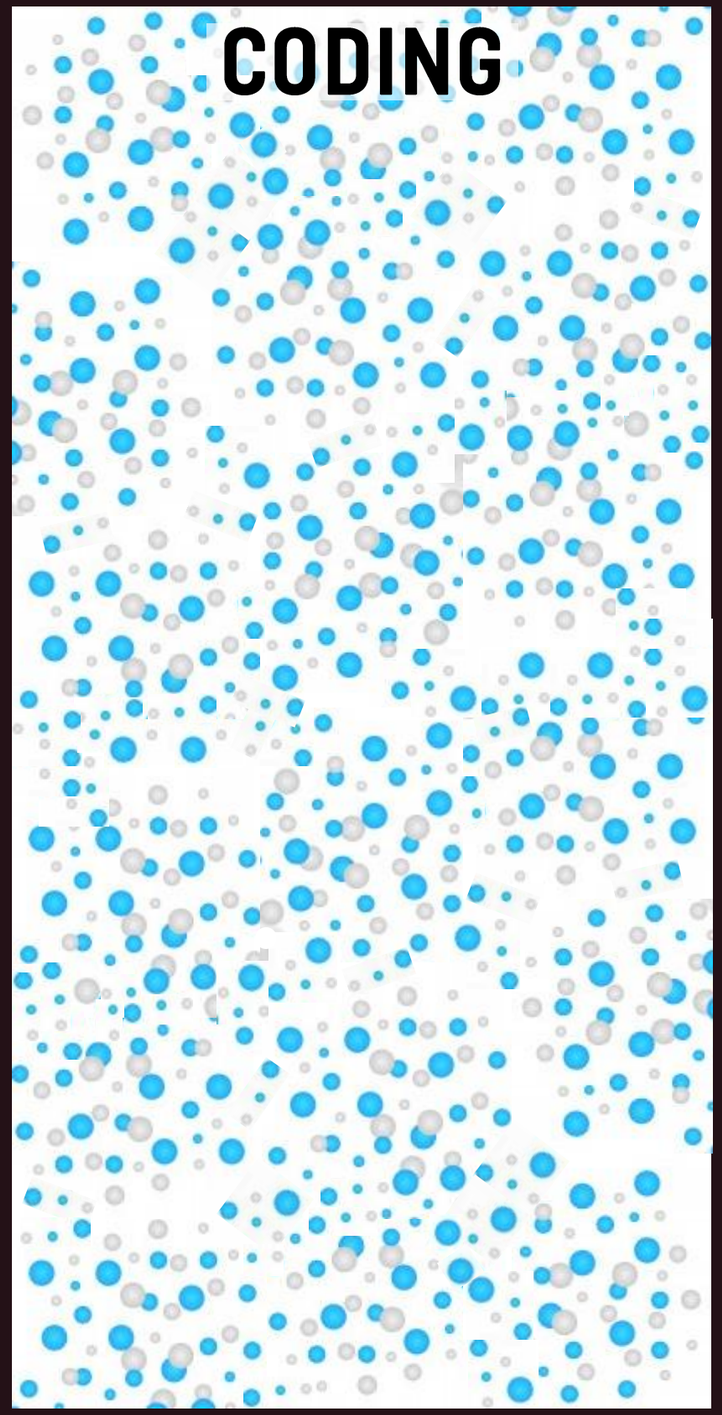


DATA AND THE FUTURE OF BUILDING DESIGN

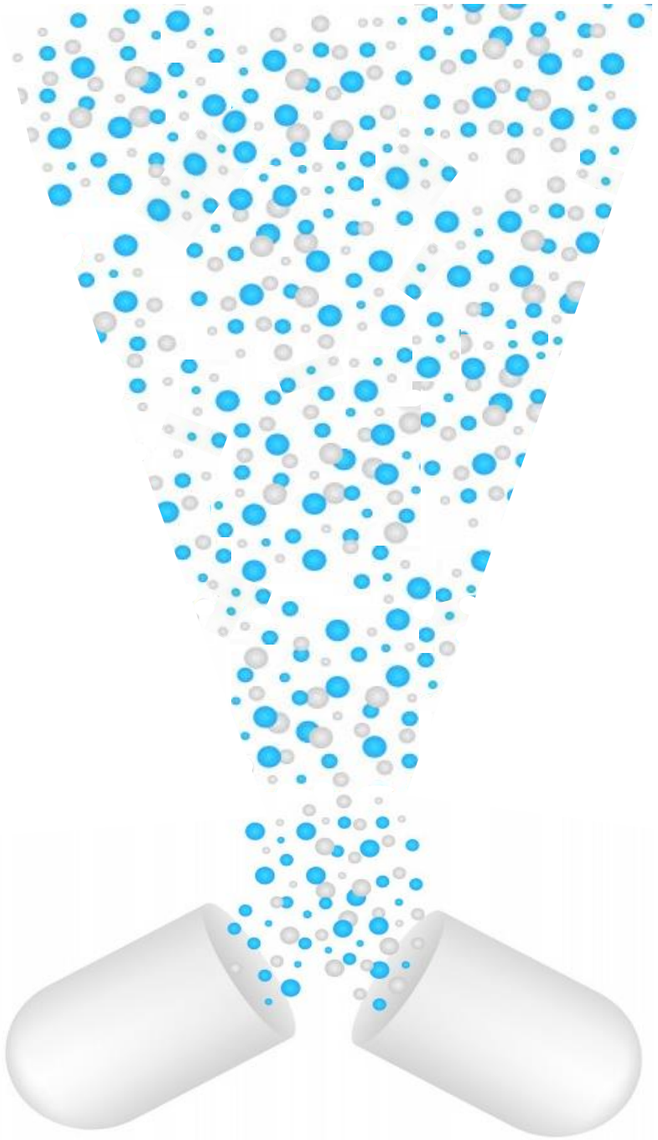
SMITHGROUP

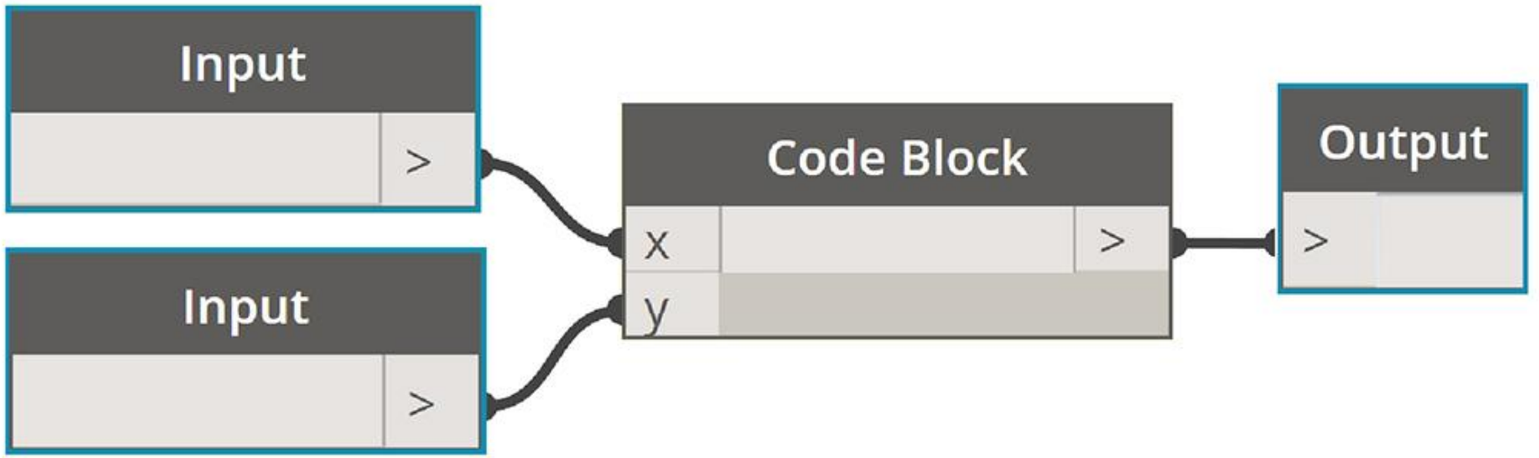
WHAT IS DATA?


