~ONE BILLION HUMANS LIVE IN INFORMAL SETTLEMENTS

UN ESTIMATES THIS NUMBER TO TRIPLE BY 2050

TODAY, PROGRESSIVE DISCOURSE ON DESIGNERS' ENGAGEMENT WITH SUCH COMMUNITIES RELIES EITHER ON SLUM UPGRADING OR INCREMENTAL SOLUTIONS.

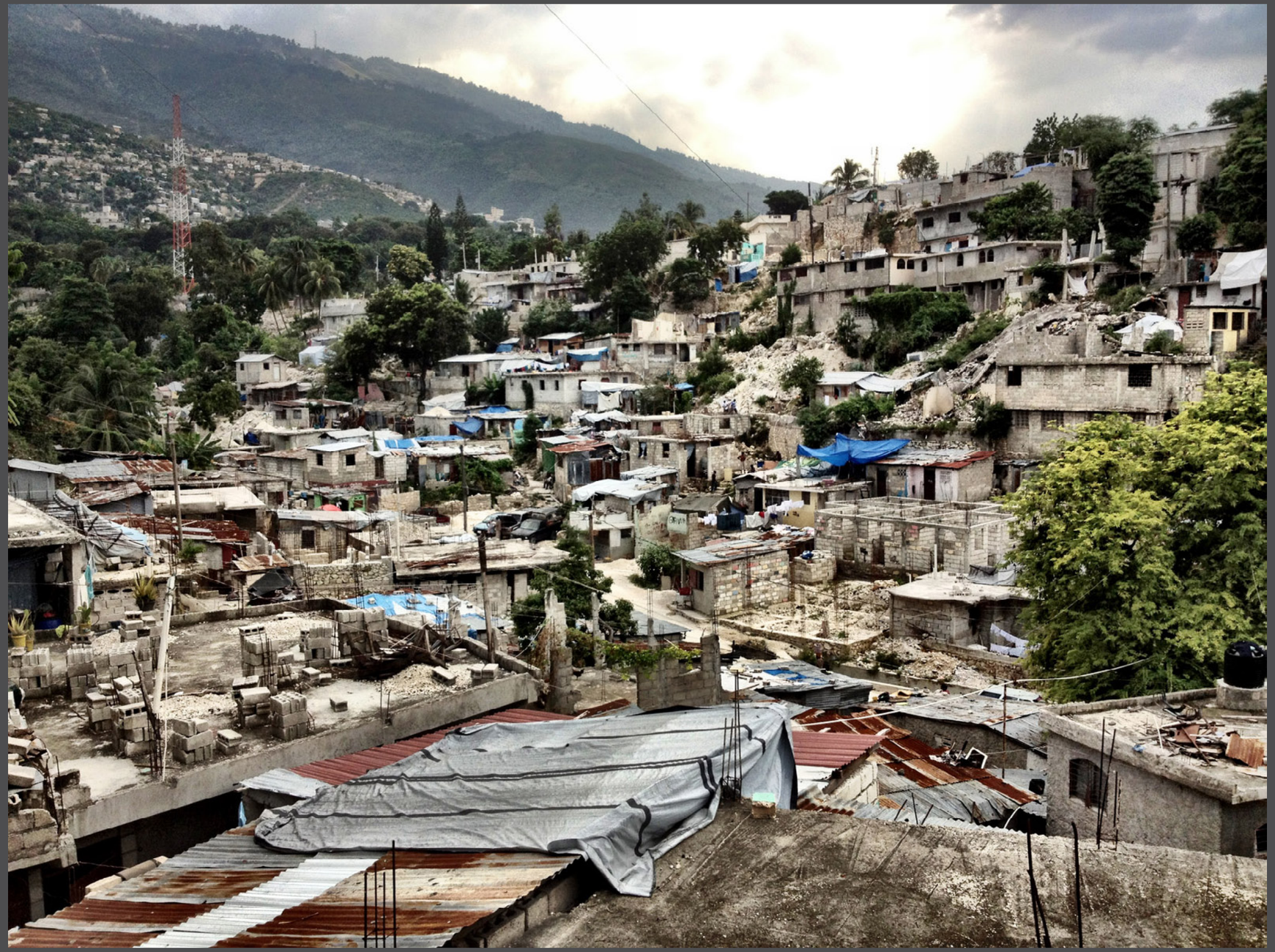
CAN DIGITAL ANALYSIS OF BUILDING AND URBAN PERFORMANCE FURTHER THE SUCCESS OF SUCH DESIGN INTERVENTIONS?

URBAN ENERGY FLOWS

INFORMAL | INCREMENTAL

PORT AU PRINCE: HAITI

KRISTAPALEN.DANWEISSMAN.EDDYMANKIM.JESSICAYURKOFSKY



PRIMARY SUSTAINABILITY GOAL:

IN CONDITIONS WHERE ACTIVE SYSTEMS ARE UNAVAILABLE, HOW CAN WE IMPROVE OCCUPANT COMFORT THROUGH PASSIVE DESIGN STRATEGIES?

