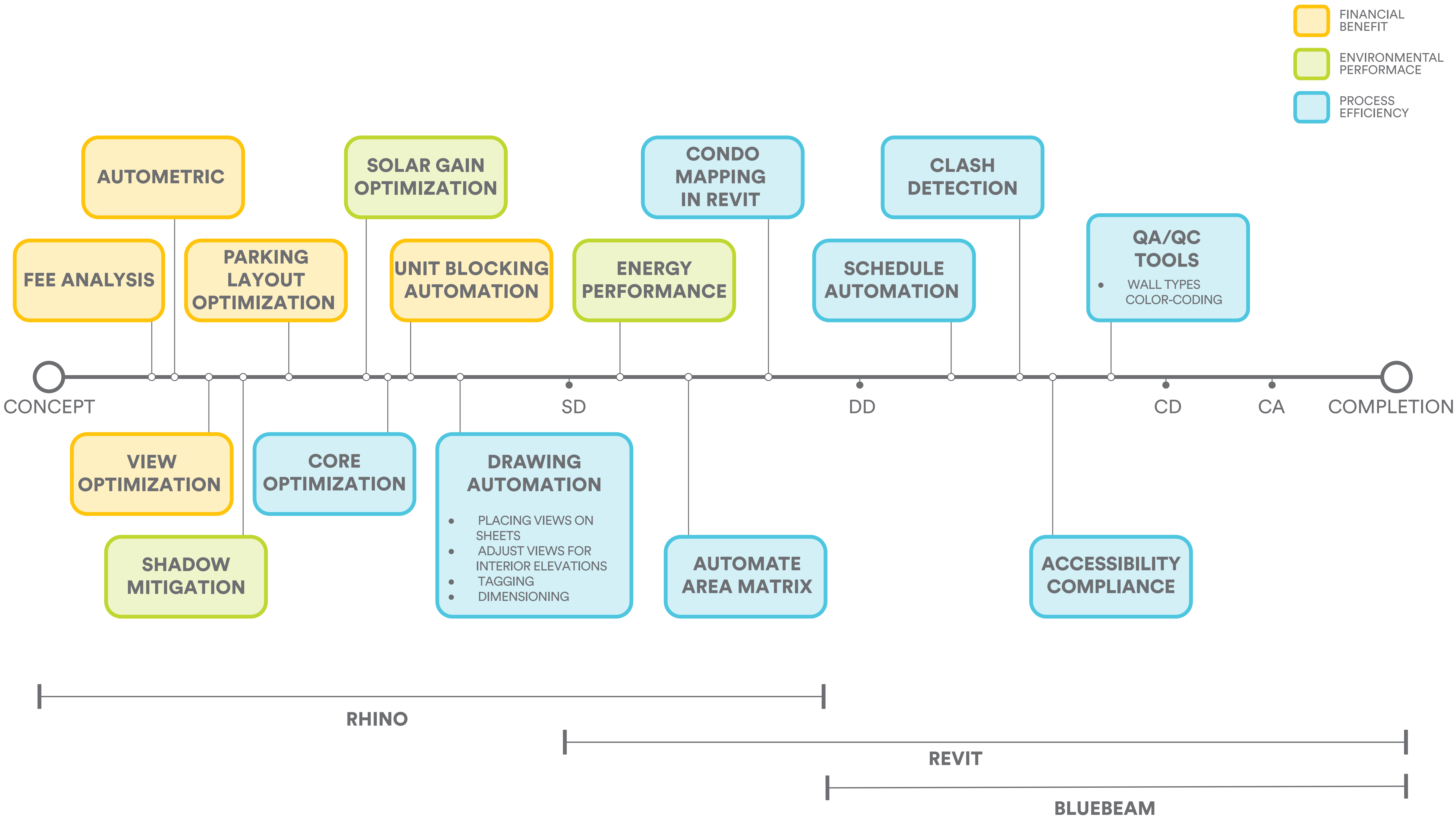
residential r+d

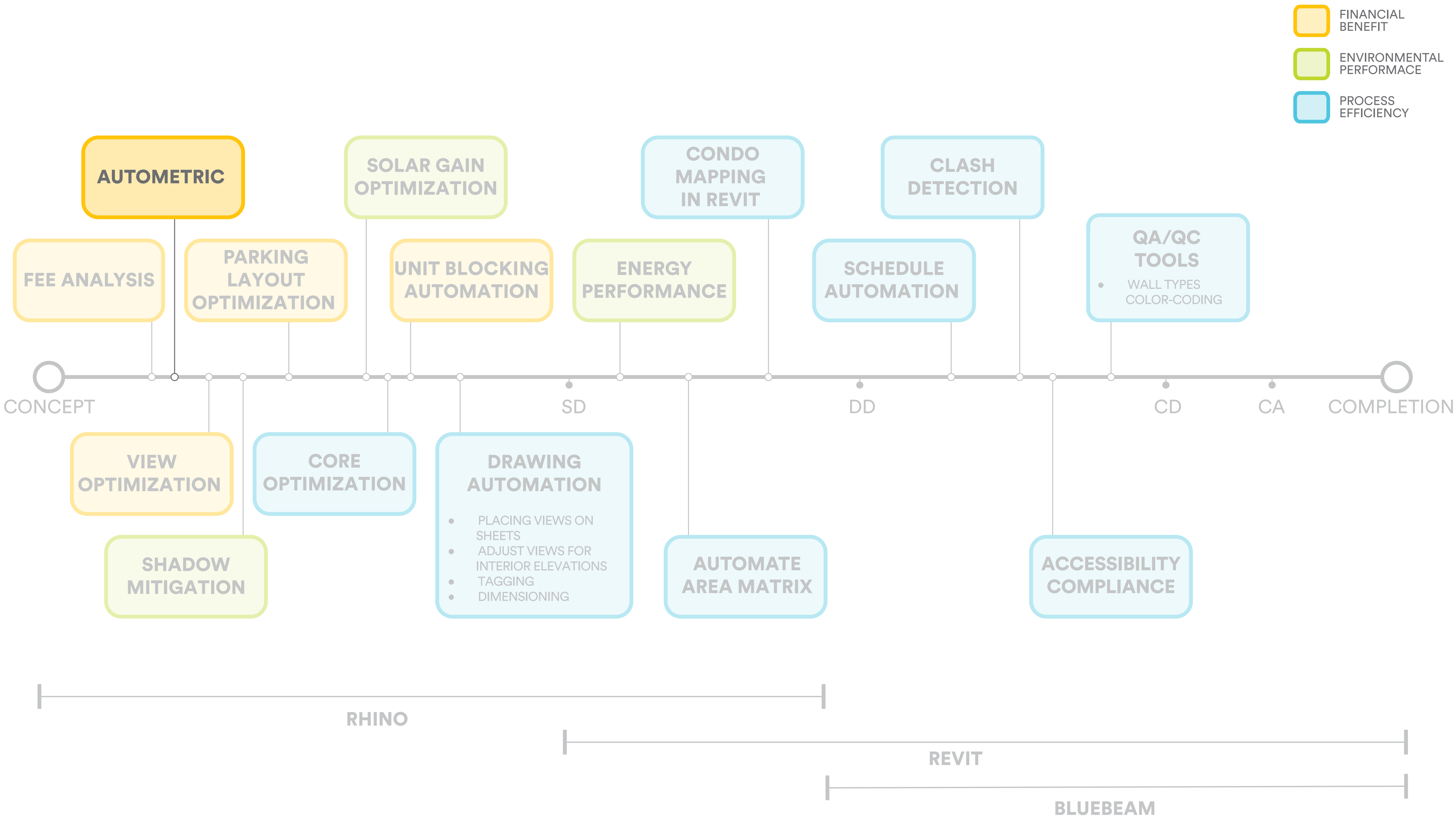
computational design

SCB

as we look for **opportunities** to leverage **computational design,** we consider a **“day in the life”...**

...of a prototypical project

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PROCESS EFFICIENCY
AUTOMETRIC
SOLAR GAIN OPTIMIZATION
CONDO MAPPING IN REVIT
CLASH DETECTION
FEE ANALYSIS
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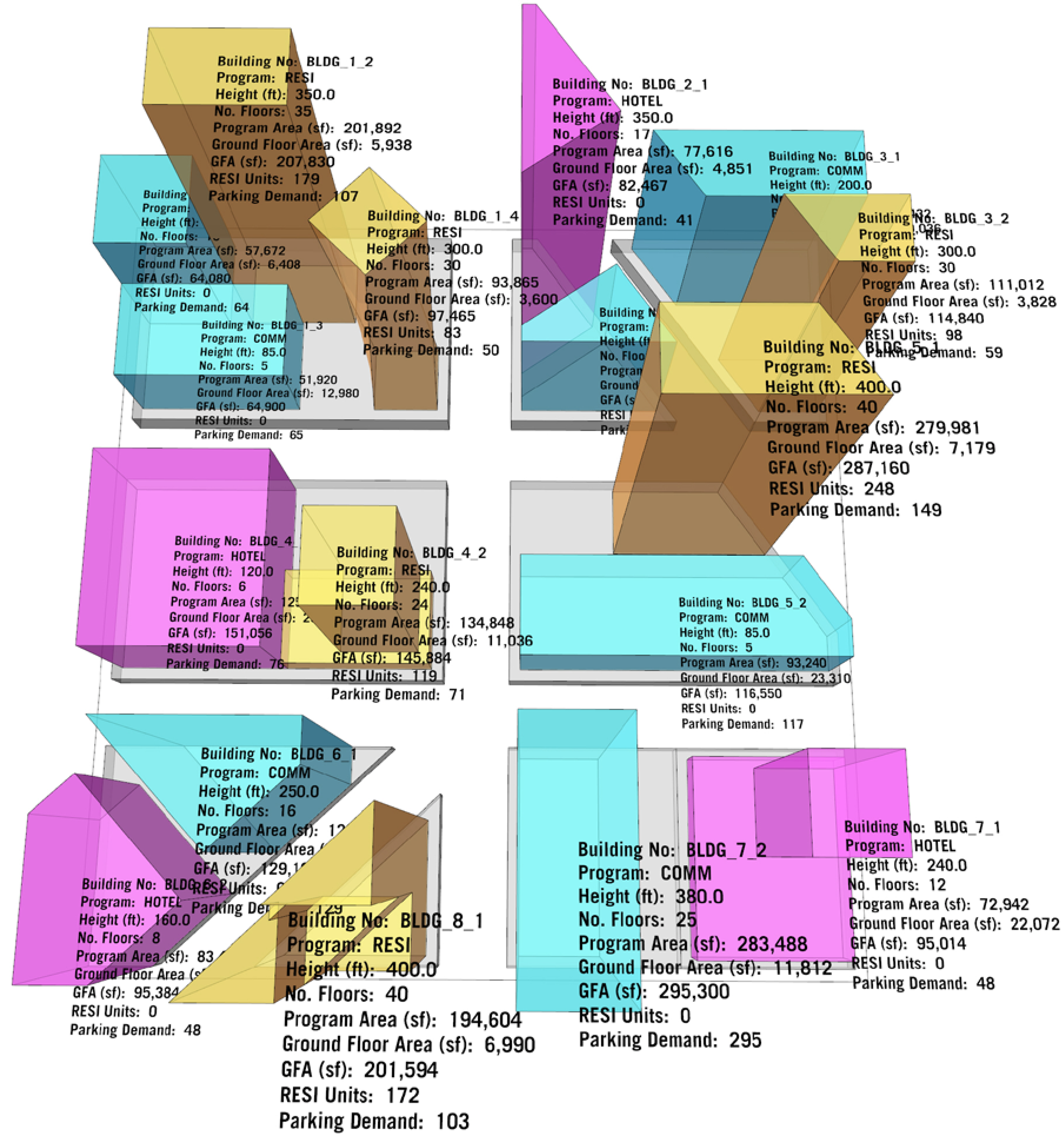
SHADOW MITIGATION
RHINO
REVIT
BLUEBEAM