WISDOM
KNOWLEDGE
INFORMATION
DATA
+ insight
+ meaning
+ context


CODING

VISUAL SCRIPTING

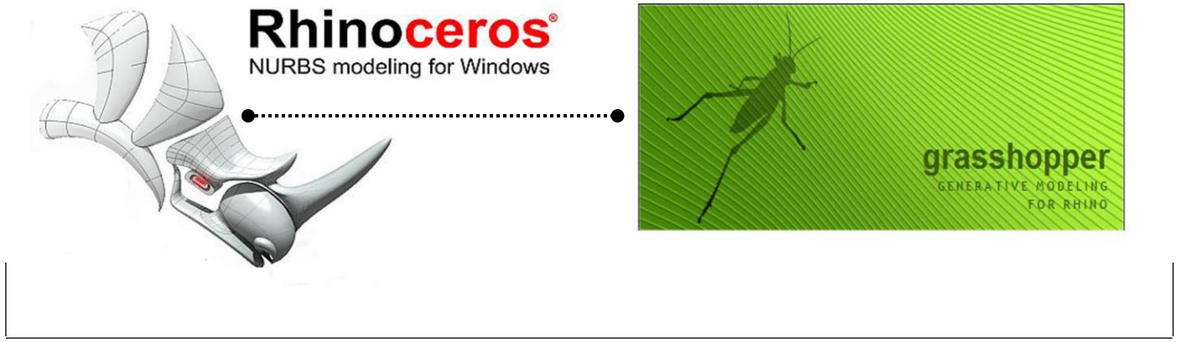




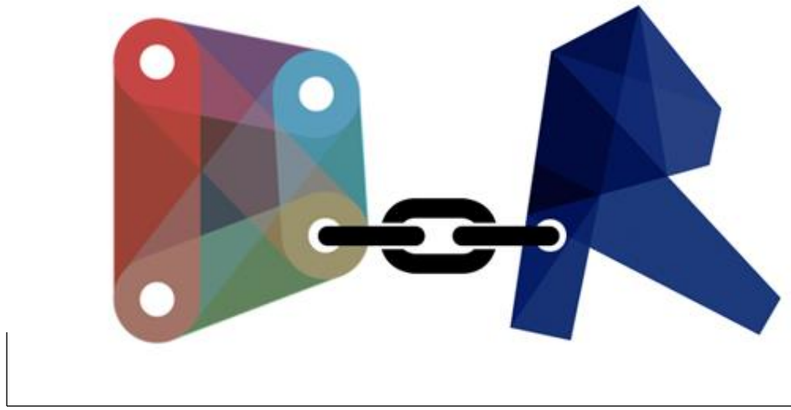
CODING IS HOW WE REFINE DATA INTO USEFUL PRODUCTS

VISUAL SCRIPTING MAKES CODING ACCESSIBLE

VISUAL SCRIPTING



Rhino + Grasshopper



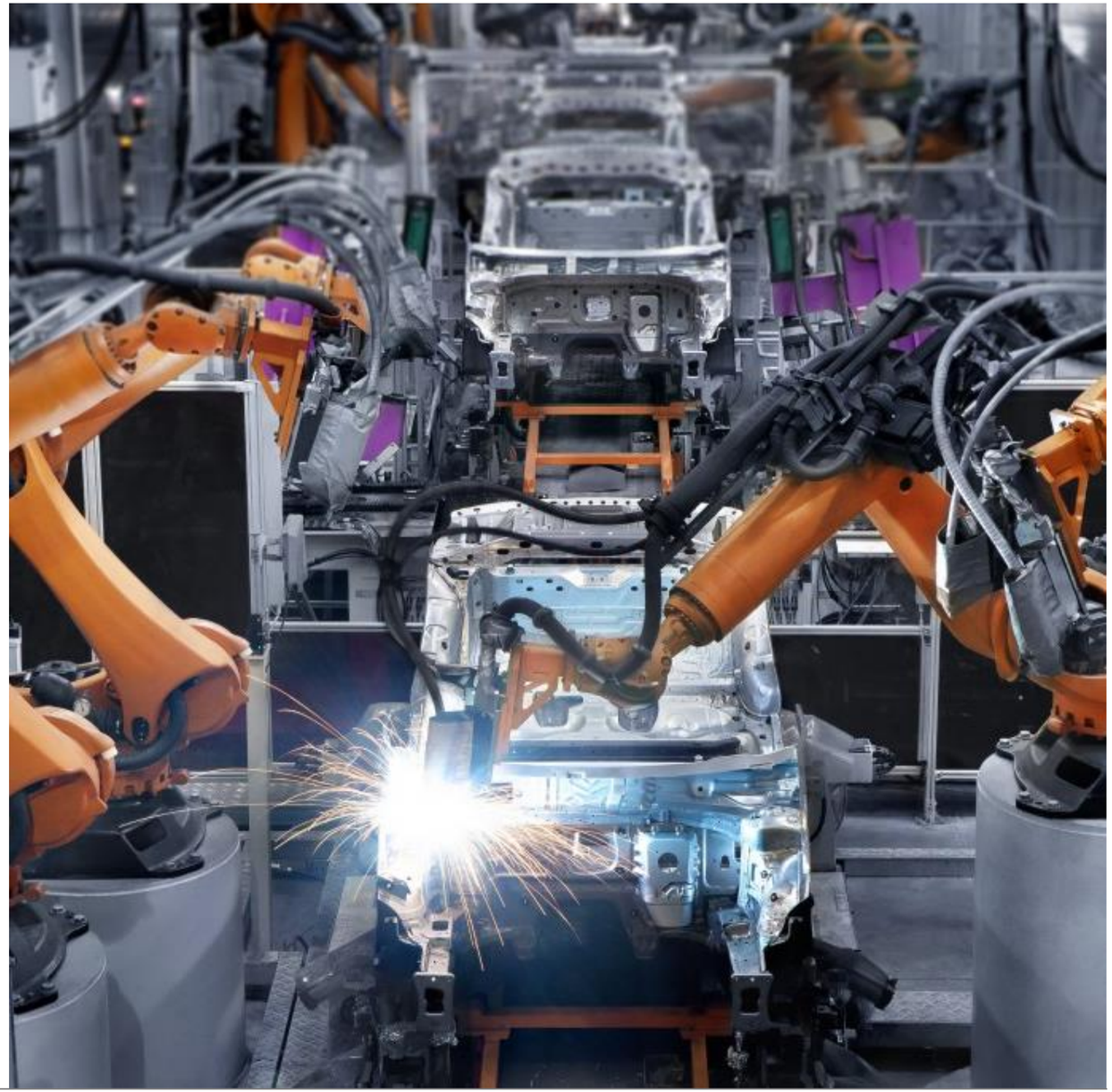
Dynamo + Revit

Rhino.Inside Revit

SMITHGROUP

THE NEIGHBORHOOD'S TOOLSHED

WHICH AGE ARE WE IN?

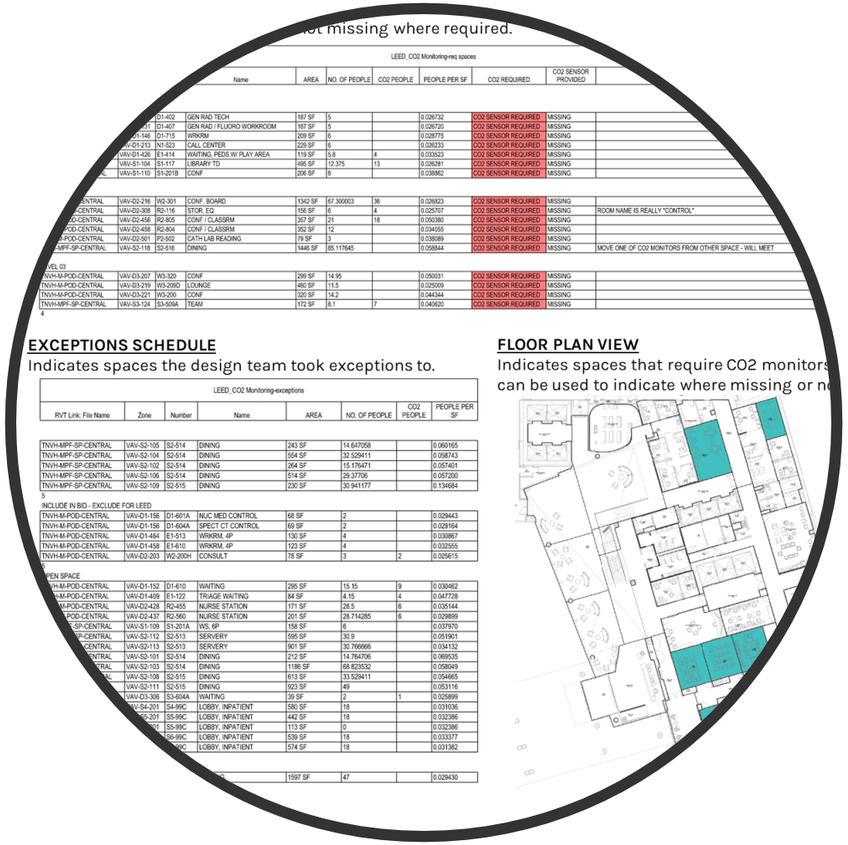


EXPERT SOFTWARE USERS ARE WHITE COLLAR MACHINISTS

THE ROBOTS ARE COMING

HOW WILL OUR WORKFLOWS CHANGE?

AUTOMATED



...ot missing where required.