PRIMARY METRICS OF INVESTIGATION

OPERATIVE TEMPERATURE
VENTILATION
DAYLIGHT AVAILABILITY
ACCESS TO SERVICES

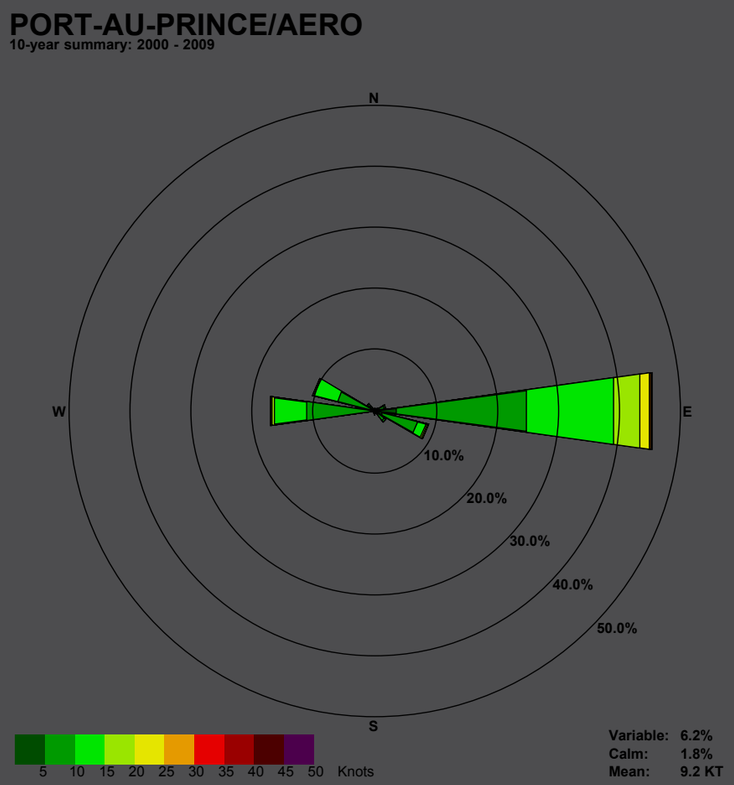
SITE

Port Au Prince, Haiti

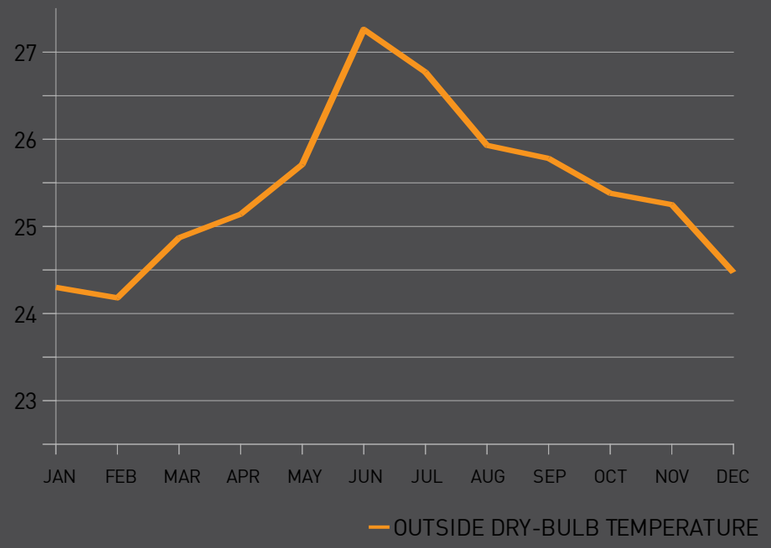
North

0 0.5 1 2 3 4 Miles

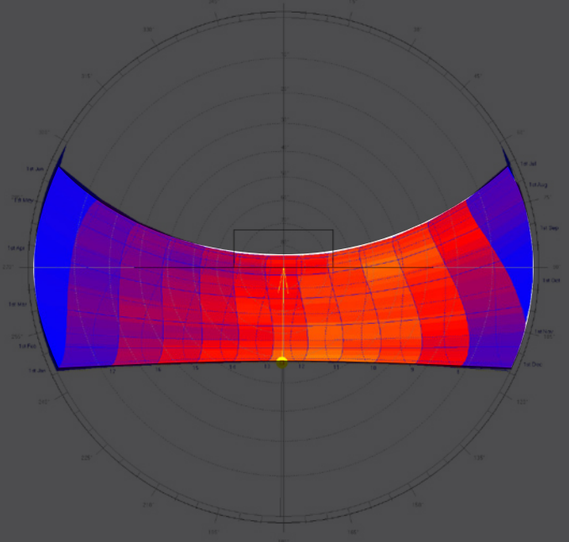
CLIMATE



WIND



TEMPERATURE



SOLAR

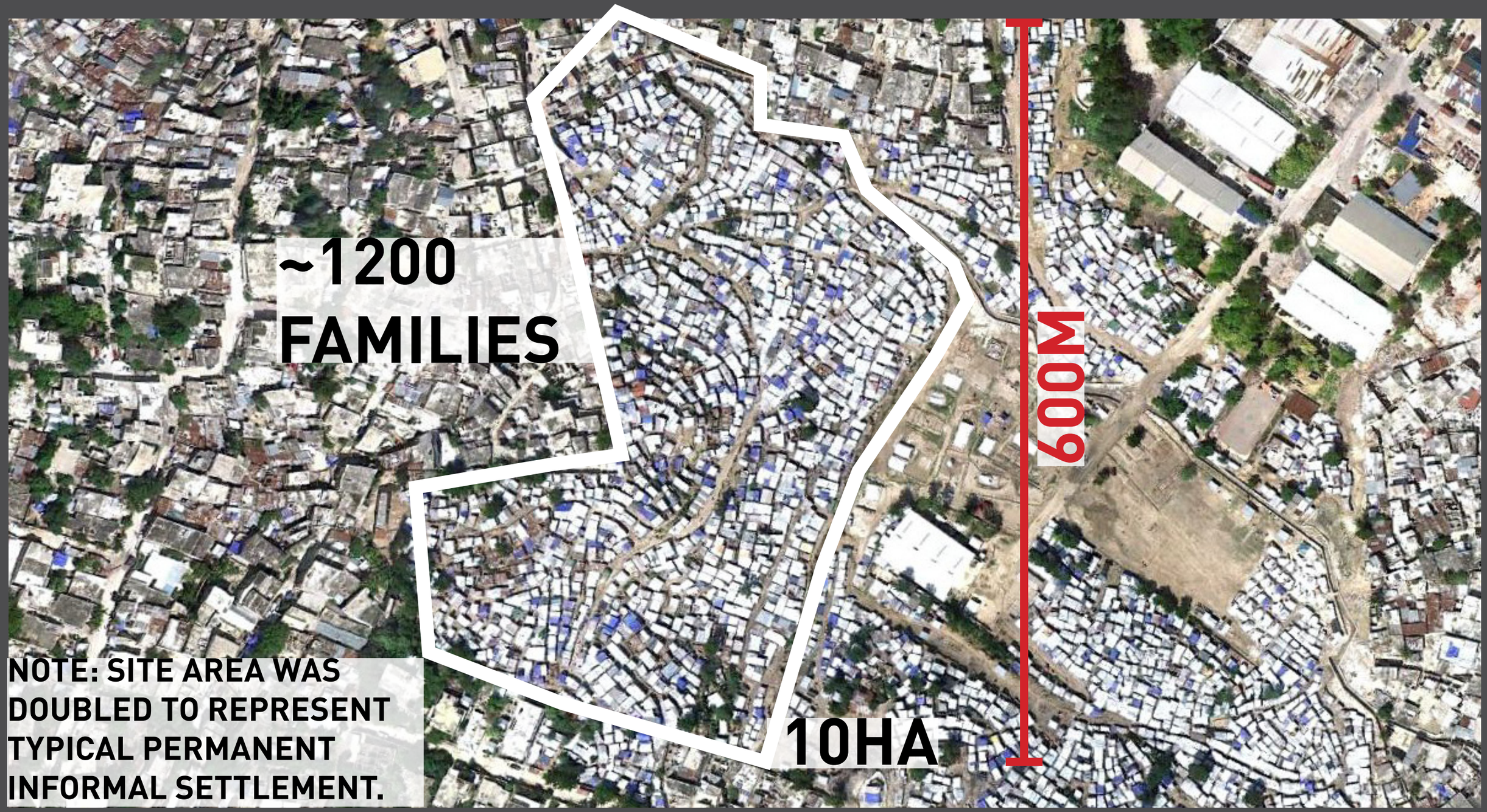

DELMAS 32

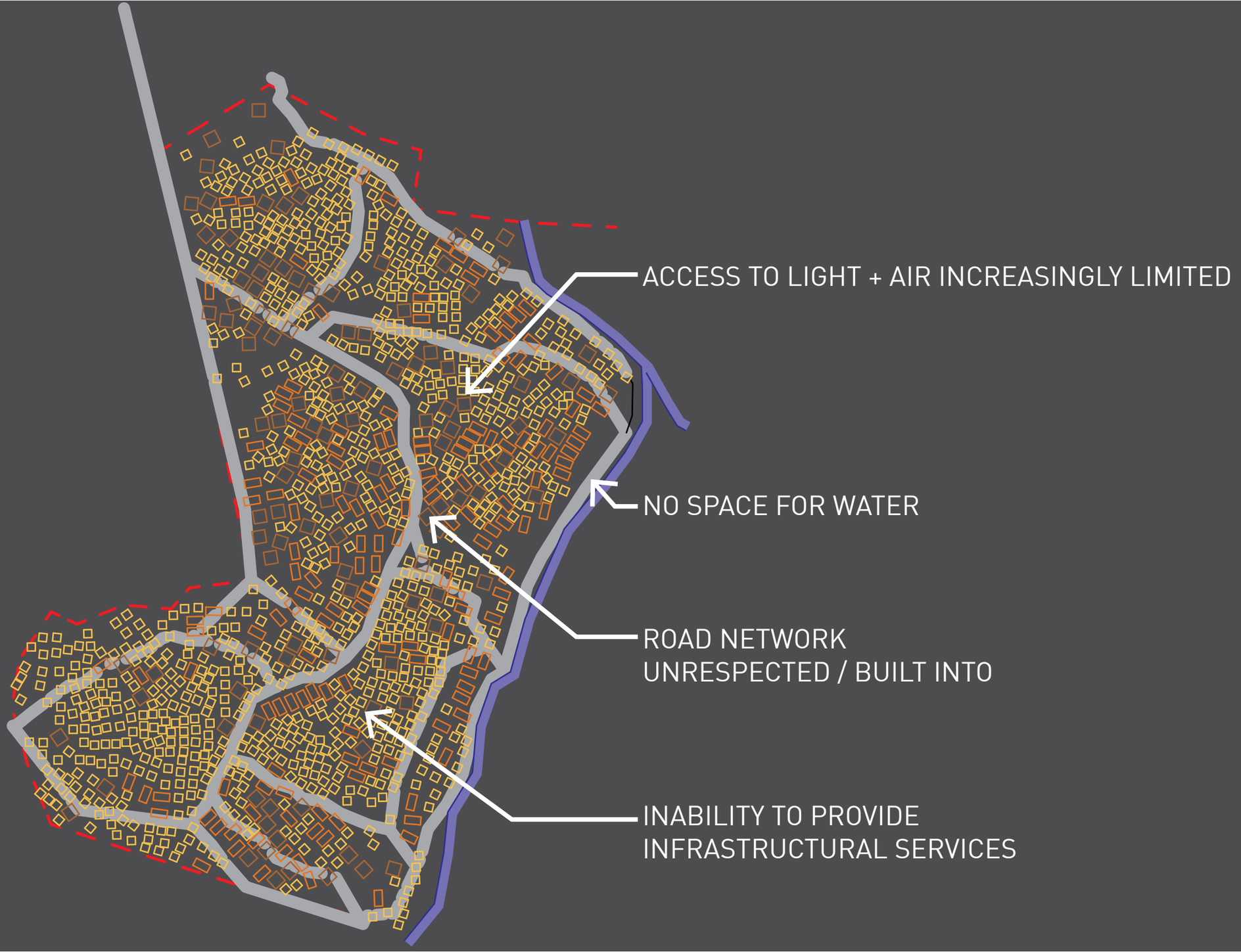

1.12.2010


1.26.2010


2.22.2010


11.7.2010


~1200
FAMILIES
600M
10HA
NOTE: SITE AREA WAS
DOUBLED TO REPRESENT
TYPICAL PERMANENT
INFORMAL SETTLEMENT.


ACCESS TO LIGHT + AIR INCREASINGLY LIMITED
NO SPACE FOR WATER
ROAD NETWORK
UNRESPECTED / BUILT INTO
INABILITY TO PROVIDE
INFRASTRUCTURAL SERVICES

SIMPLIFICATIONS FOR ANALYSIS:

NO TOPOGRAPHY
TENT CAMP SCALED 2X

INFORMAL

NO BUILDING HEIGHT VARIATIONS
NO BUILDINGS TOUCH
SOME EXCESS SPACE BETWEEN HOUSES

INCREMENTAL

2 STORY MAX
NO ROOFS OR WINDOWS
NO PRIVACY WALLS

3 SCALES OF ANALYSIS:

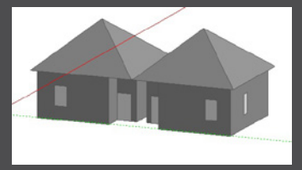
UNIT

PROTO-BLOCK

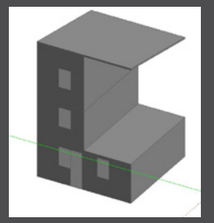
URBAN ZONE

UNIT

ROOF HEIGHT, VENT AND OVERHANG MAKE THIS HOUSE VERY COMFORTABLE.