01

autometric

real-time massing metrics

Confidential Project, San Francisco



inform the design process in **real-time,**
from **concept** to **yield + financial impact.**
evaluate, adjust, and repeat.

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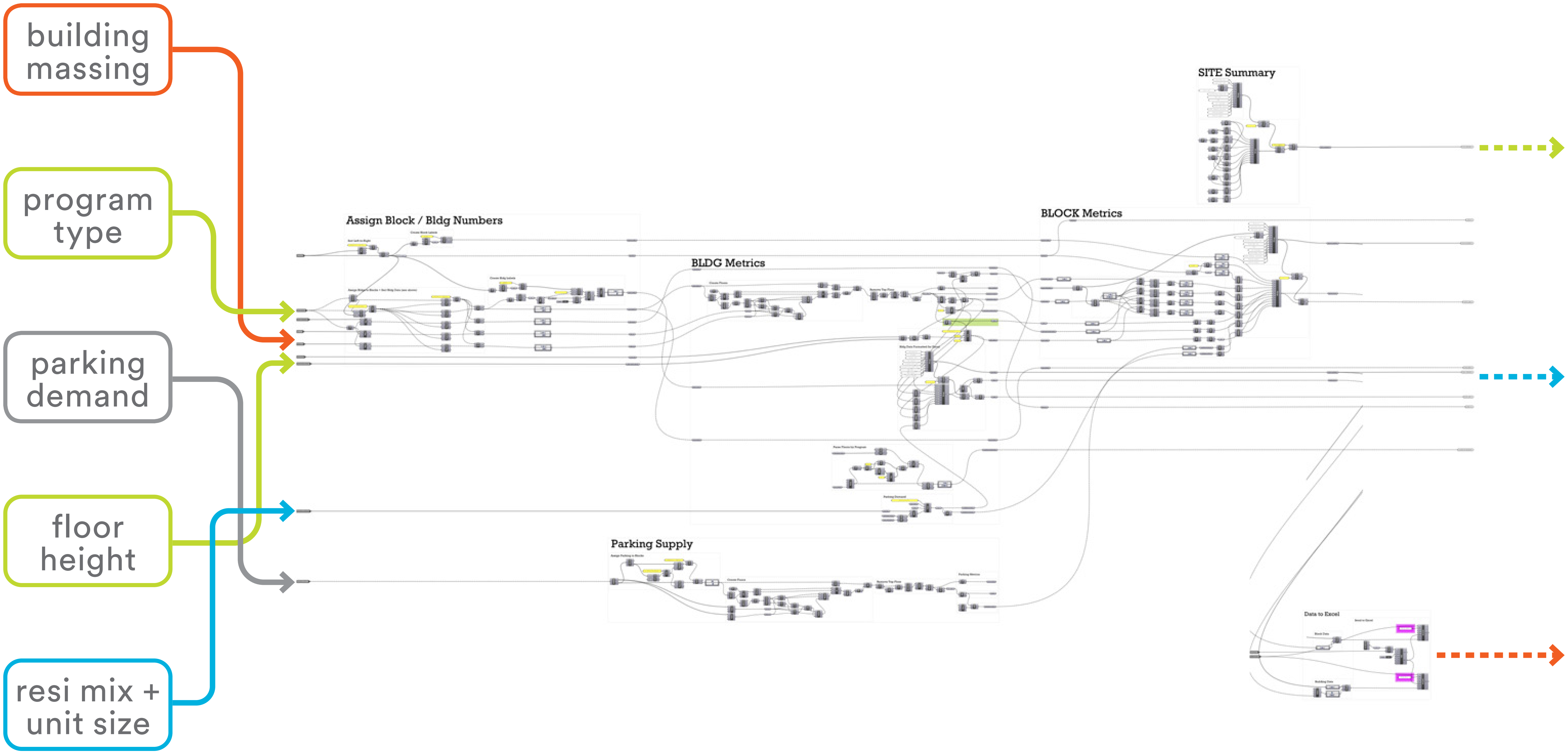
reads rhino massing w/ various user inputs

autometric



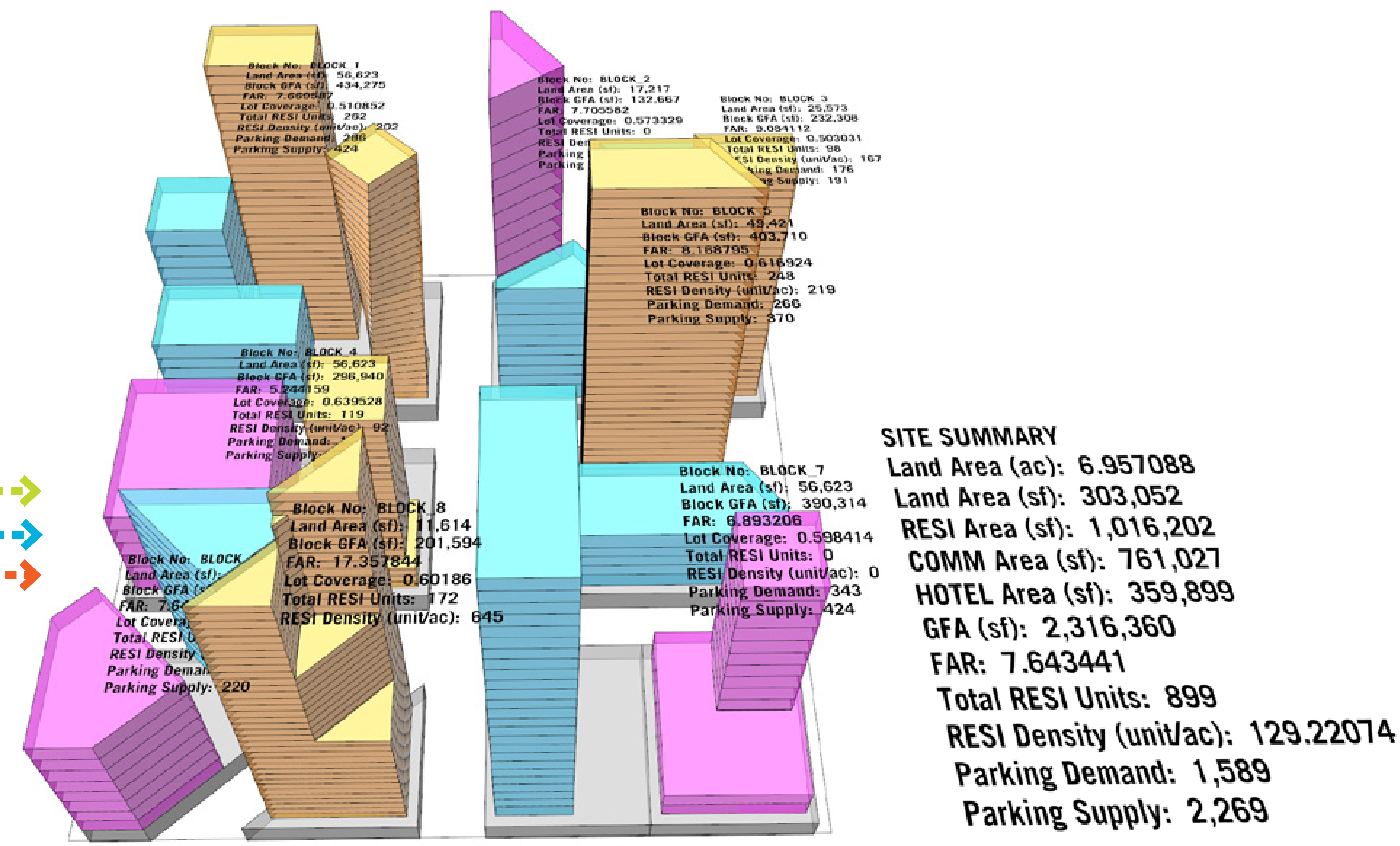
real-time yield calculation w/ linked pro forma