LEED_CO2 Monitoring-req spaces

	Name	AREA	NO. OF PEOPLE	CO2 PEOPLE	PEOPLE PER SF	CO2 REQUIRED	CO2 SENSOR PROVIDED	
	D1-402 GEN RAD TECH	167 SF	5		0.026732	CO2 SENSOR REQUIRED	MISSING	
...23	D1-407 GEN RAD / FLUORO WORKROOM	187 SF	5		0.026720	CO2 SENSOR REQUIRED	MISSING	
	D1-146 D1-715 WRKRM	209 SF	6		0.028775	CO2 SENSOR REQUIRED	MISSING	
	D1-213 N1-523 CALL CENTER	229 SF	6		0.026233	CO2 SENSOR REQUIRED	MISSING	
	VAV-D1-426 E1-414 WAITING, PEDS W PLAY AREA	119 SF	5.8	4	0.033523	CO2 SENSOR REQUIRED	MISSING	
	VAV-S1-104 S1-117 LIBRARY TD	496 SF	12.375	13	0.026281	CO2 SENSOR REQUIRED	MISSING	
	VAV-S1-110 S1-2018 CONF	266 SF	6		0.038962	CO2 SENSOR REQUIRED	MISSING	
...CENTRAL	VAV-D2-216 W2-301 CONF. BOARD	1342 SF	67.300003	36	0.026823	CO2 SENSOR REQUIRED	MISSING	
...CENTRAL	VAV-D2-308 R2-116 STOR, EQ	156 SF	6	4	0.025707	CO2 SENSOR REQUIRED	MISSING	ROOM NAME IS REALLY "CONTROL"
...OD-CENTRAL	VAV-D2-456 R2-805 CONF / CLASSRM	357 SF	21	18	0.050380	CO2 SENSOR REQUIRED	MISSING	
...OD-CENTRAL	VAV-D2-458 R2-804 CONF / CLASSRM	352 SF	12		0.034055	CO2 SENSOR REQUIRED	MISSING	
...POD-CENTRAL	VAV-D2-501 P2-502 CATH LAB READING	79 SF	3		0.038089	CO2 SENSOR REQUIRED	MISSING	
...MPF-SP-CENTRAL	VAV-S2-118 S2-516 DINING	1446 SF	85.117645		0.058844	CO2 SENSOR REQUIRED	MISSING	MOVE ONE OF CO2 MONITORS FROM OTHER SPACE - WILL MEET
LEVEL 03								
TNVH-M-POD-CENTRAL	VAV-D3-207 W3-320 CONF	299 SF	14.95		0.050031	CO2 SENSOR REQUIRED	MISSING	
TNVH-M-POD-CENTRAL	VAV-D3-219 W3-209D LOUNGE	460 SF	11.5		0.025009	CO2 SENSOR REQUIRED	MISSING	
TNVH-M-POD-CENTRAL	VAV-D3-221 W3-200 CONF	320 SF	14.2		0.044344	CO2 SENSOR REQUIRED	MISSING	
TNVH-M-PF-SP-CENTRAL	VAV-S3-124 S3-509A TEAM	172 SF	8.1	7	0.040620	CO2 SENSOR REQUIRED	MISSING	

EXCEPTIONS SCHEDULE

Indicates spaces the design team took exceptions to.

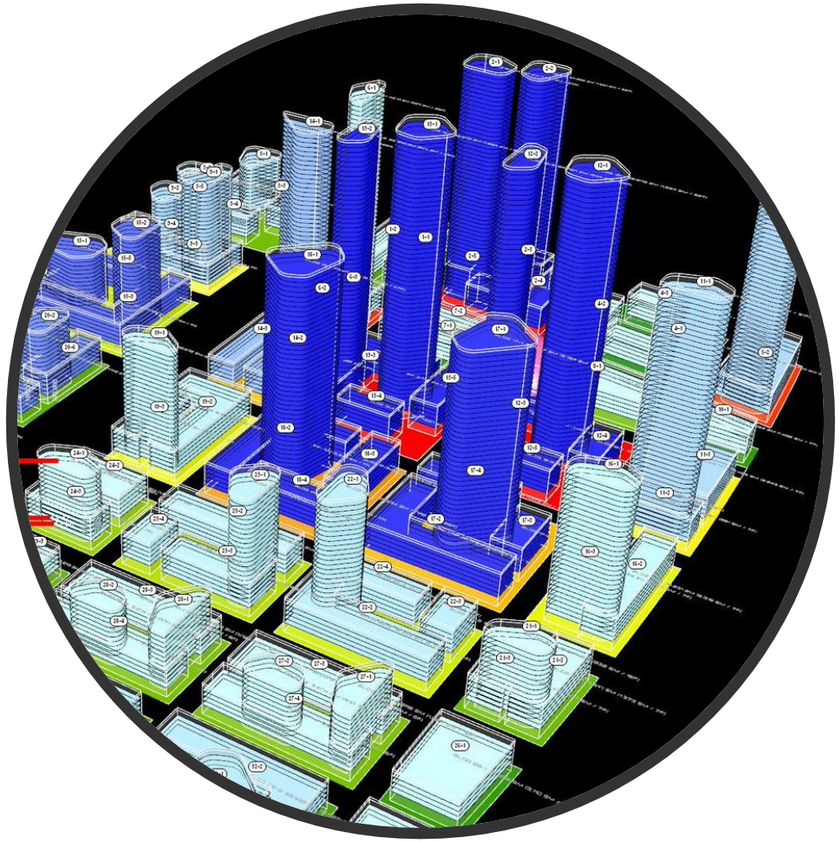
LEED_CO2 Monitoring-exceptions

RVT Link: File Name	Zone	Number	Name	AREA	NO. OF PEOPLE	CO2 PEOPLE	PEOPLE PER SF
TNVH-MPF-SP-CENTRAL	VAV-S2-105	S2-514	DINING	243 SF	14.647058		0.060165
TNVH-MPF-SP-CENTRAL	VAV-S2-104	S2-514	DINING	564 SF	32.529411		0.057743
TNVH-MPF-SP-CENTRAL	VAV-S2-102	S2-514	DINING	264 SF	15.176471		0.057501
TNVH-MPF-SP-CENTRAL	VAV-S2-106	S2-514	DINING	514 SF	29.37706		0.057200
TNVH-MPF-SP-CENTRAL	VAV-S2-109	S2-515	DINING	230 SF	30.941177		0.134684
5							
INCLUDE IN BID - EXCLUDE FOR LEED							
TNVH-M-POD-CENTRAL	VAV-D1-156	D1-601A	NUC MED CONTROL	68 SF	2		0.029443
TNVH-M-POD-CENTRAL	VAV-D1-156	D1-604A	SPECT CT CONTROL	69 SF	2		0.029164
TNVH-M-POD-CENTRAL	VAV-D1-464	E1-613	WRKRM, 4P	130 SF	4		0.030867
TNVH-M-POD-CENTRAL	VAV-D1-458	E1-610	WRKRM, 4P	123 SF	4		0.032555
TNVH-M-POD-CENTRAL	VAV-D2-203	W2-200H	CONSULT	78 SF	3	2	0.025615
6							
OPEN SPACE							
...H-M-POD-CENTRAL	VAV-D1-152	D1-610	WAITING	295 SF	15.15	9	0.030462
...M-POD-CENTRAL	VAV-D1-409	E1-122	TRIAGE WAITING	84 SF	4.15	4	0.047728
...M-POD-CENTRAL	VAV-D2-428	R2-455	NURSE STATION	171 SF	28.5	6	0.035144
...POD-CENTRAL	VAV-D2-437	R2-560	NURSE STATION	201 SF	28.714285	6	0.029899
...-SP-CENTRAL	VAV-S1-109	S1-201A	WS, 6P	158 SF	6		0.037970
...P-CENTRAL	VAV-S2-112	S2-513	SERVERY	595 SF	30.9		0.051901
...CENTRAL	VAV-S2-113	S2-513	SERVERY	901 SF	30.766666		0.034132
...CENTRAL	VAV-S2-101	S2-514	DINING	212 SF	14.764706		0.069535
...CENTRAL	VAV-S2-103	S2-514	DINING	1186 SF	68.823532		0.058049
	VAV-S2-108	S2-515	DINING	613 SF	33.529411		0.054665
	VAV-S2-111	S2-515	DINING	923 SF	49		0.053116
	VAV-D3-306	S3-604A	WAITING	39 SF	2	1	0.025899
	VAV-S4-201	S4-99C	LOBBY, INPATIENT	580 SF	18		0.031036
	...S5-201	S5-99C	LOBBY, INPATIENT	442 SF	18		0.032386
	...01	S5-99C	LOBBY, INPATIENT	113 SF	0		0.032386
	...S6-99C	S6-99C	LOBBY, INPATIENT	539 SF	18		0.033377
		99C	LOBBY, INPATIENT	574 SF	18		0.031362
	...G			1597 SF	47		0.029430