TSC GLOBAL HOUSE

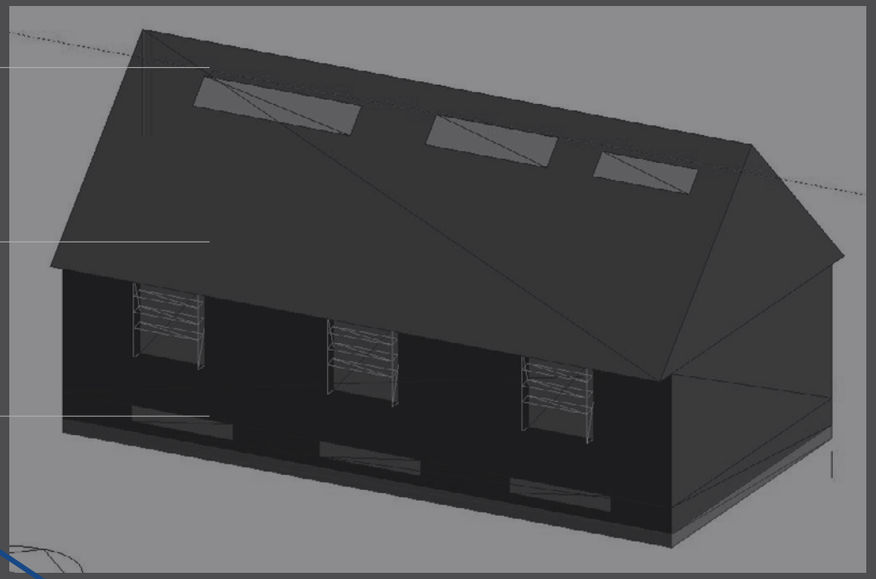


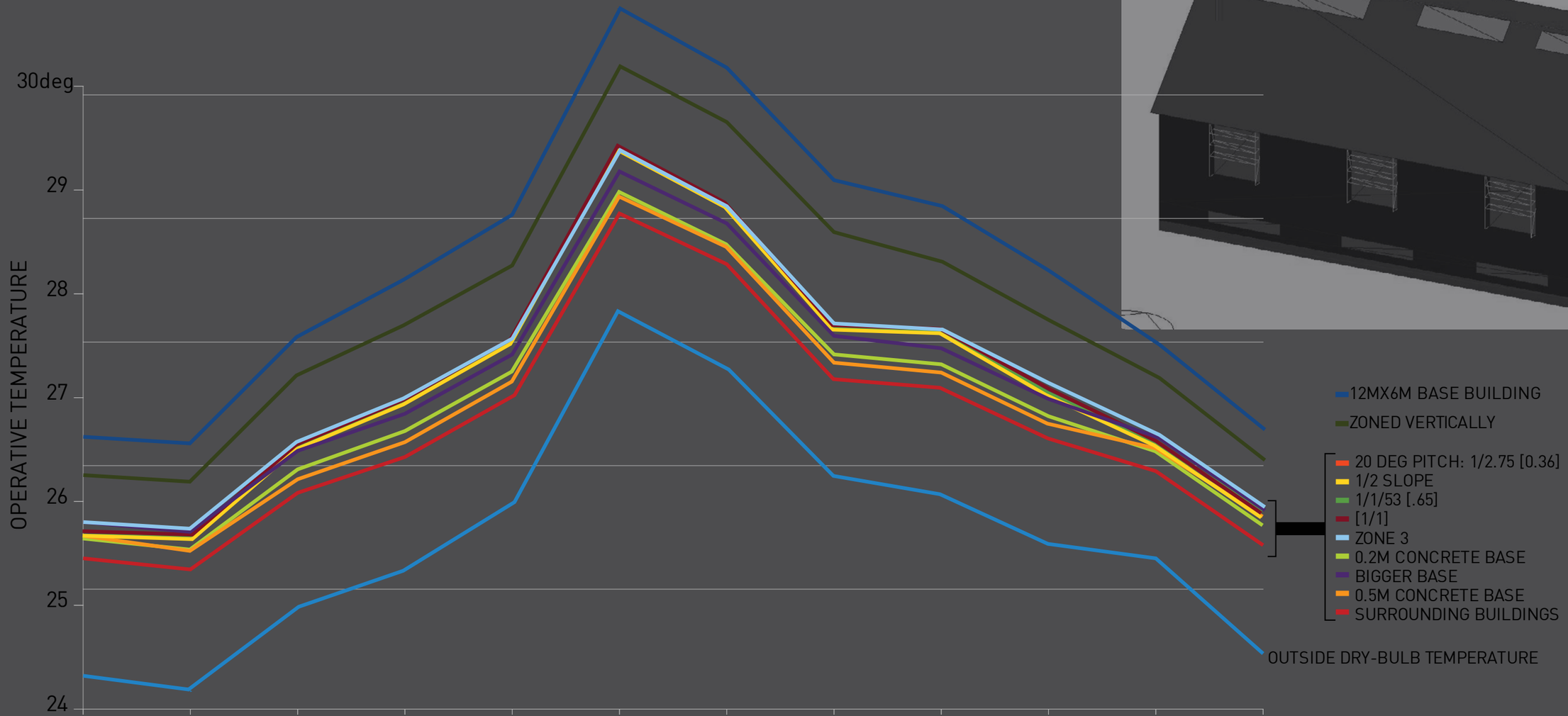
ELEMENTAL

GUIDED INCREMENTAL CONSTRUCTION ALLOWS DESIGNERS TO ASSIST IN PROCESS OF OVER TIME.

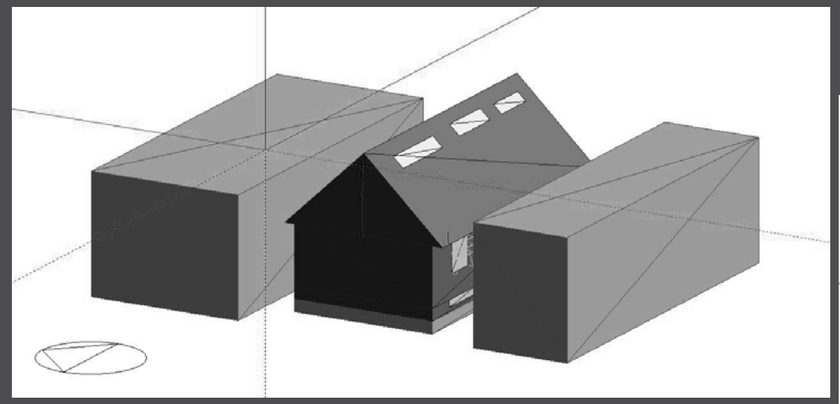
Quinta Monroy residential development [Chile]