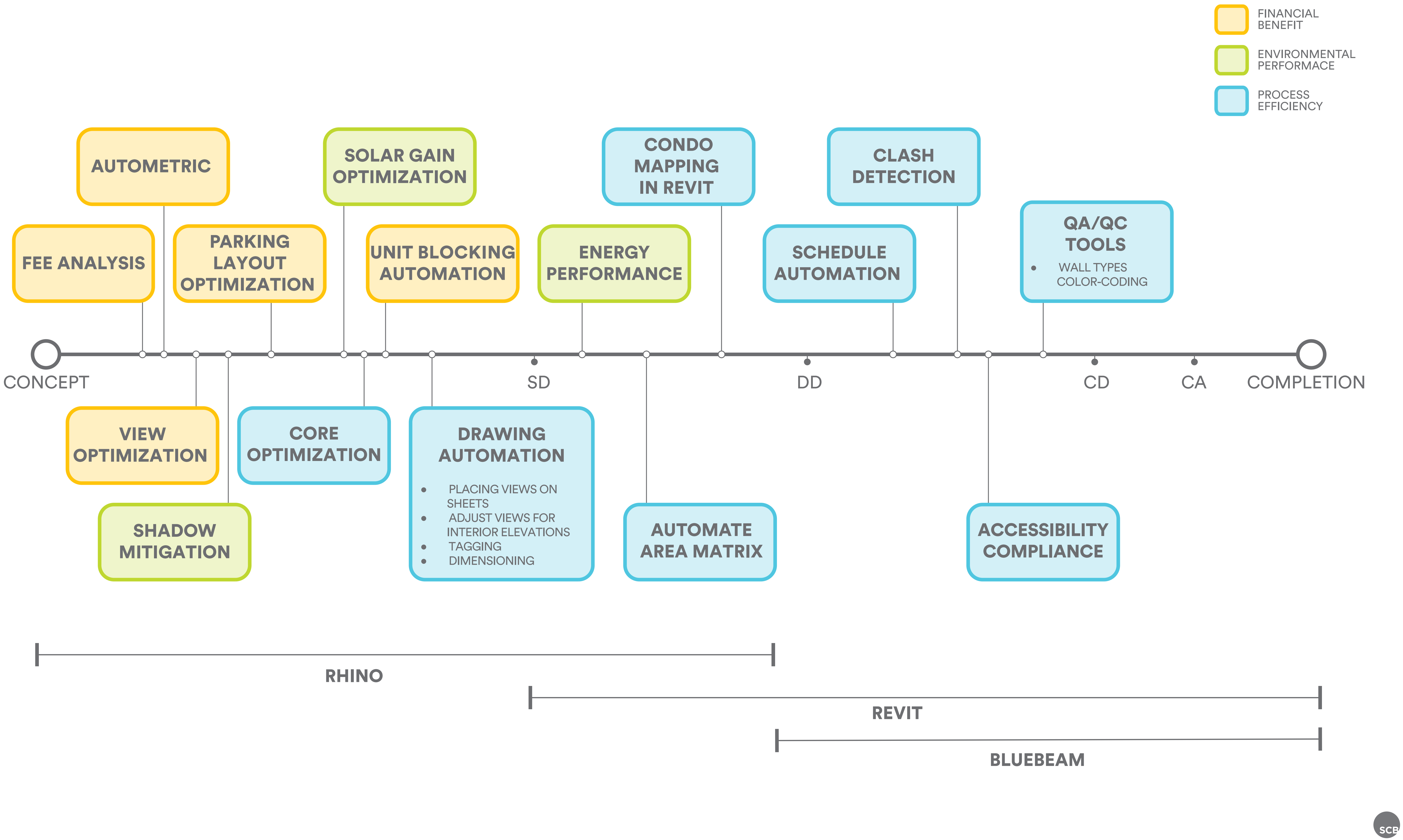
autometric

output to excel

Parcel No	Land Area (ac)	Land Area (sf)	RESI Area (sf)	PDR Area (sf)	Ground Floor Area (sf)	Parcel GFA (sf)	FAR	Total RESI Units	RESI Density (unit/ac)	Parking Demand	Parking Supply
PARCEL_1	0.69	30,025	84,000	19,564	40,564	103,564	3.45	92	133	72	101
PARCEL_2	0.48	21,090	58,688	9,951	24,623	68,639	3.25	64	132	46	79
PARCEL_3	0.92	40,258	129,608	40,184	72,586	169,792	4.22	143	155	122	100
PARCEL_4	0.46	19,917	70,188	19,917	37,464	90,105	4.52	77	168	63	49
PARCEL_5	1.85	80,567	326,333	14,389	103,710	340,722	4.23	358	194	256	270
PARCEL_6	0.46	19,939	70,296	19,939	37,513	90,235	4.53	77	168	63	49
PARCEL_7	0.46	19,881	69,964	19,881	37,372	89,845	4.52	77	169	63	49
PARCEL_8	0.43	18,817	22,144	7,403	12,939	29,547	1.57	24	56	17	47
PARCEL_9	1.21	52,539	180,660	38,038	83,203	218,698	4.16	199	165	160	167
PARCEL_10	0.46	20,000	70,400	20,000	37,600	90,400	4.52	77	168	63	50
PARCEL_11	0.92	39,974	193,374	40,027	72,256	233,401	5.84	213	232	171	100
PARCEL_12	0.92	40,068	128,936	25,148	57,382	154,084	3.85	142	154	111	137
PARCEL_13	0.49	21,216	83,976	21,216	35,212	105,192	4.96	92	189	73	53
TOTALS	**9.74**	**424,291**	**1,488,567**	**295,657**	**652,424**	**1,784,224**	**4.21**	**1,635**	**168**	**1,280**	**1,251**

real-time display in rhino

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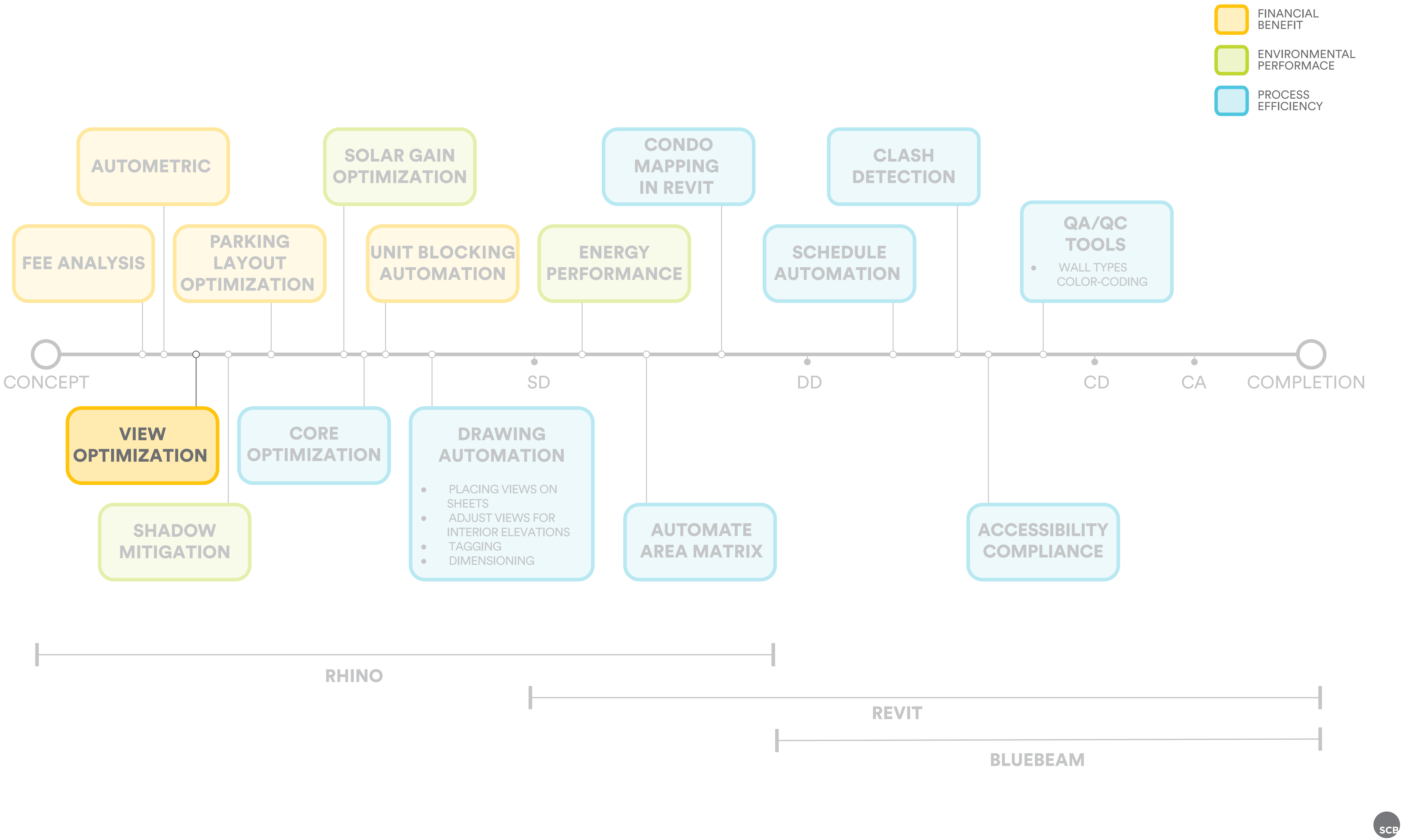
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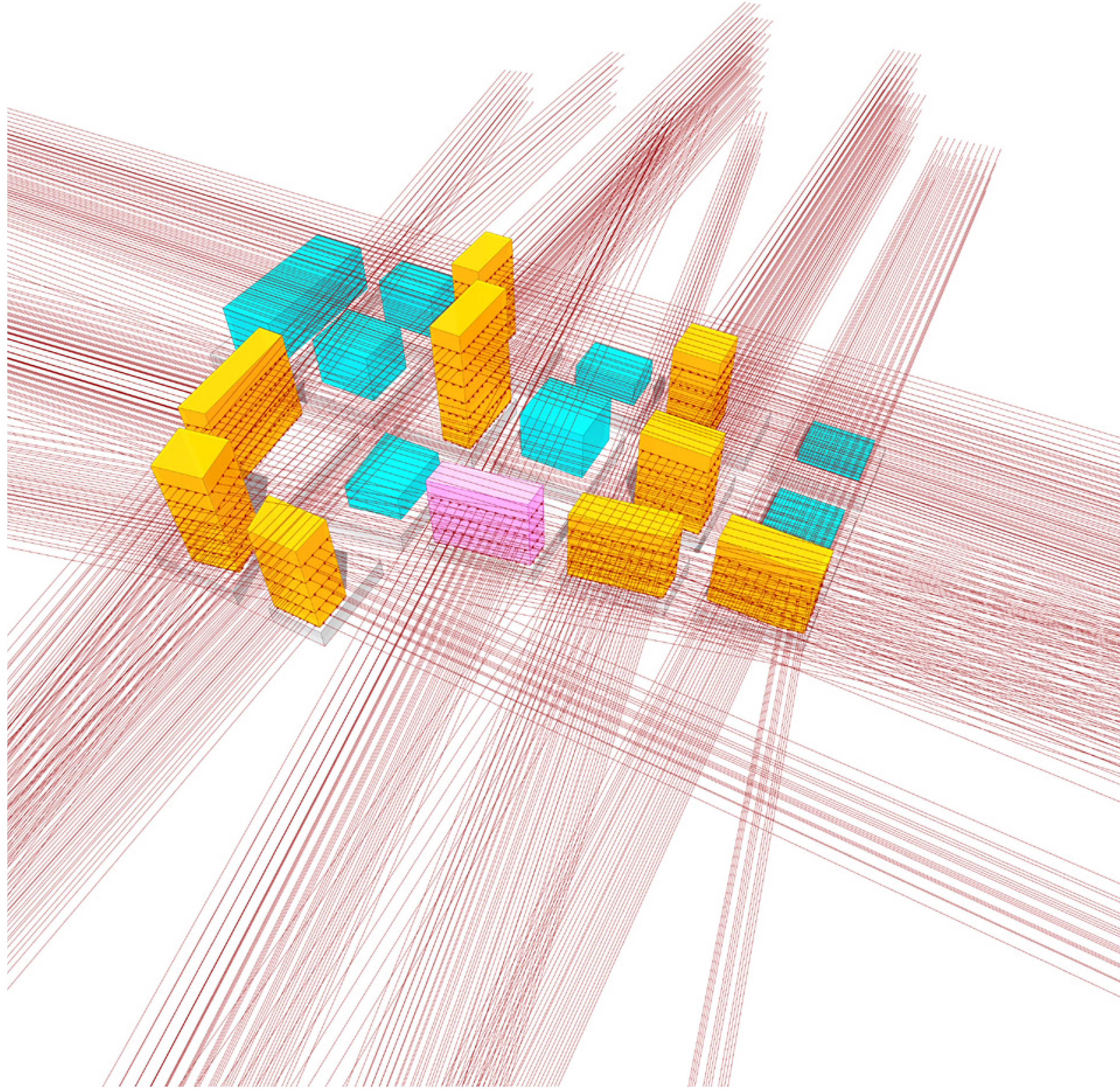
02