FLOOR PLAN VIEW

Indicates spaces that require CO2 monitors
can be used to indicate where missing or n

AUGMENTED



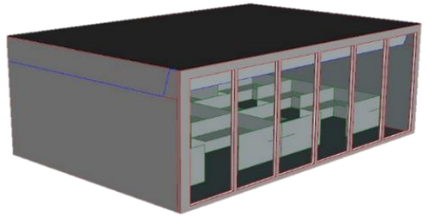
ANALOG

UM BIOLOGICAL SCIENCES BUILDING

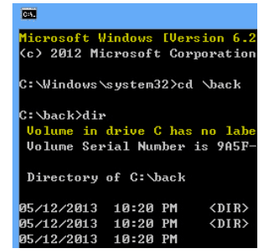
TRADITIONAL PERFORMANCE ANALYSIS

VALIDATE DESIGN OPTIONS

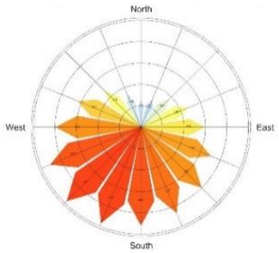
Model



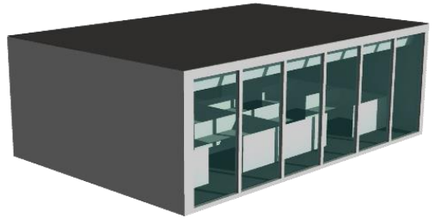
Calculate



Analyze



Design



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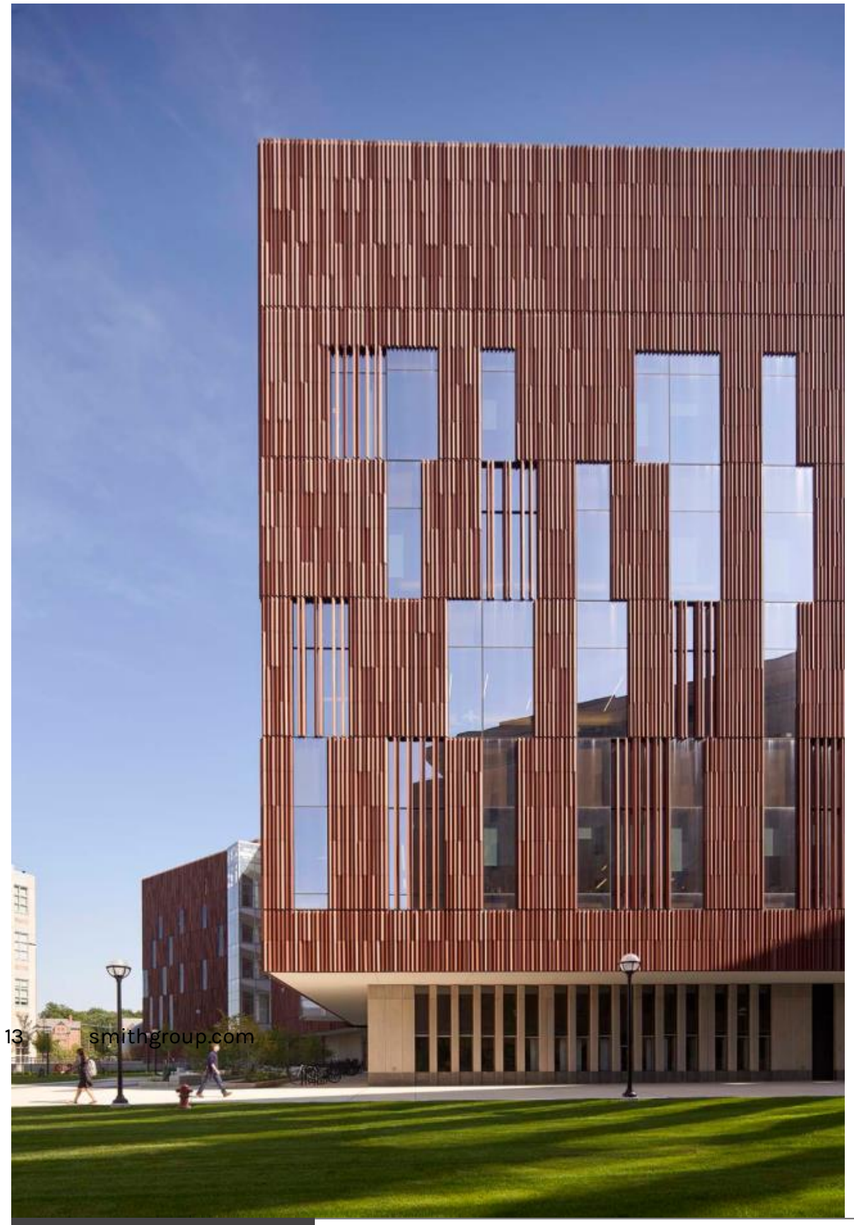
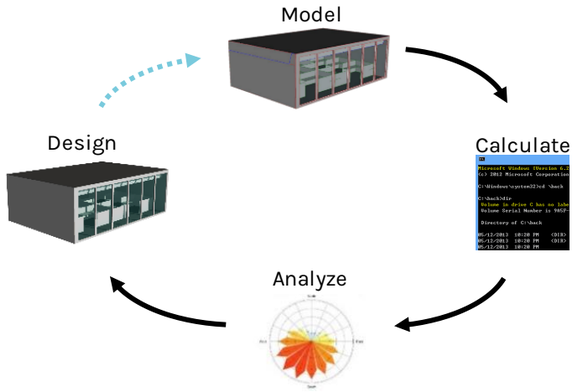
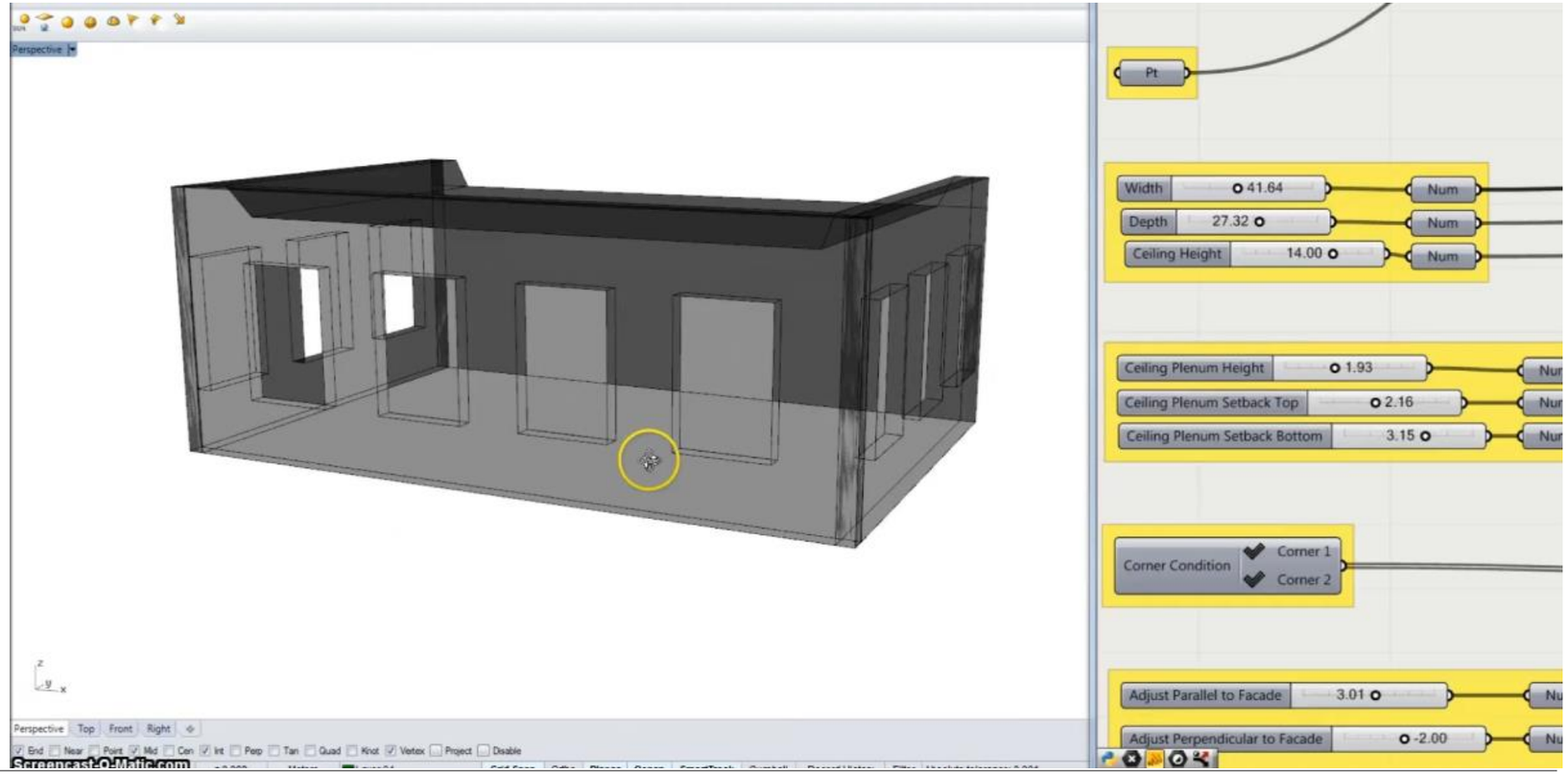
AUTOMATED ANALYSIS: BSB