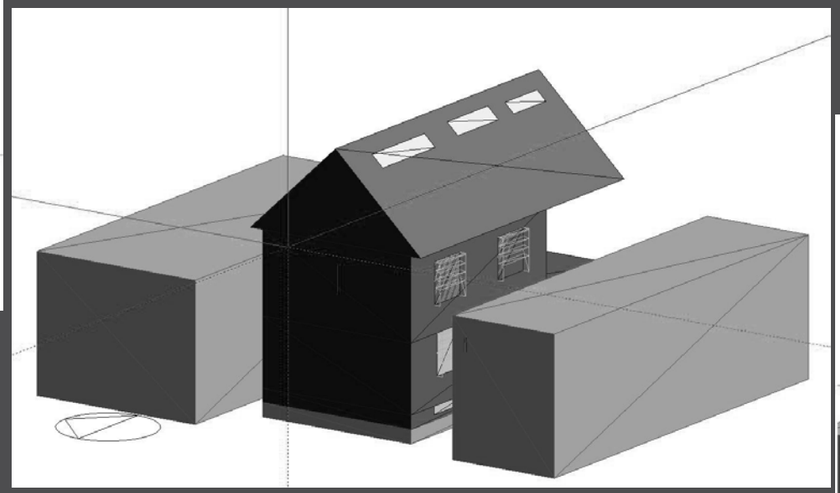
BASE MODEL OPTIMIZATION

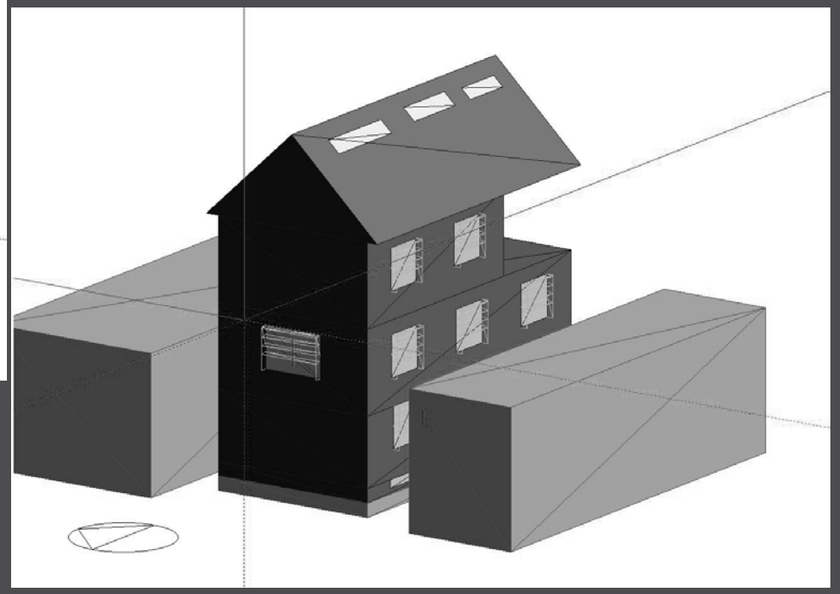




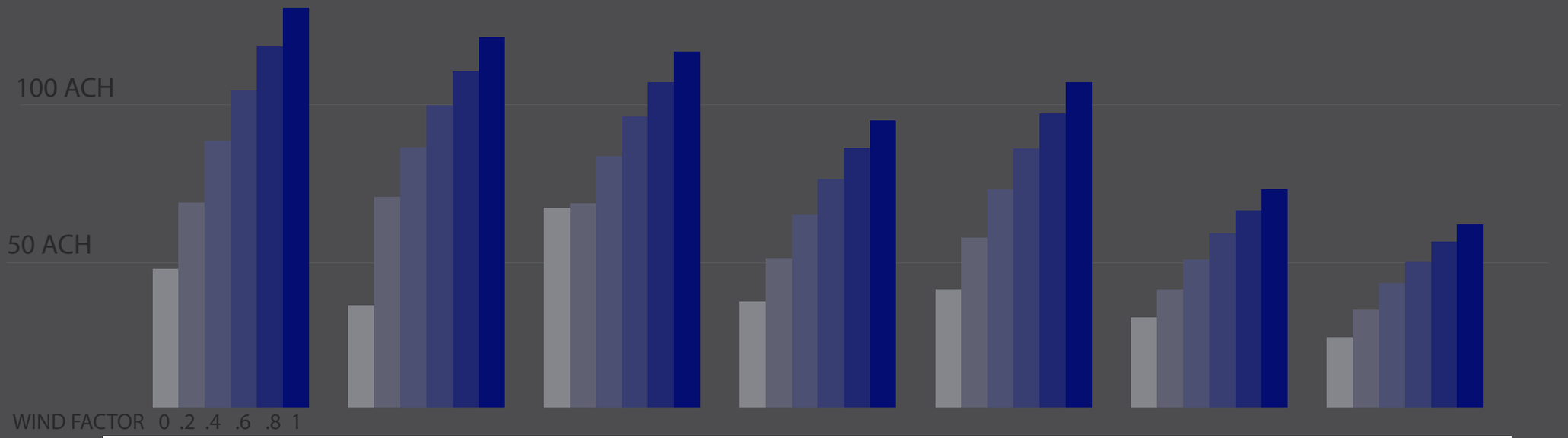
[DB]
INCREMENTAL HOUSING



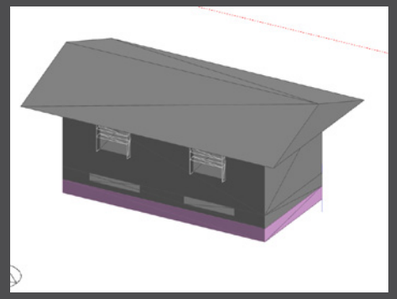


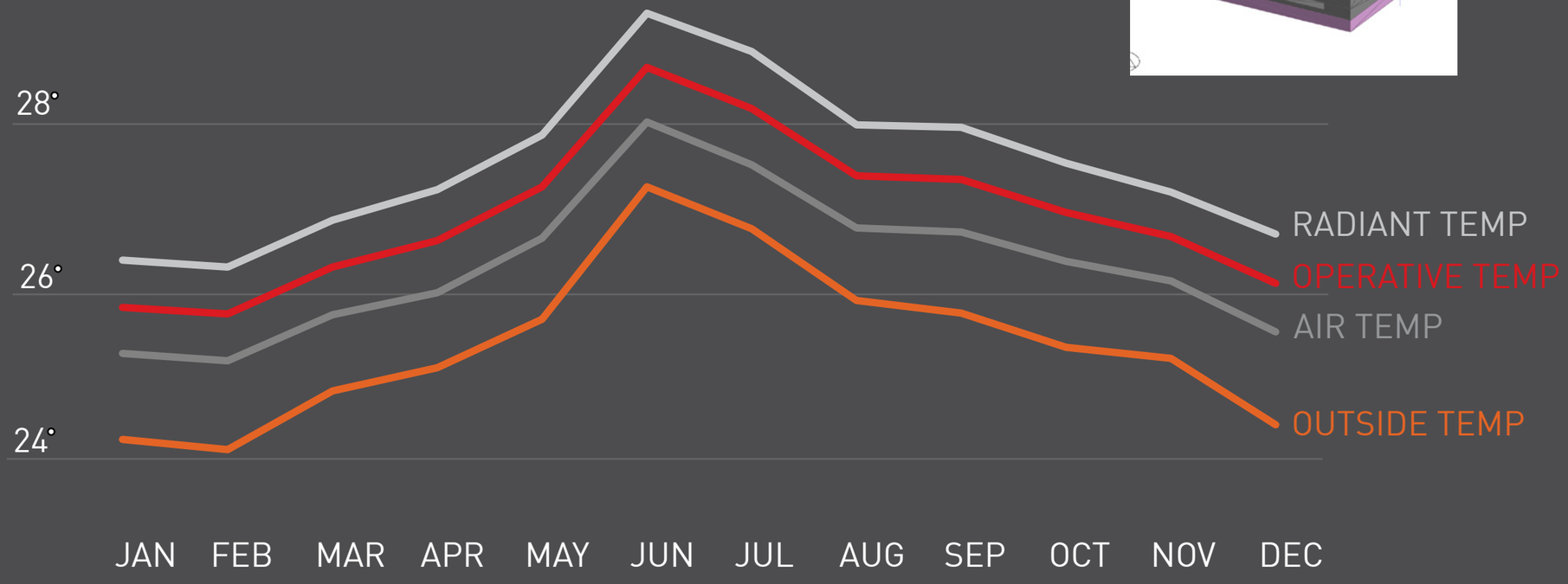


[E+]
ACH / WIND FACTOR / BUILDING TYPE



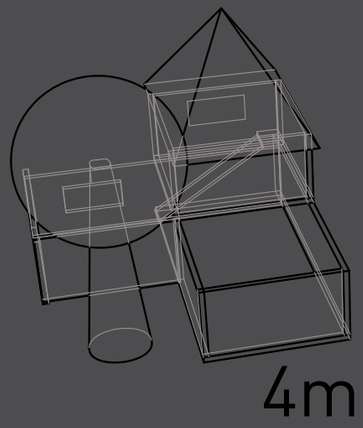
[DB]
OPERATIVE TEMP VS OUTSIDE TEMP

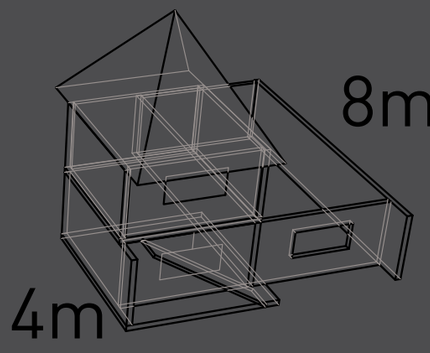




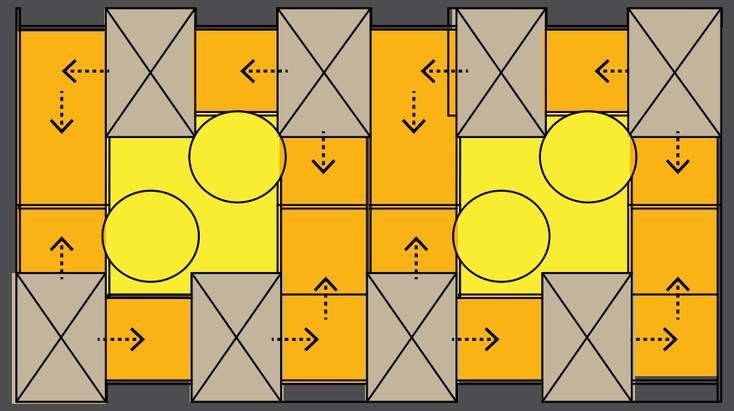
PROTO-BLOCK

INCREMENTAL HOUSING

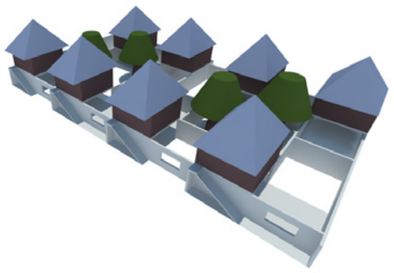


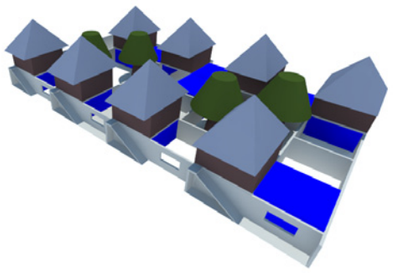


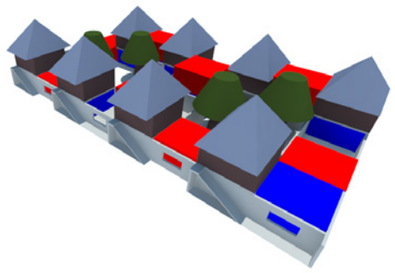
L BLOCK
One module: 16m^2
1 family: 32-48m^2
8 families: 256-384m^2
Public Space: 64m^2