view optimization + machine learning

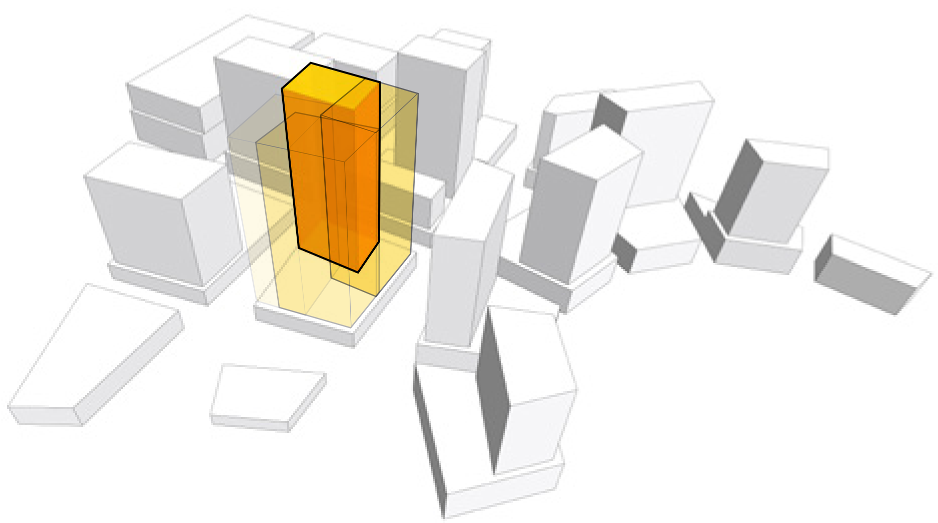
masterplan scale

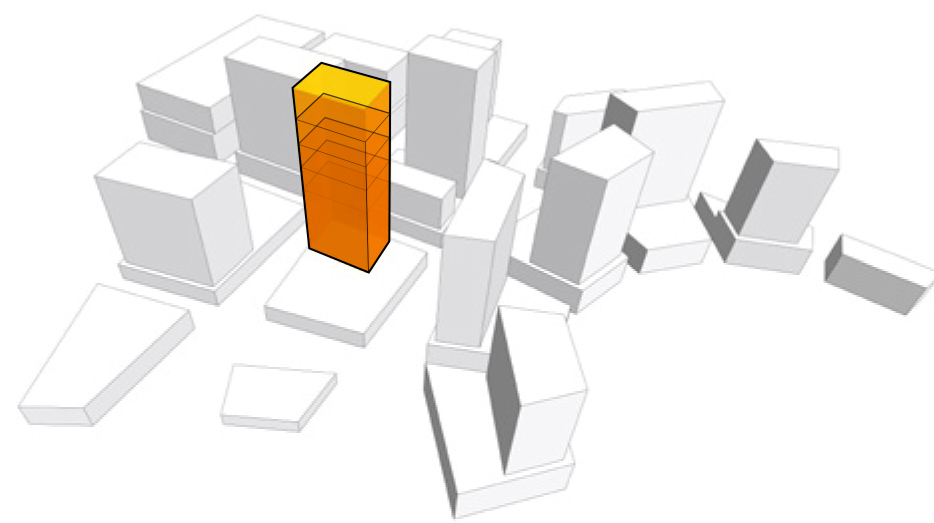
Confidential Project, Oakland

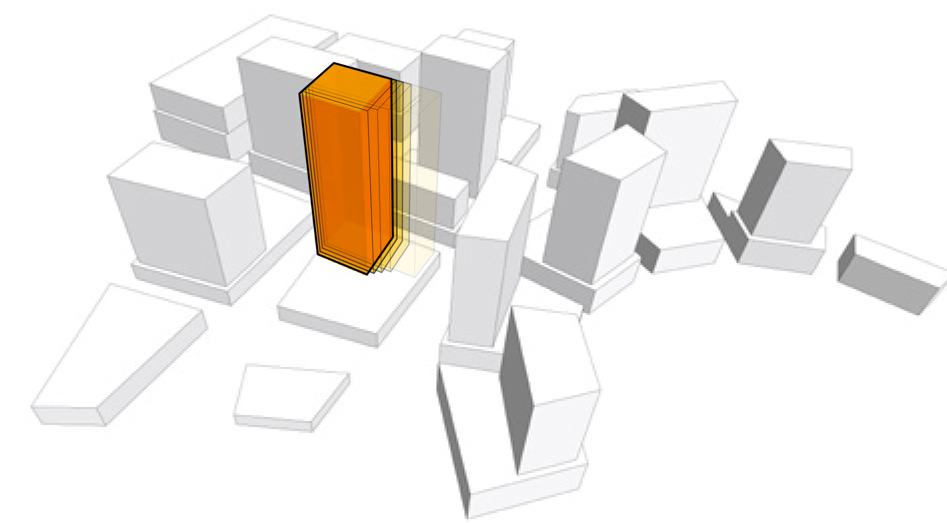


how do we know we have achieved an **optimal solution** within the **complexity of exponential possibility?**

maximize unobstructed residential views







where is the tower located? + **how tall is it?** + **what is its proportion?**

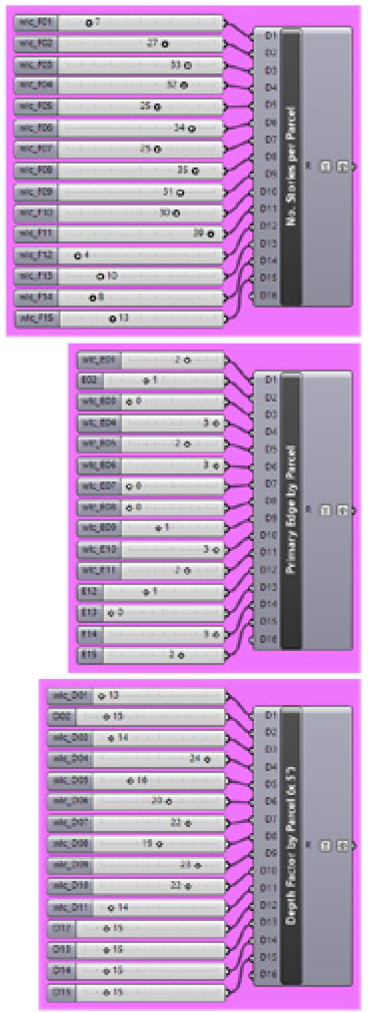
3 variables x 18 buildings = 1.5 × 10^{30} sphere of possible solutions

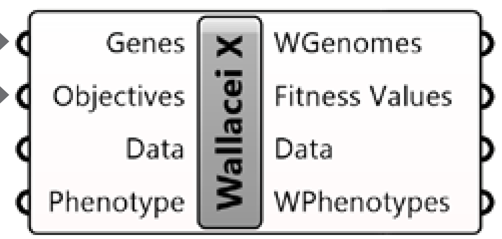
through **machine-learning** we define the **variables** and **objectives** and let the machine run **thousands of options**