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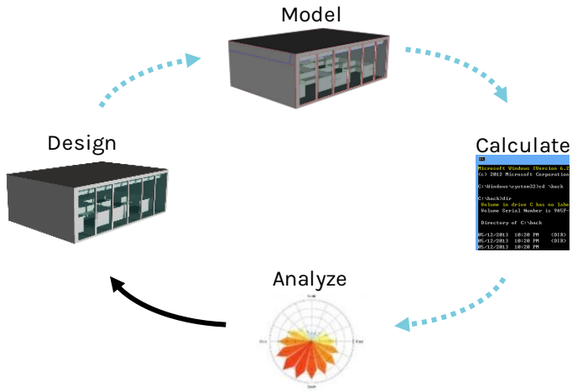
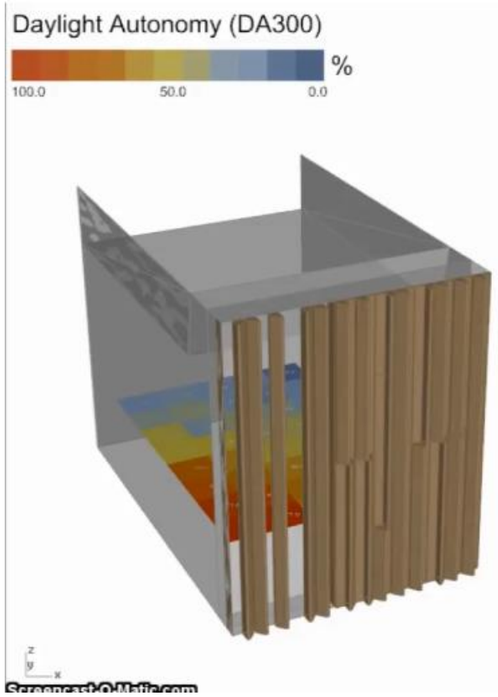
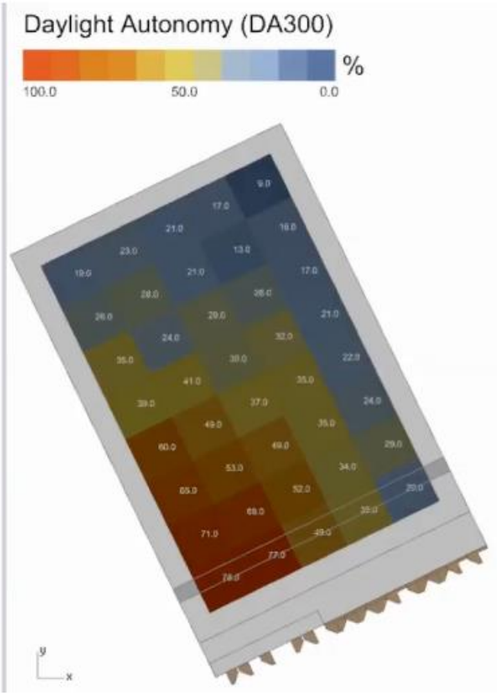
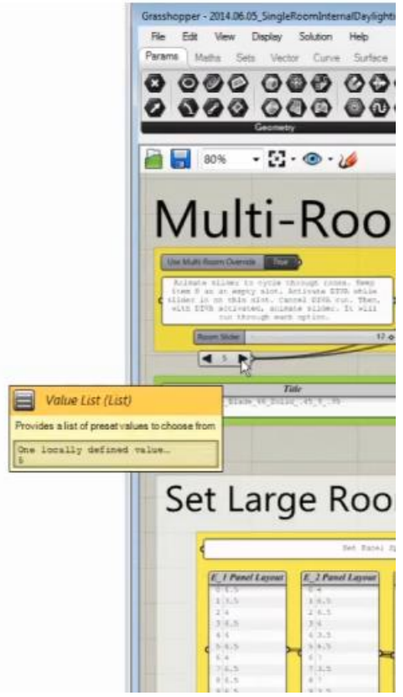
AUTOMATED ANALYSIS: BSB









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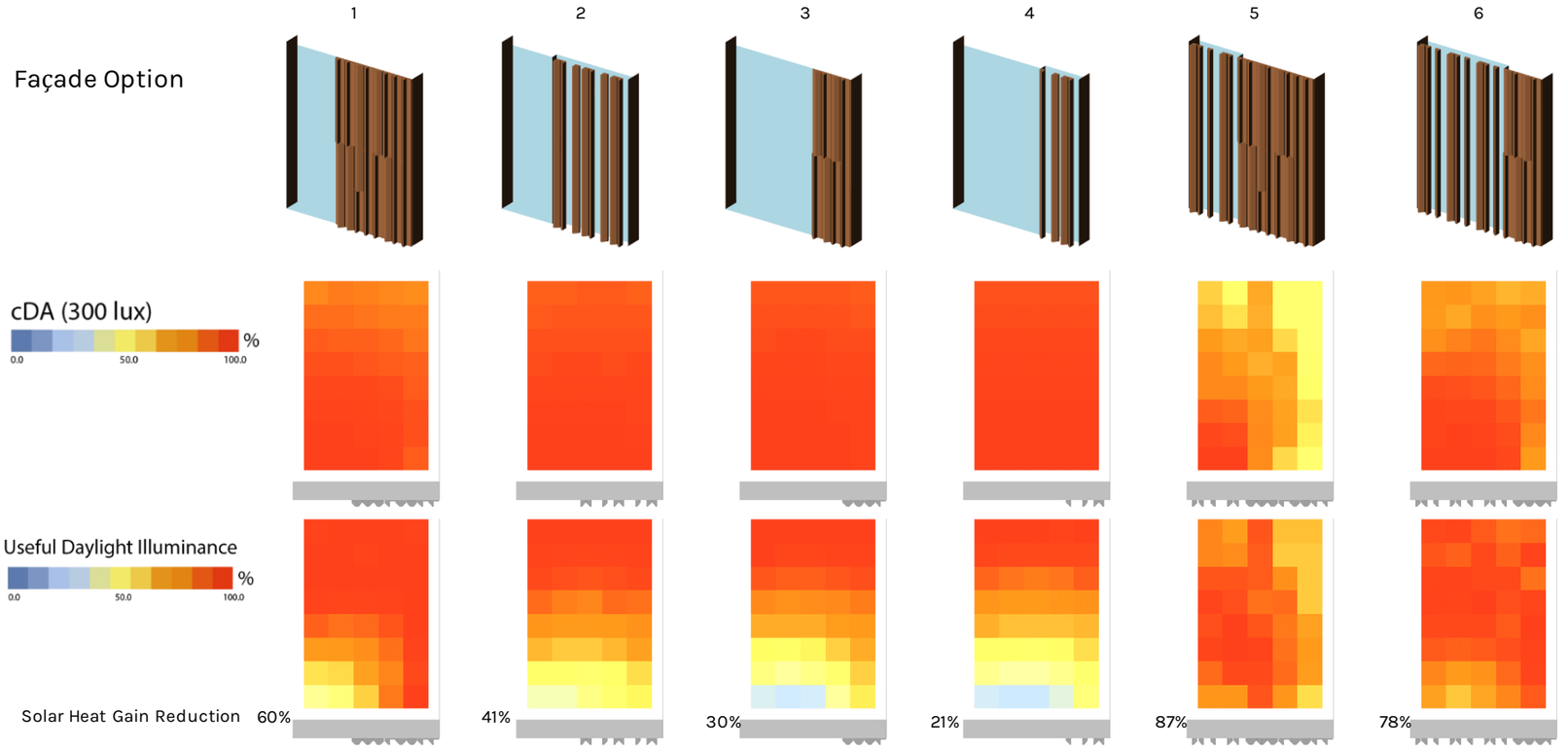
AUTOMATED ANALYSIS: BSB



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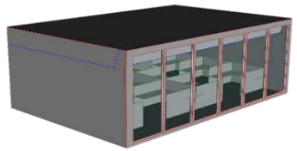
PARAMETRIC ANALYSIS