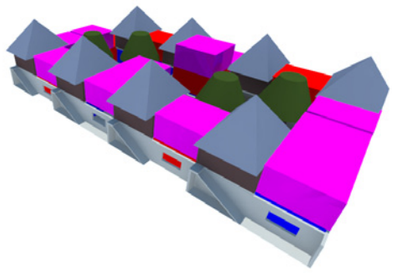


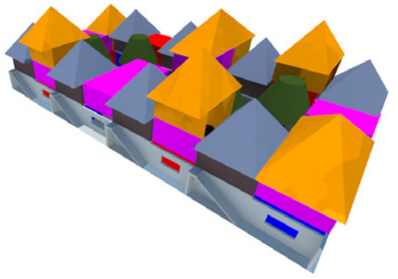
BASE UNIT
EXPANSION SPACE
SEMI-PUBLIC



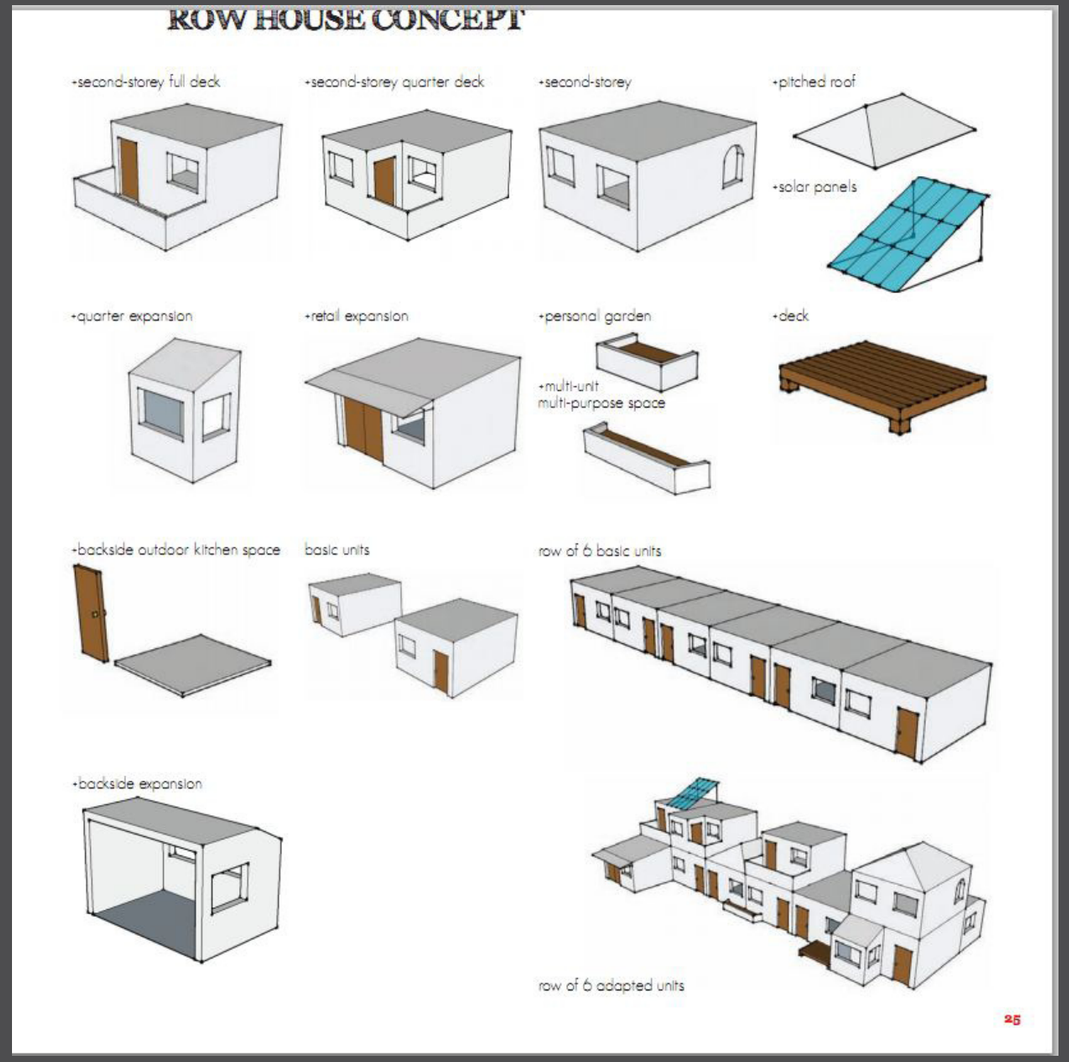




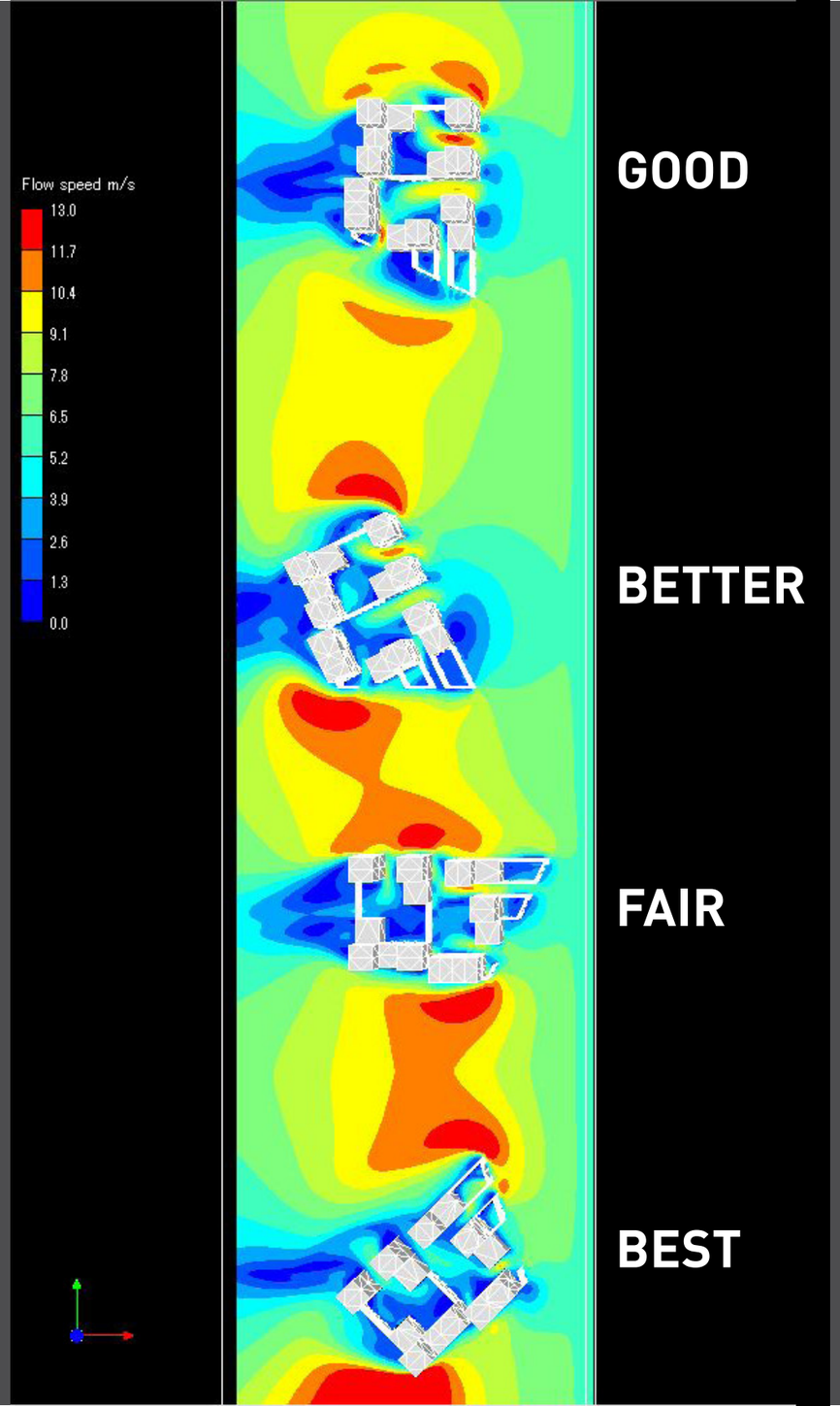


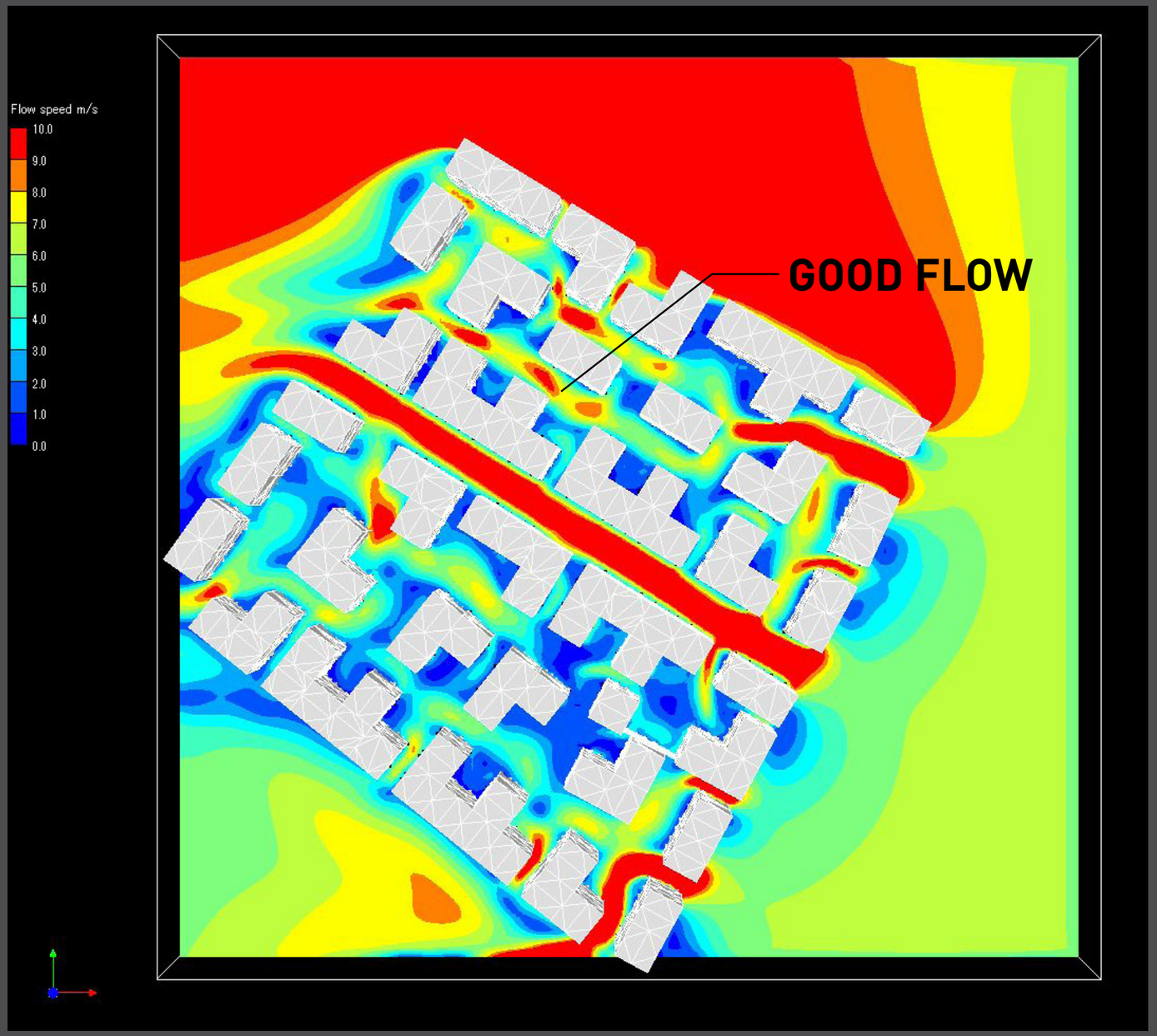


ARCHITECTURE FOR HUMANITY
+
CORDAID



UNIVERSITY OF MANITOBA


Flow speed m/s
13.0
11.7
10.4
9.1
7.8
6.5
5.2
3.9
2.6
1.3
0.0
GOOD
BETTER
FAIR
BEST


Flow speed m/s