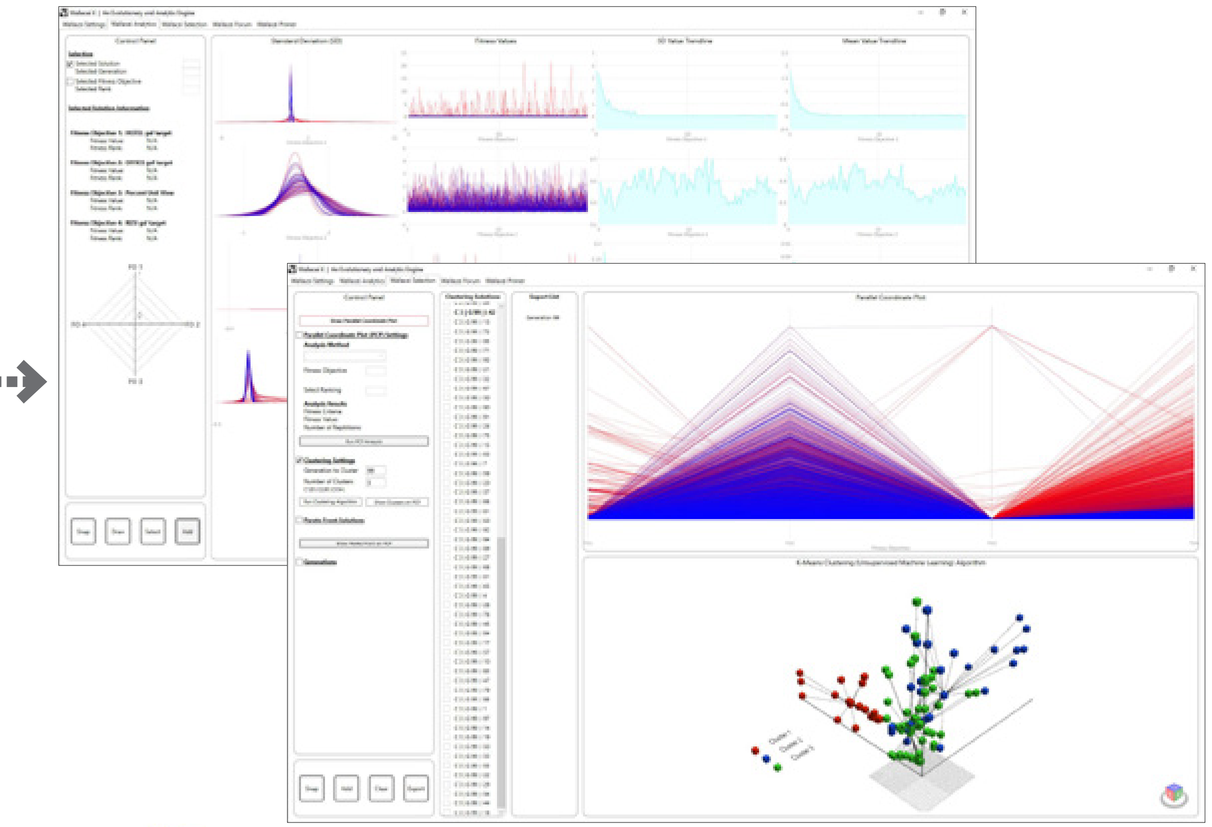
evolutionary-based solver learns as it iterates

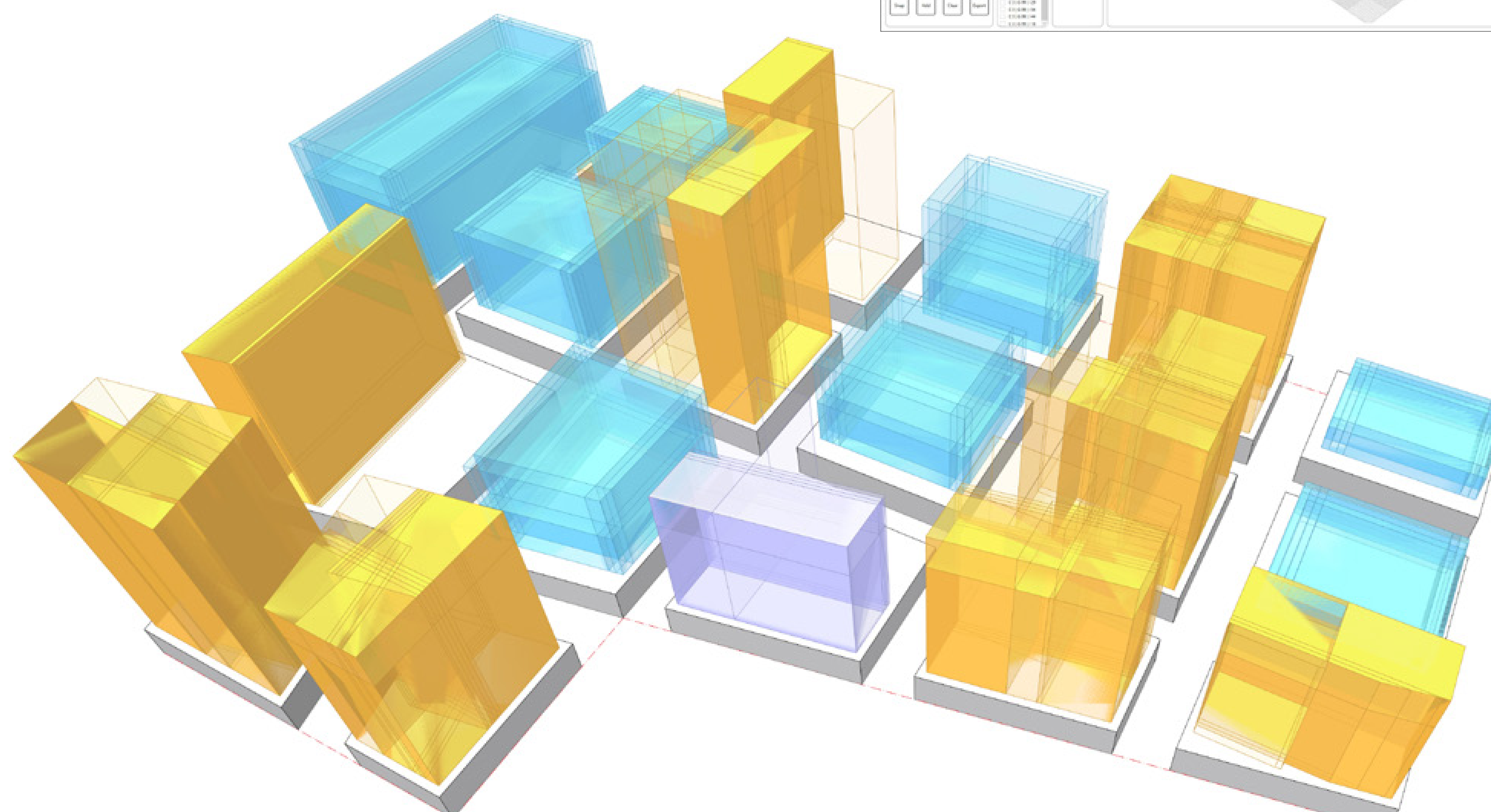
views + machine learning

variables ("genes")