INFORM DESIGN DECISIONS

PARAMETRIC ENGINE

Model



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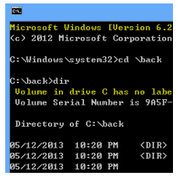
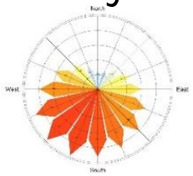


Analyze



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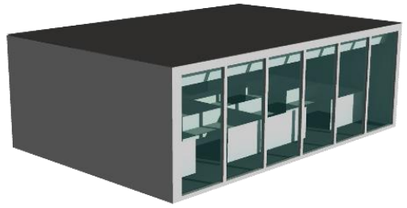
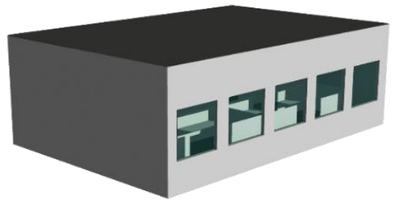
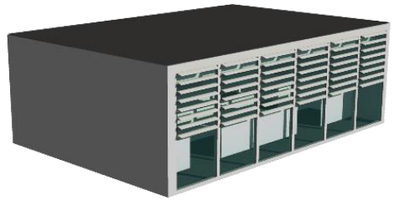




INFORMED DESIGN



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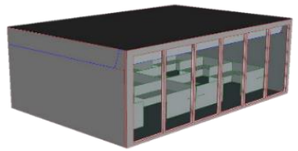
SURROGATE MODELING

INFORM DESIGN DECISIONS IN REAL TIME

PARAMETRIC ENGINE

Model



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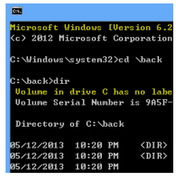
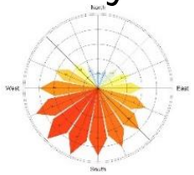


Analyze



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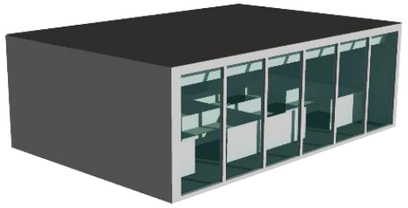
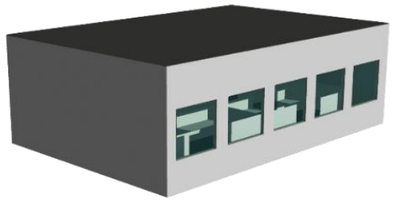
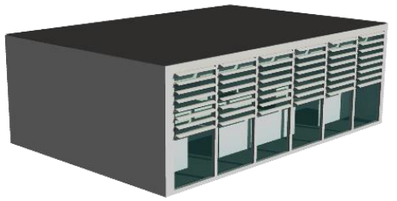