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
GOOD FLOW

DESIGN CONSIDERATIONS

+ MAINTAIN SPACE BETWEEN BUILDINGS: 4M MODULE
+ 20% WWR
+ ROOFS ADD BOYANCY FOR VENTILATION

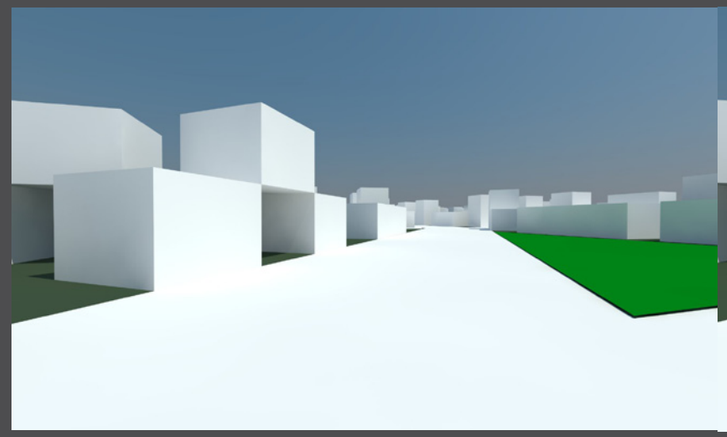
URBAN ZONE

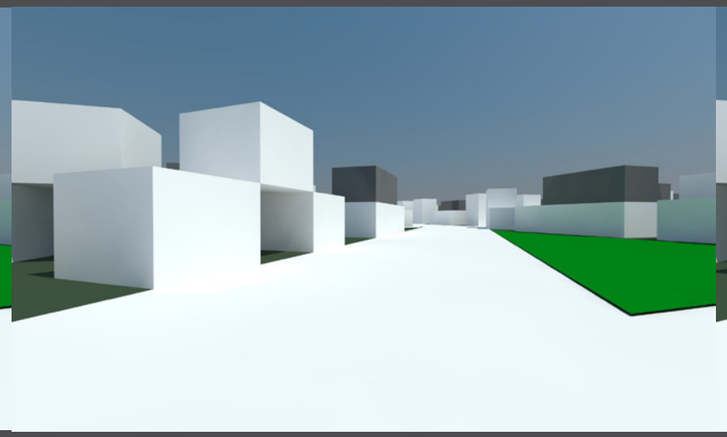
~400 FAMILIES

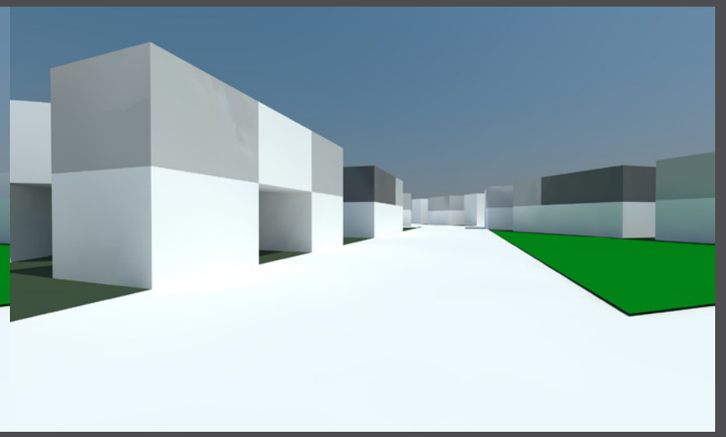
~700 FAMILIES

~1000 FAMILIES

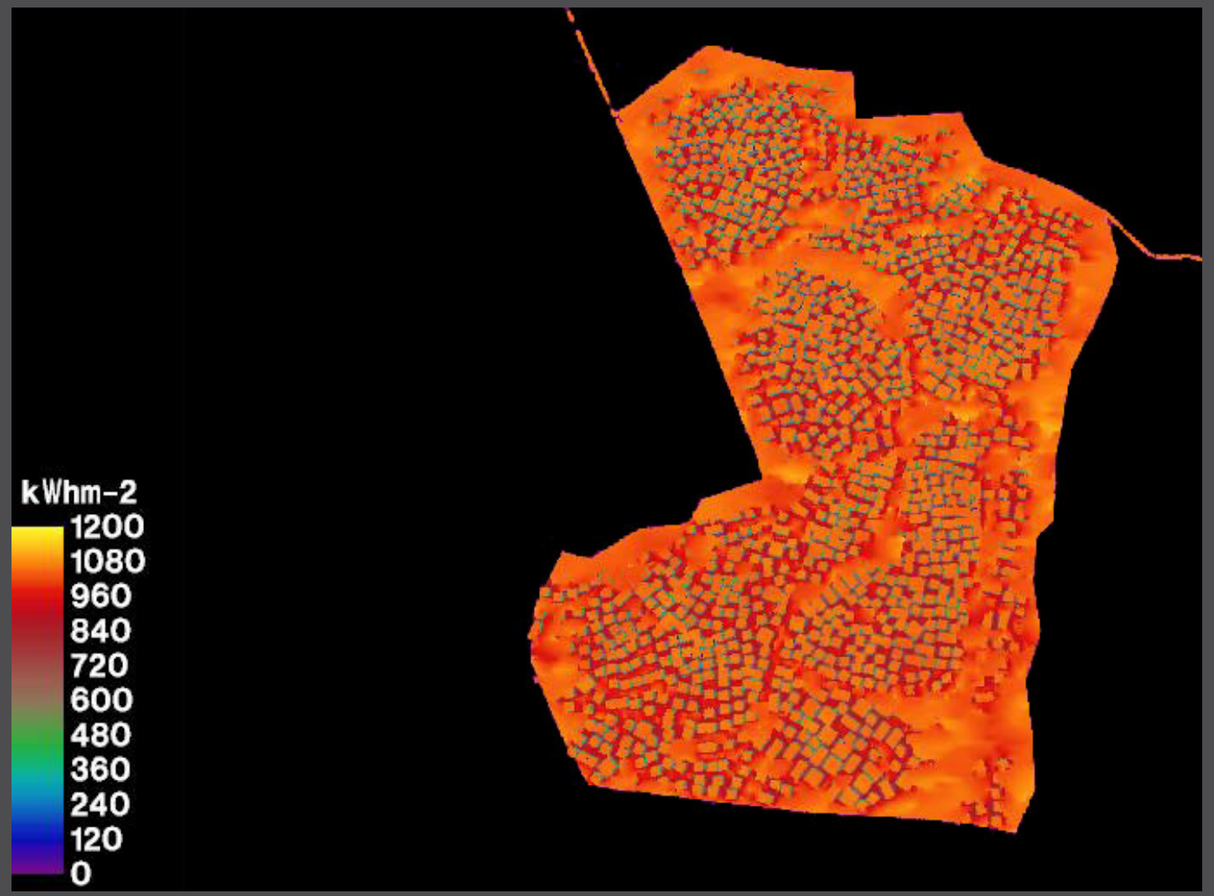
[INFORMAL SETTLEMENT
~1200 FAMILIES]