objectives

meet program

resi	3m gsf
office	1.5m gsf
hotel	300k gsf

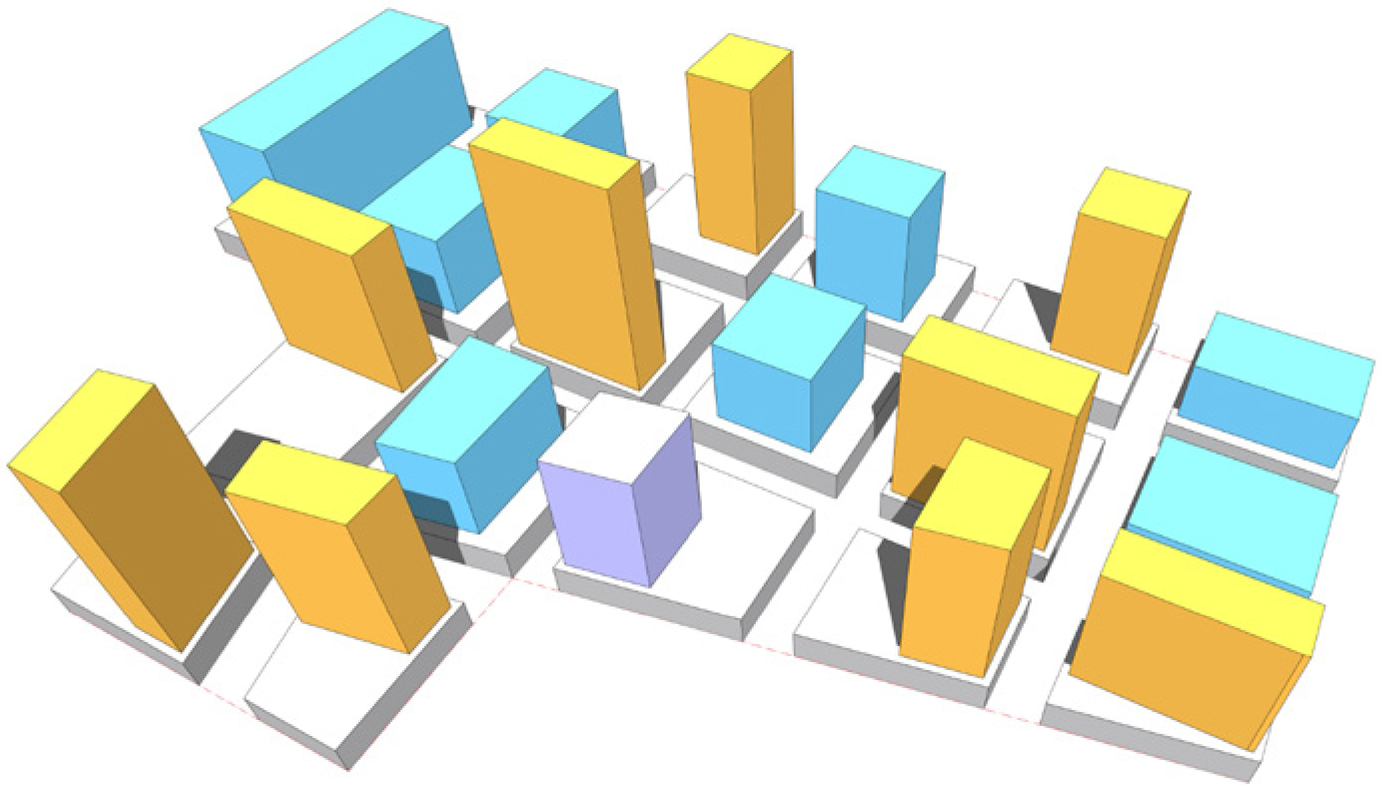
maximize resi unit views

100 best solutions of 10,000 iterations

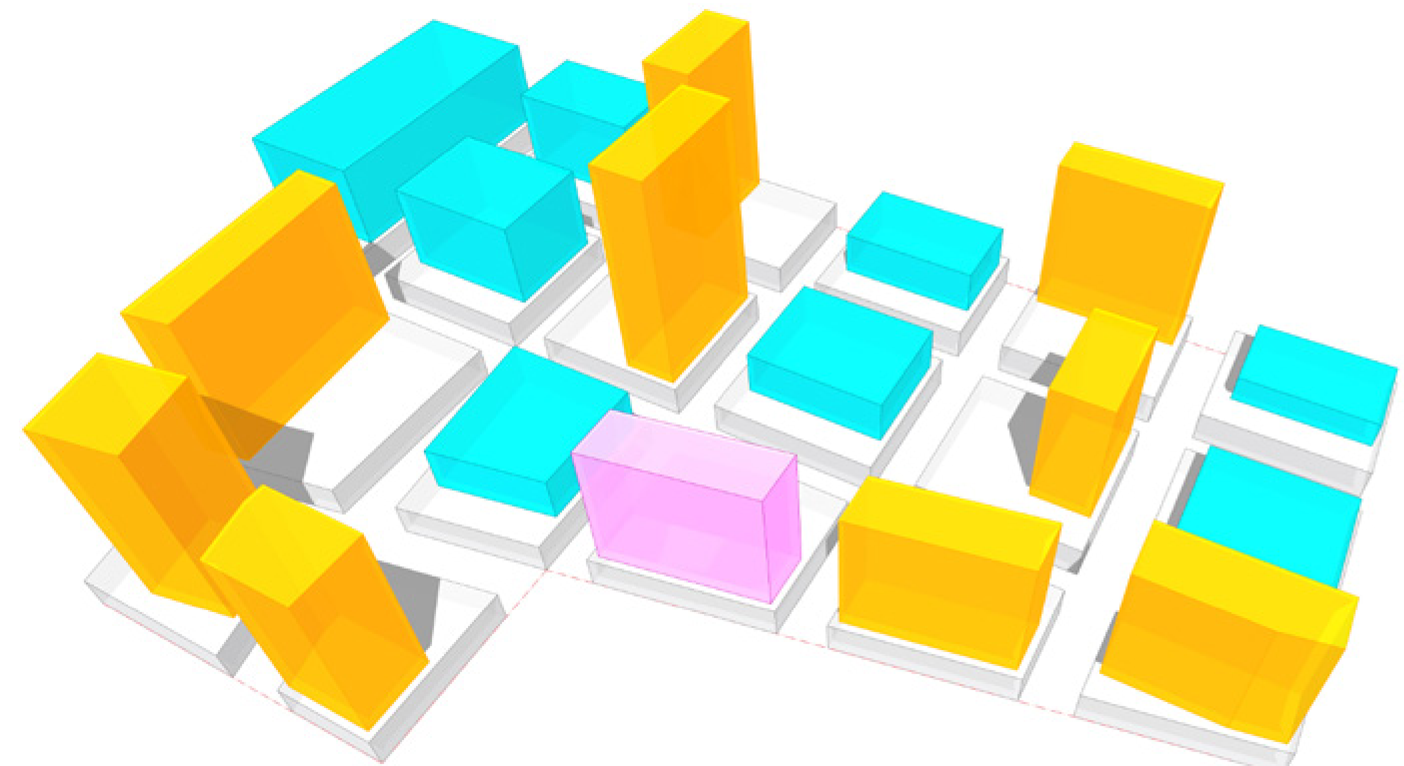
views + machine learning

value proposition against baseline

views + machine learning



residential units with view: **48.4%**



residential units with view: **65.6%**

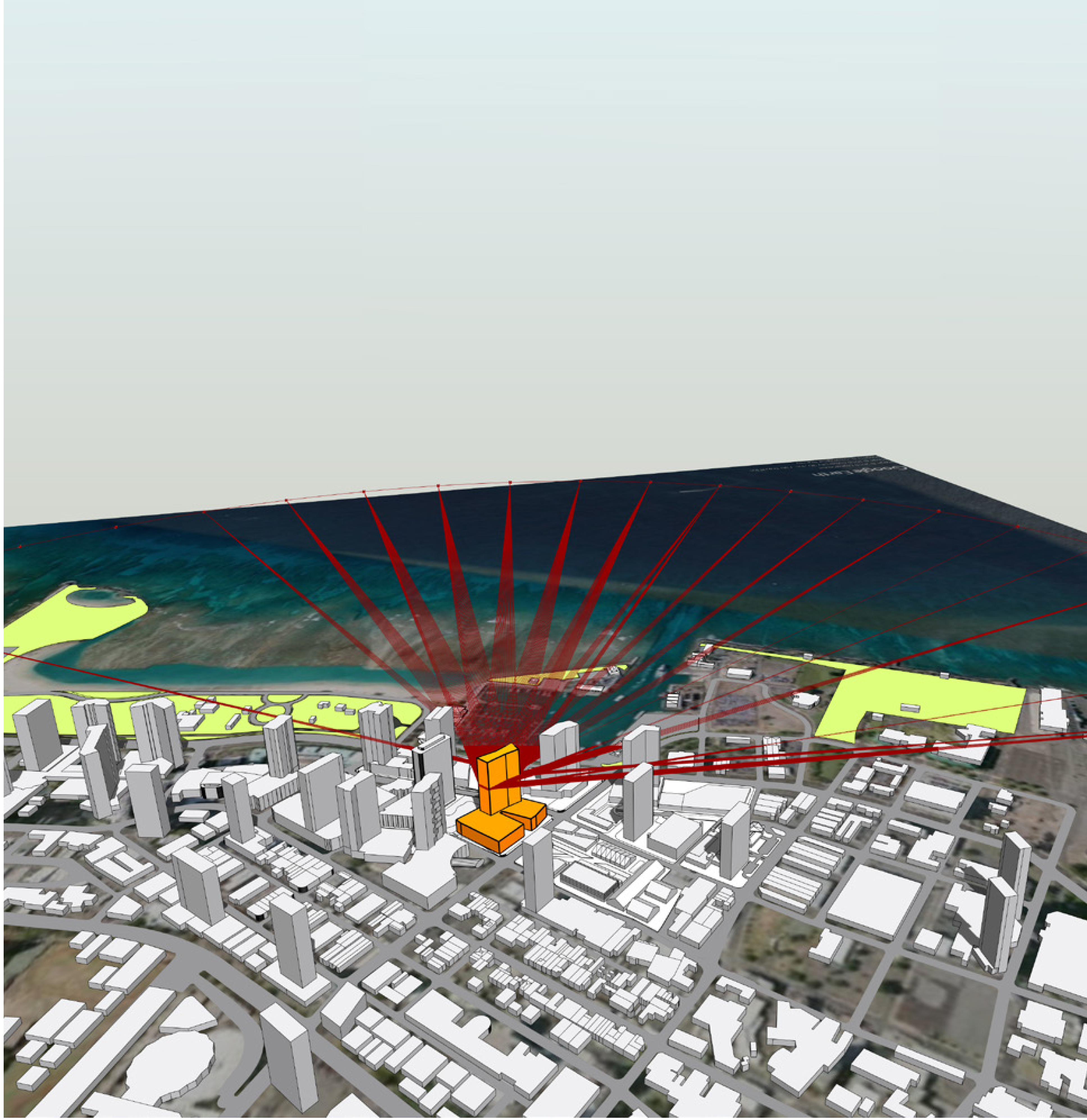
35% increase in views!

03

view optimization + machine learning

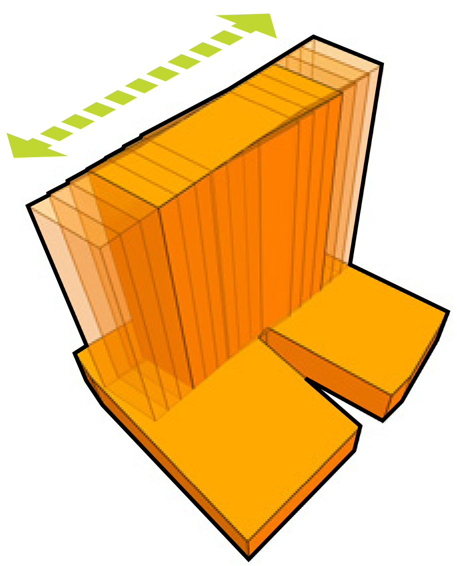
building scale

Howard Hughes Corporation, Honolulu



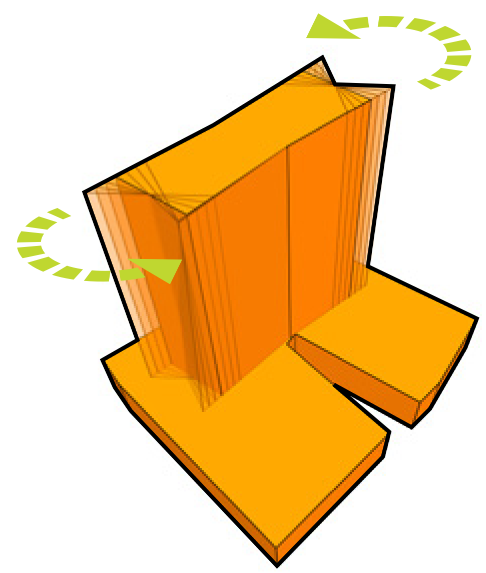
through **machine learning** the computer can **manipulate** building form, within defined **constraints,** to **maximize views** for every residential unit