SURROGATE MODEL

INFORMED DESIGN



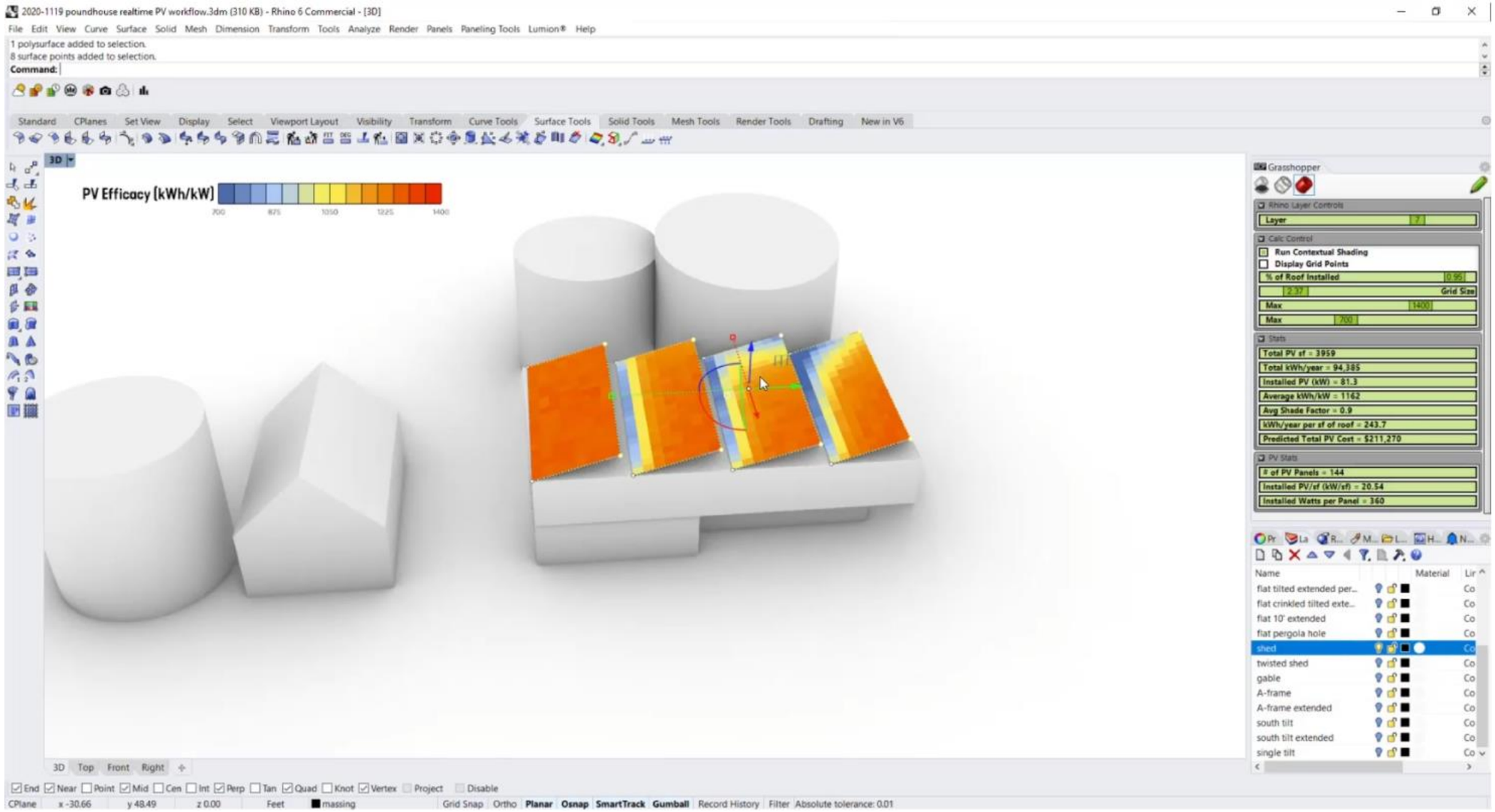
AUTOMATION GENERATES DATA

DATA FEEDS ANALYTICS AND ALGORITHMS

NEW ALGORITHMS = NEW DESIGN WORKFLOWS

DESIGN AUGMENTED BY AI

REALTIME PV ANALYSIS WITH SURROGATE MODELING



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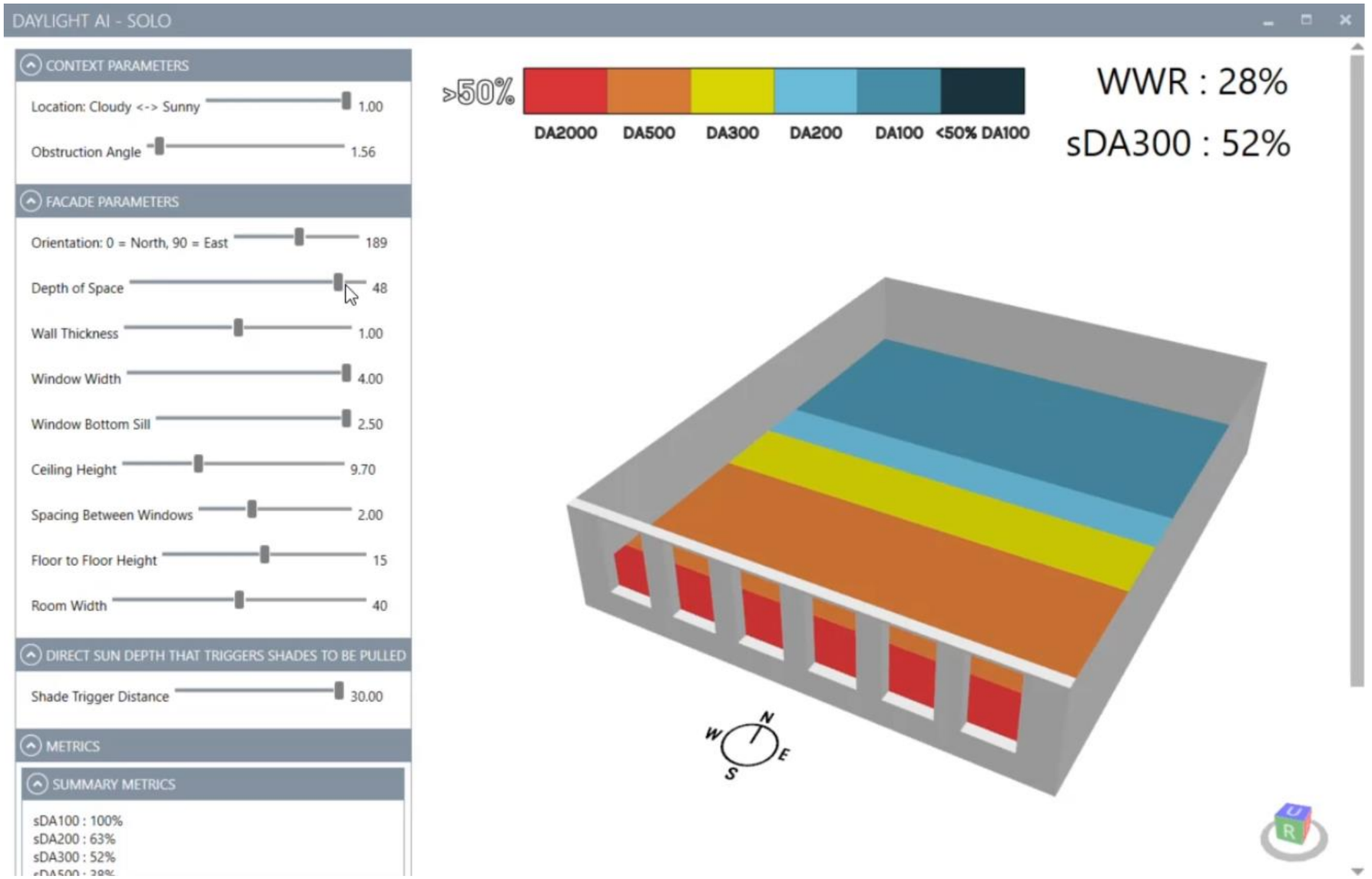
REAL-TIME DETAILED DAYLIGHTING ANALYSIS

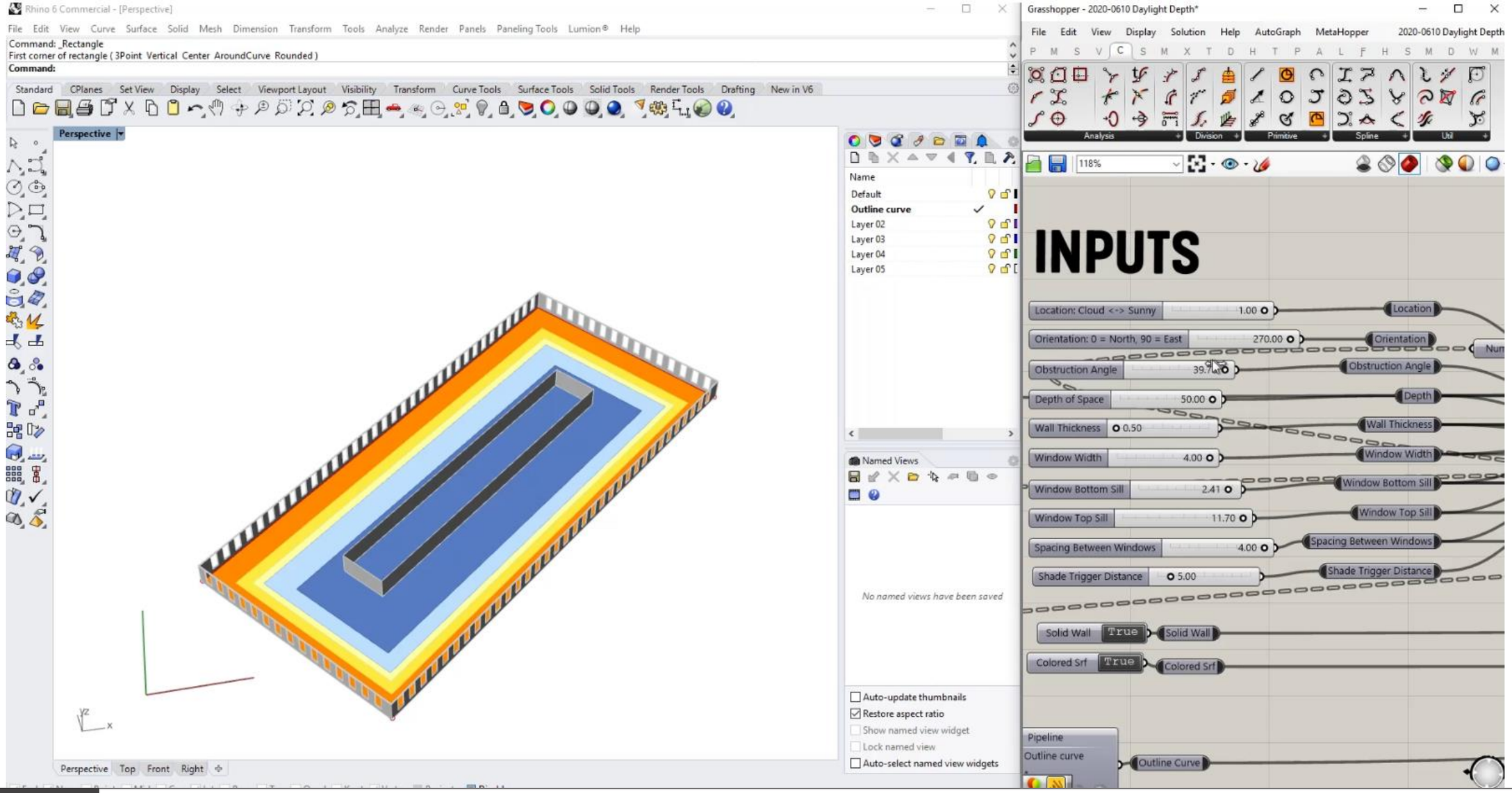
FOR FACADE



SMITHGROUP

REAL-TIME DETAILED DAYLIGHTING ANALYSIS

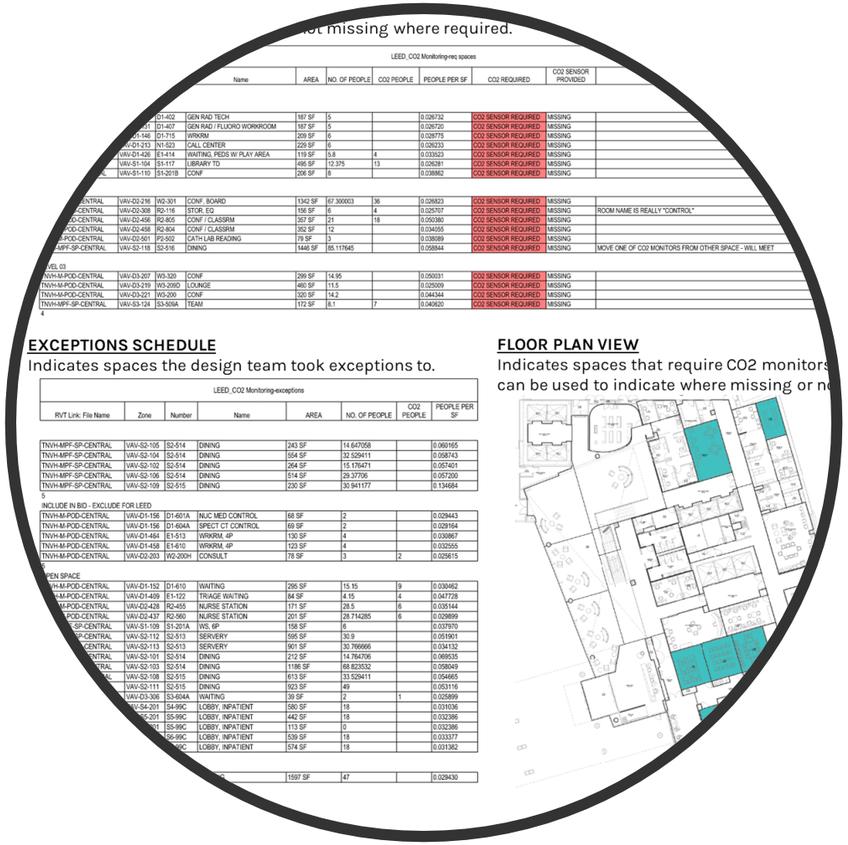
FOR FULL FLOORPLATES



SMITHGROUP

HOW WILL DATA CHANGE YOUR WORKFLOWS?

AUTOMATED



not missing where required.