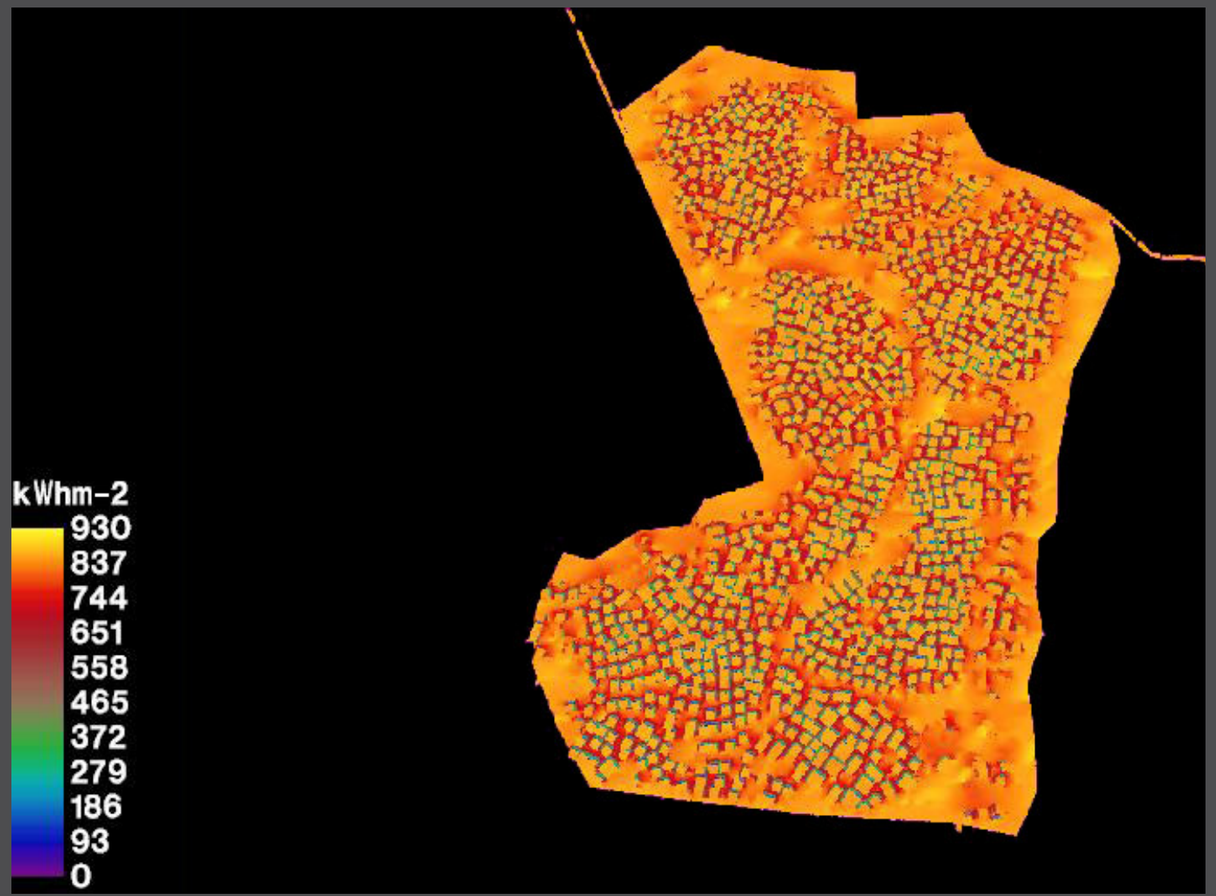




DAYLIGHT



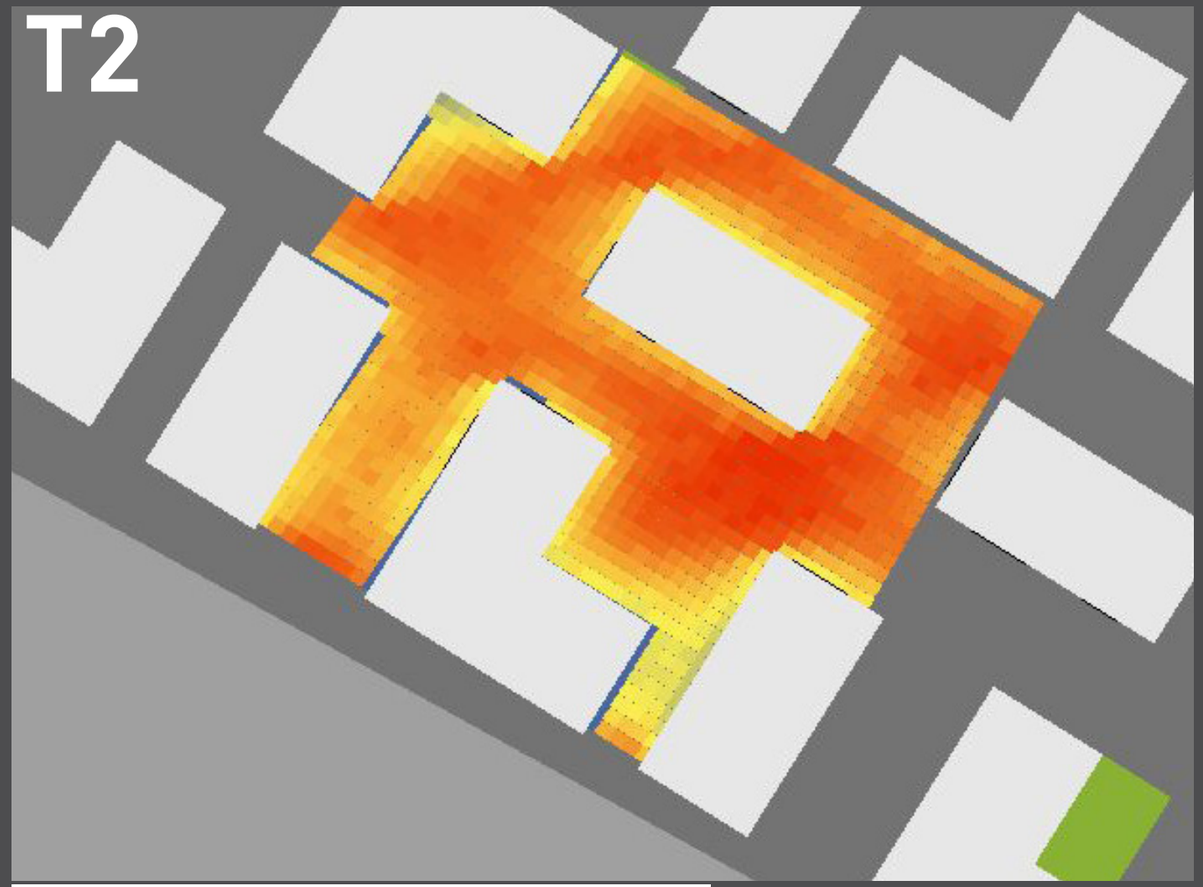
SUMMER

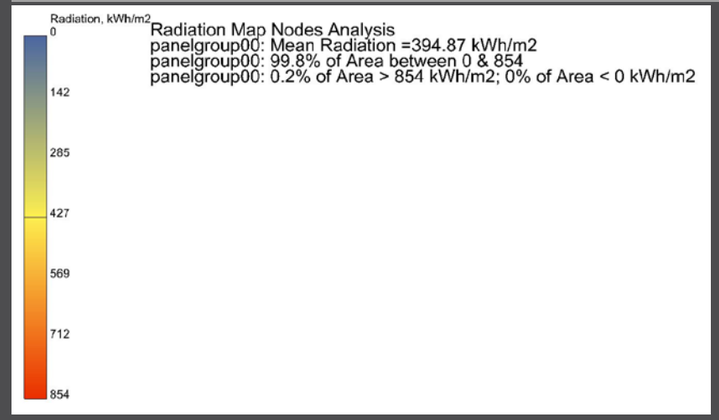


WINTER

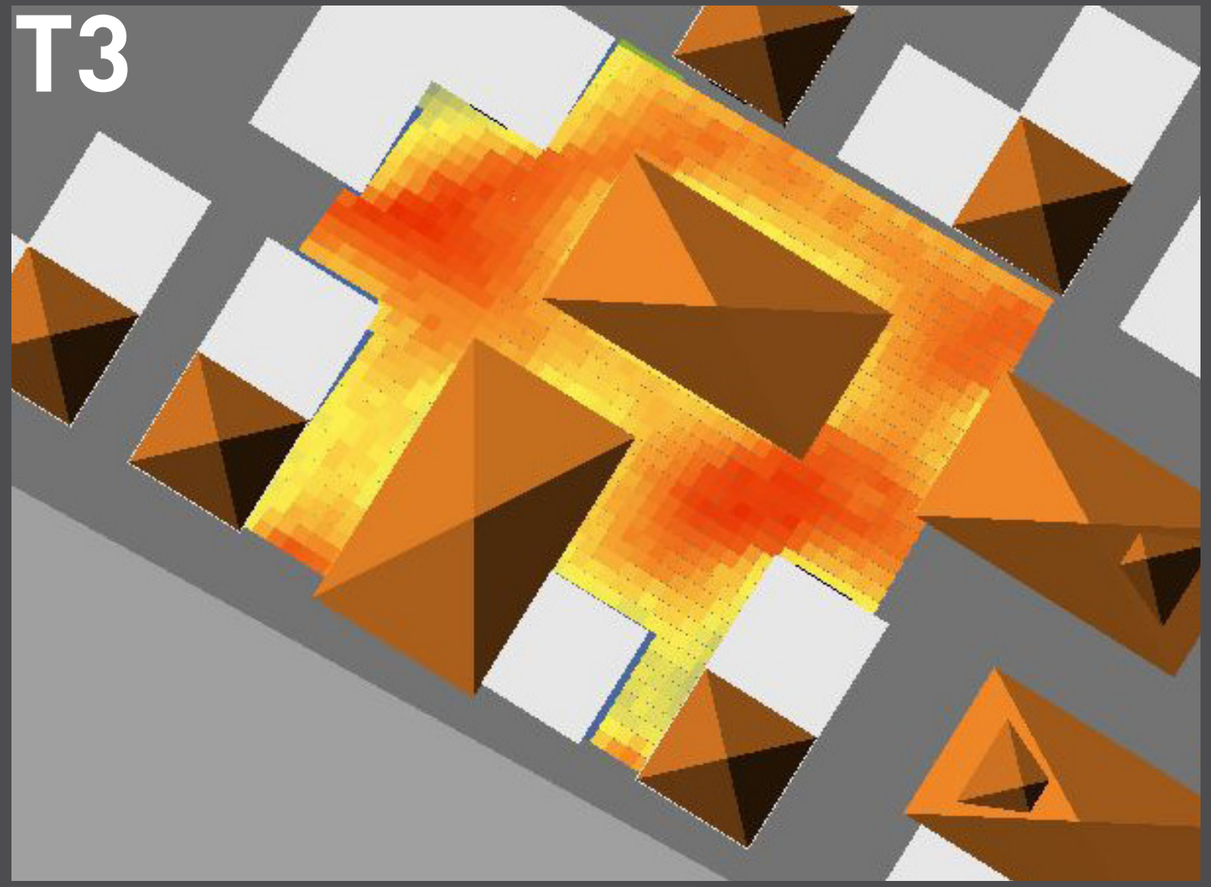
SUMMER RADIATION

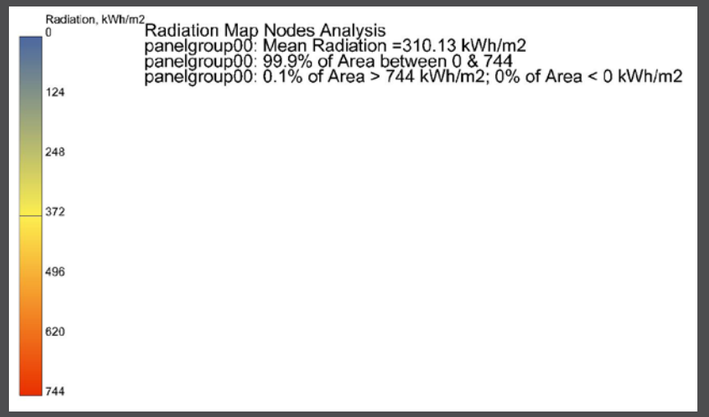
T2



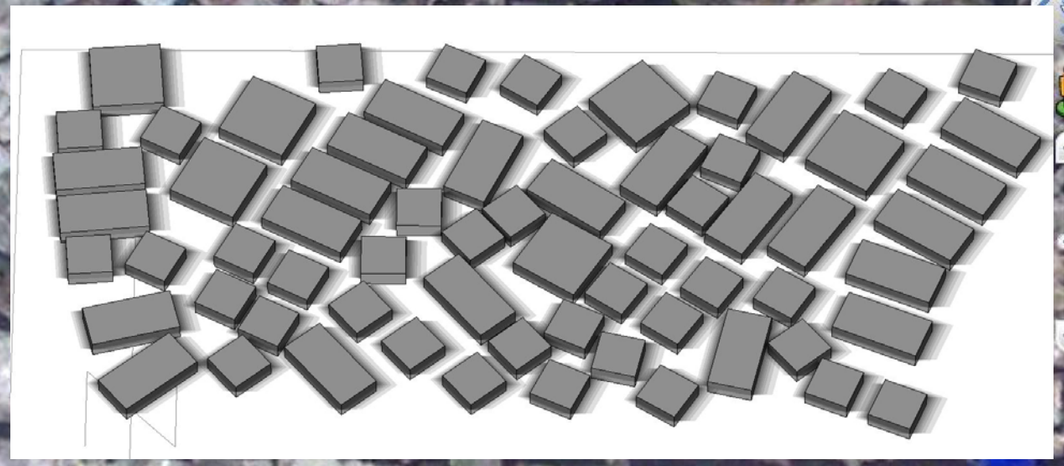