variables for the computer to manipulate

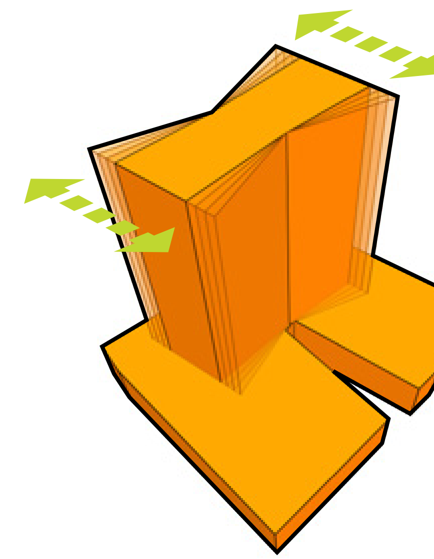


shift / lengthen the building

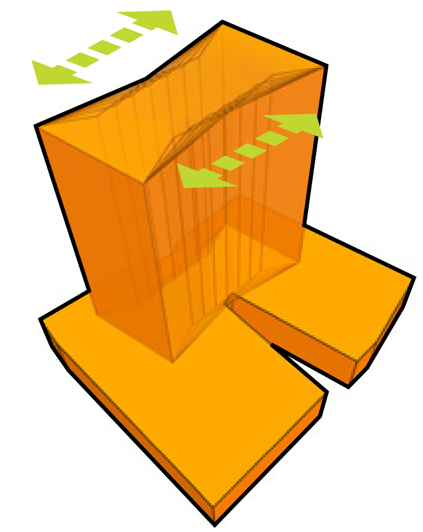
rotate the building



rotate the ends



shift the endpoints



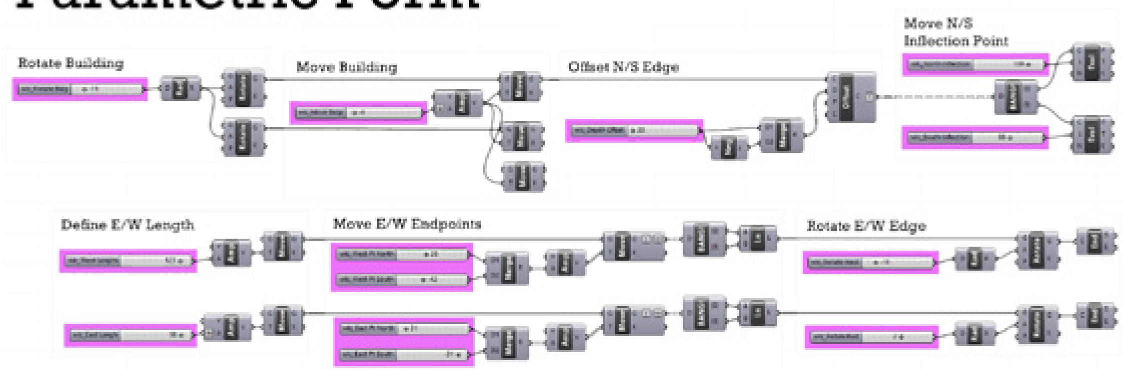
shift the inflection point

13 variables = 3.1×10^{19} sphere of possible solutions

evolutionary-based solver learns as it iterates

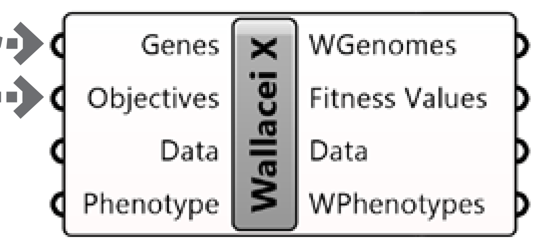
variables ("genes")