LEED_CO2 Monitoring-req spaces

	Name	AREA	NO. OF PEOPLE	CO2 PEOPLE	PEOPLE PER SF	CO2 REQUIRED	CO2 SENSOR PROVIDED	
	D1-402 GEN RAD TECH	187 SF	5		0.026732	CO2 SENSOR REQUIRED	MISSING	
	D1-407 GEN RAD / FLUORO WORKROOM	187 SF	5		0.026720	CO2 SENSOR REQUIRED	MISSING	
	D1-715 WRKRM	209 SF	6		0.028775	CO2 SENSOR REQUIRED	MISSING	
	N1-523 CALL CENTER	229 SF	6		0.026233	CO2 SENSOR REQUIRED	MISSING	
	E1-414 WAITING, PEDS W PLAY AREA	119 SF	5.8	4	0.033523	CO2 SENSOR REQUIRED	MISSING	
	S1-117 LIBRARY TD	495 SF	12.375	13	0.026281	CO2 SENSOR REQUIRED	MISSING	
	S1-201B CONF	266 SF	8		0.030962	CO2 SENSOR REQUIRED	MISSING	
	W2-301 CONF, BOARD	1342 SF	67.300003	36	0.026823	CO2 SENSOR REQUIRED	MISSING	
	R2-116 STOR, EQ	156 SF	6	4	0.025707	CO2 SENSOR REQUIRED	MISSING	ROOM NAME IS REALLY "CONTROL"
	R2-805 CONF / CLASSRM	357 SF	21	18	0.050380	CO2 SENSOR REQUIRED	MISSING	
	R2-804 CONF / CLASSRM	352 SF	12		0.034055	CO2 SENSOR REQUIRED	MISSING	
	P2-502 CATH LAB READING	79 SF	3		0.038089	CO2 SENSOR REQUIRED	MISSING	
	S2-516 DINING	1446 SF	85.117645		0.058844	CO2 SENSOR REQUIRED	MISSING	MOVE ONE OF CO2 MONITORS FROM OTHER SPACE - WILL MEET
LEVEL 03								
	W3-320 CONF	299 SF	14.95		0.050031	CO2 SENSOR REQUIRED	MISSING	
	W3-209D LOUNGE	460 SF	11.5		0.025099	CO2 SENSOR REQUIRED	MISSING	
	W3-200 CONF	320 SF	14.2		0.044344	CO2 SENSOR REQUIRED	MISSING	
	S3-509A TEAM	172 SF	8.1	7	0.040620	CO2 SENSOR REQUIRED	MISSING	

EXCEPTIONS SCHEDULE

Indicates spaces the design team took exceptions to.

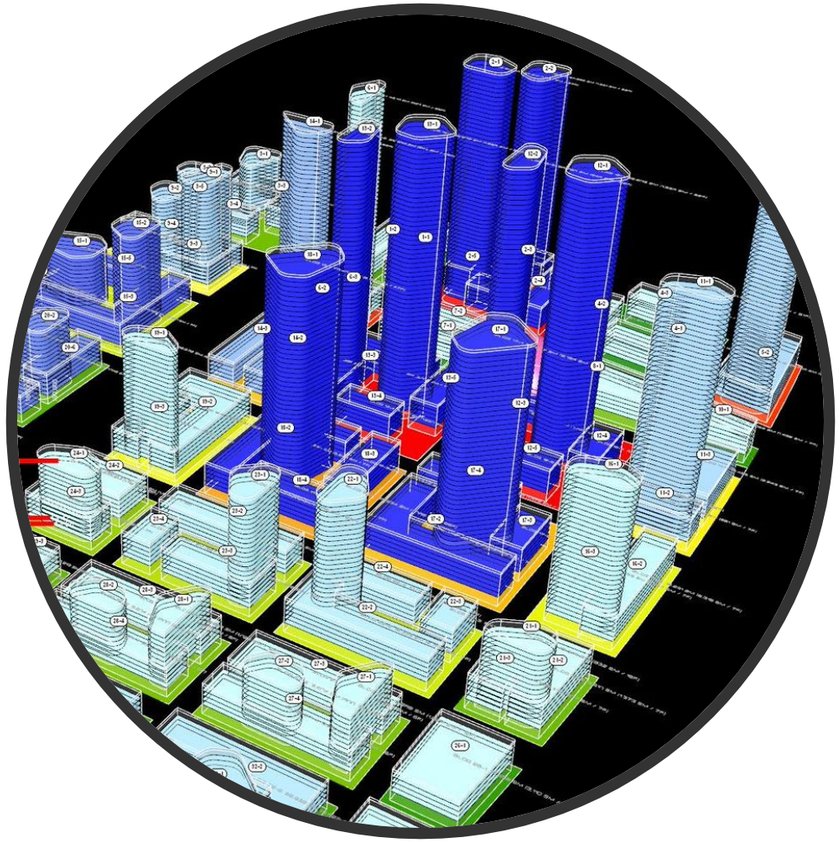
LEED_CO2 Monitoring-exceptions

RVT Link: File Name	Zone	Number	Name	AREA	NO. OF PEOPLE	CO2 PEOPLE	PEOPLE PER SF
TNVH-MPF-SP-CENTRAL	VAV-S2-105	S2-514	DINING	243 SF	14.647058		0.060165
TNVH-MPF-SP-CENTRAL	VAV-S2-104	S2-514	DINING	164 SF	32.529411		0.058743
TNVH-MPF-SP-CENTRAL	VAV-S2-102	S2-514	DINING	264 SF	15.176471		0.057401
TNVH-MPF-SP-CENTRAL	VAV-S2-106	S2-514	DINING	514 SF	29.37706		0.057200
TNVH-MPF-SP-CENTRAL	VAV-S2-109	S2-515	DINING	230 SF	30.941177		0.134684
5							
INCLUDE IN BID - EXCLUDE FOR LEED							
TNVH-M-POD-CENTRAL	VAV-D1-156	D1-601A	NUC MED CONTROL	68 SF	2		0.029443
TNVH-M-POD-CENTRAL	VAV-D1-156	D1-604A	SPECT CT CONTROL	69 SF	2		0.029164
TNVH-M-POD-CENTRAL	VAV-D1-464	E1-613	WRKRNL 4P	130 SF	4		0.030867
TNVH-M-POD-CENTRAL	VAV-D1-458	E1-610	WRKRM, 4P	123 SF	4		0.032555
TNVH-M-POD-CENTRAL	VAV-D2-203	W2-200H	CONSULT	78 SF	3	2	0.025615
6							
OPEN SPACE							
TNVH-M-POD-CENTRAL	VAV-D1-152	D1-610	WAITING	295 SF	15.15	9	0.030462
TNVH-M-POD-CENTRAL	VAV-D1-409	E1-122	TRIAGE WAITING	84 SF	4.15	4	0.047728
TNVH-M-POD-CENTRAL	VAV-D2-428	R2-455	NURSE STATION	171 SF	28.5	6	0.035144
TNVH-M-POD-CENTRAL	VAV-D2-437	R2-560	NURSE STATION	201 SF	28.714285	6	0.029899
TNVH-MPF-SP-CENTRAL	VAV-S1-109	S1-201A	WS, 6P	158 SF	6		0.037970
TNVH-MPF-SP-CENTRAL	VAV-S2-112	S2-513	SERVERY	595 SF	30.9		0.051901
TNVH-MPF-SP-CENTRAL	VAV-S2-113	S2-513	SERVERY	901 SF	30.766666		0.034132
TNVH-MPF-SP-CENTRAL	VAV-S2-101	S2-514	DINING	212 SF	14.764706		0.069535
TNVH-MPF-SP-CENTRAL	VAV-S2-103	S2-514	DINING	1186 SF	68.823532		0.058049
TNVH-MPF-SP-CENTRAL	VAV-S2-108	S2-515	DINING	613 SF	33.529411		0.054665
TNVH-MPF-SP-CENTRAL	VAV-S2-111	S2-515	DINING	923 SF	49		0.053116
TNVH-MPF-SP-CENTRAL	VAV-D3-306	S3-604A	WAITING	39 SF	2	1	0.025899
TNVH-M-POD-CENTRAL	VAV-S4-201	S4-99C	LOBBY, INPATIENT	580 SF	18		0.031036
TNVH-M-POD-CENTRAL	VAV-S5-201	S5-99C	LOBBY, INPATIENT	442 SF	18		0.032386
TNVH-M-POD-CENTRAL	VAV-S5-201	S5-99C	LOBBY, INPATIENT	113 SF	0		0.032386
TNVH-M-POD-CENTRAL	VAV-S6-201	S6-99C	LOBBY, INPATIENT	539 SF	18		0.033377
TNVH-M-POD-CENTRAL	VAV-S6-201	S6-99C	LOBBY, INPATIENT	574 SF	18		0.031362
7							
				1597 SF	47		0.029430

FLOOR PLAN VIEW

Indicates spaces that require CO2 monitors
can be used to indicate where missing or n

AUGMENTED



ANALOG