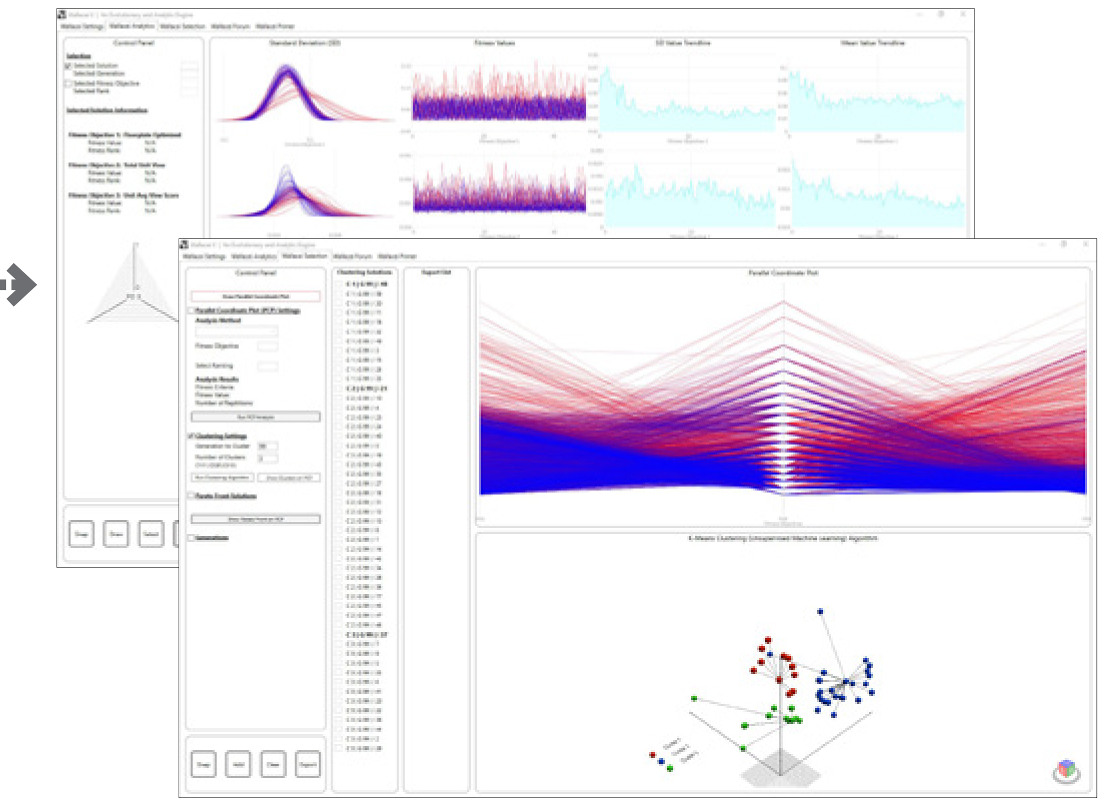
Parametric Form

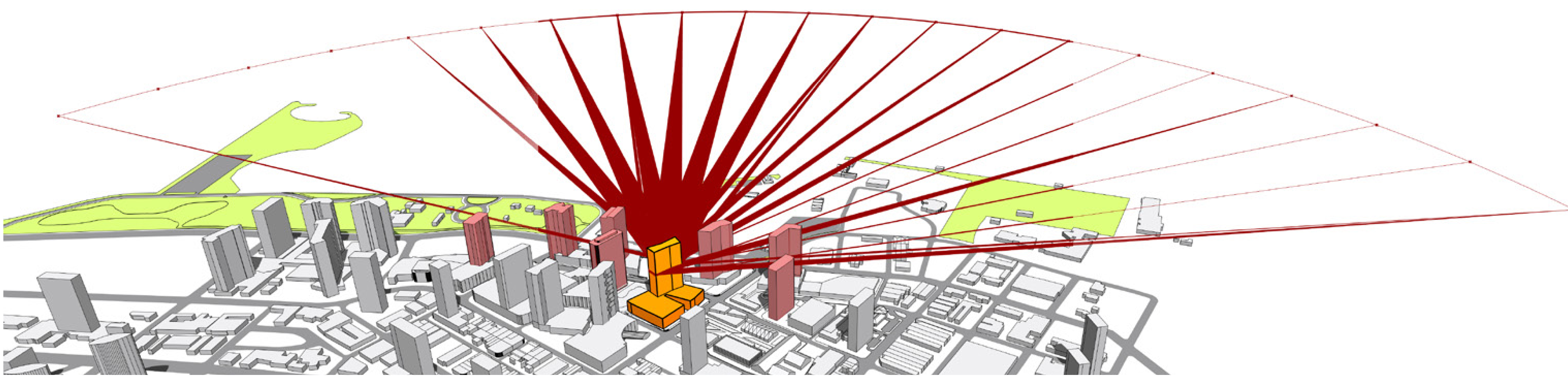


objectives

01_maintain floorplate area
02_maximize resi unit views

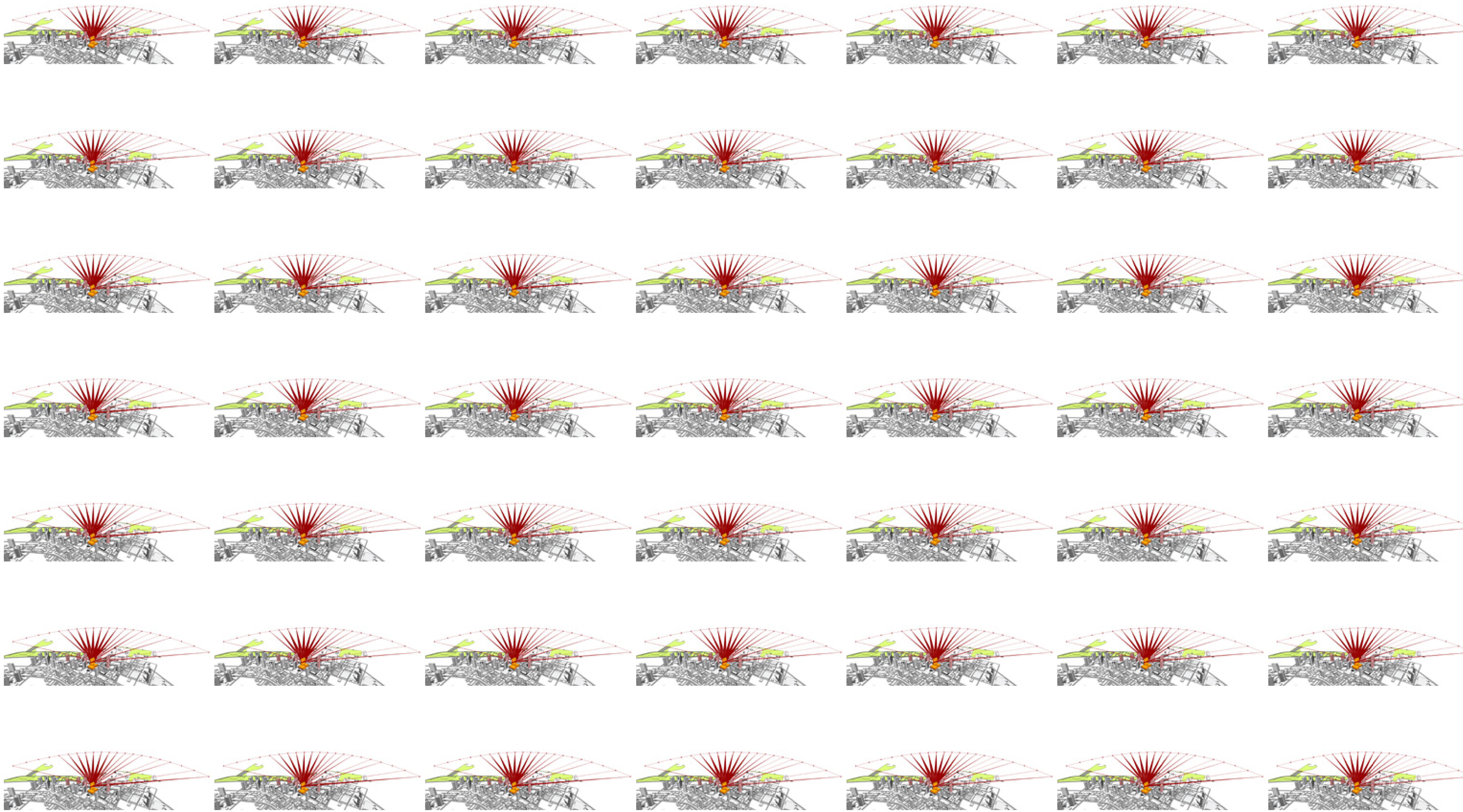




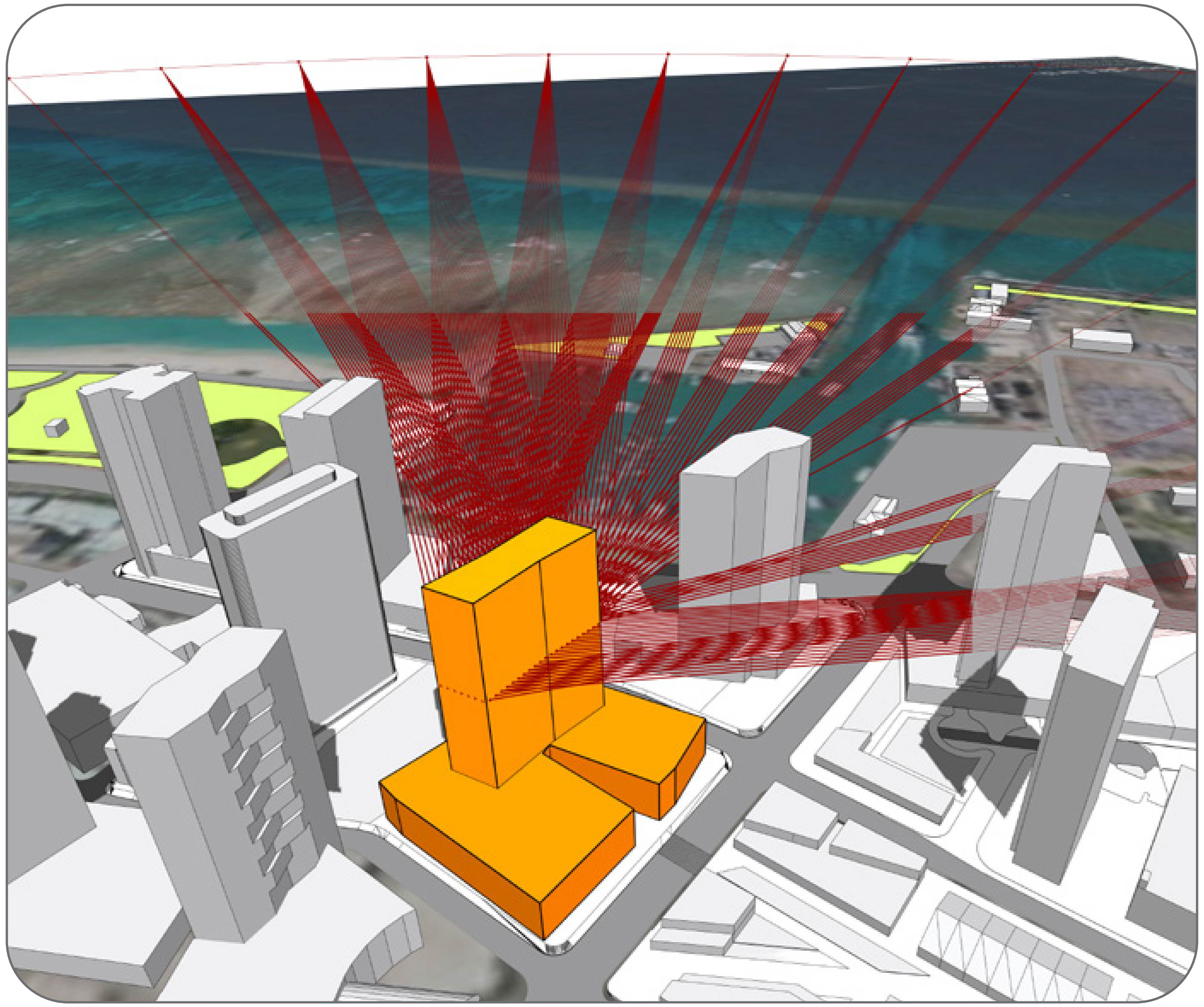


49 best solutions of 10,000 iterations

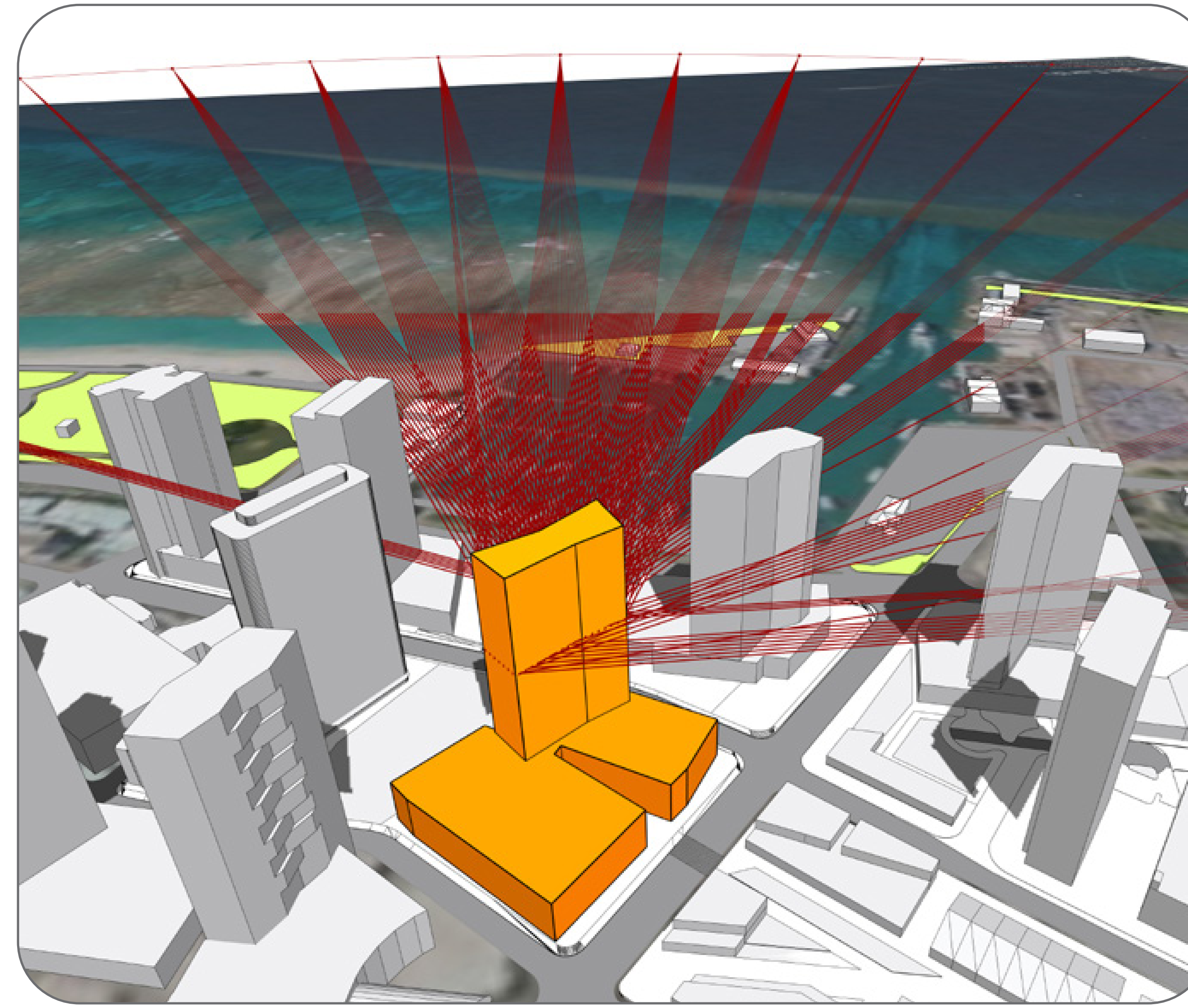
views + machine learning



value proposition against baseline



baseline view score per unit: **23%**



optimized view score per unit: **<u>47%</u>**

2x increase in view score!

thank you.