Radiation, kWh/m2
0
142
285
427
569
712
854
Radiation Map Nodes Analysis
panelgroup00: Mean Radiation =394.87 kWh/m2
panelgroup00: 99.8% of Area between 0 & 854
panelgroup00: 0.2% of Area > 854 kWh/m2; 0% of Area < 0 kWh/m2

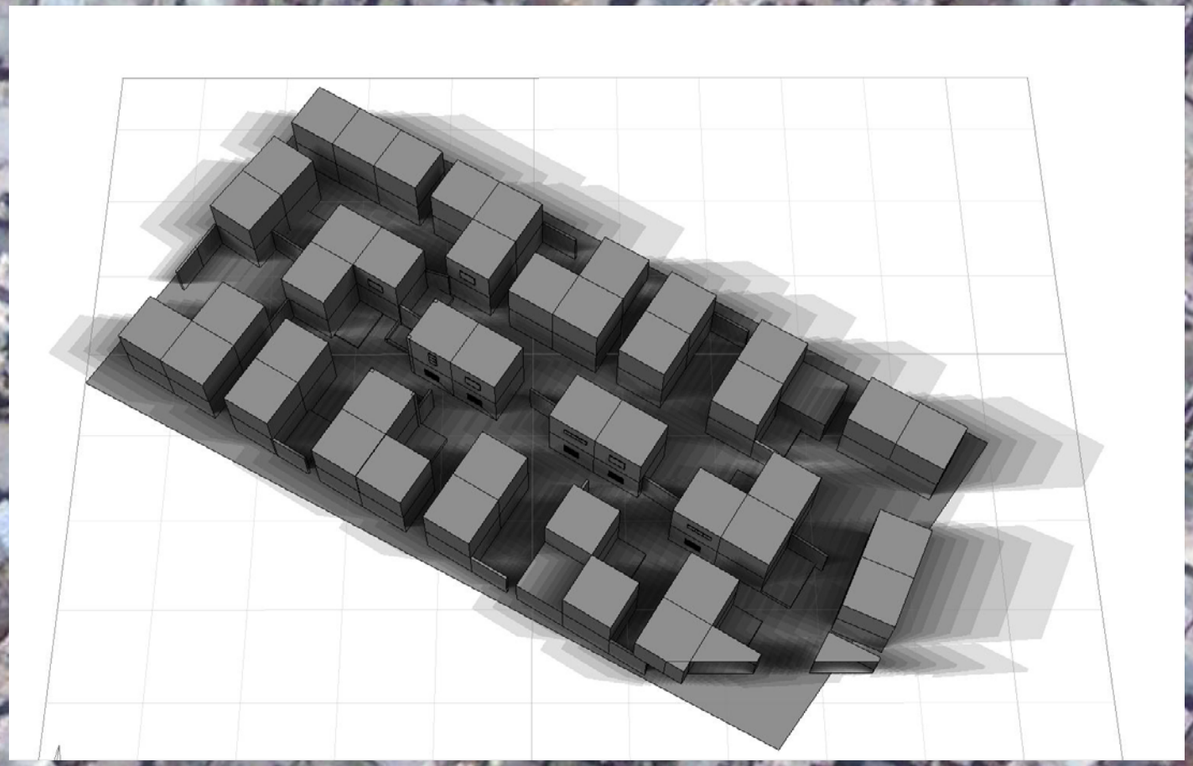
T3

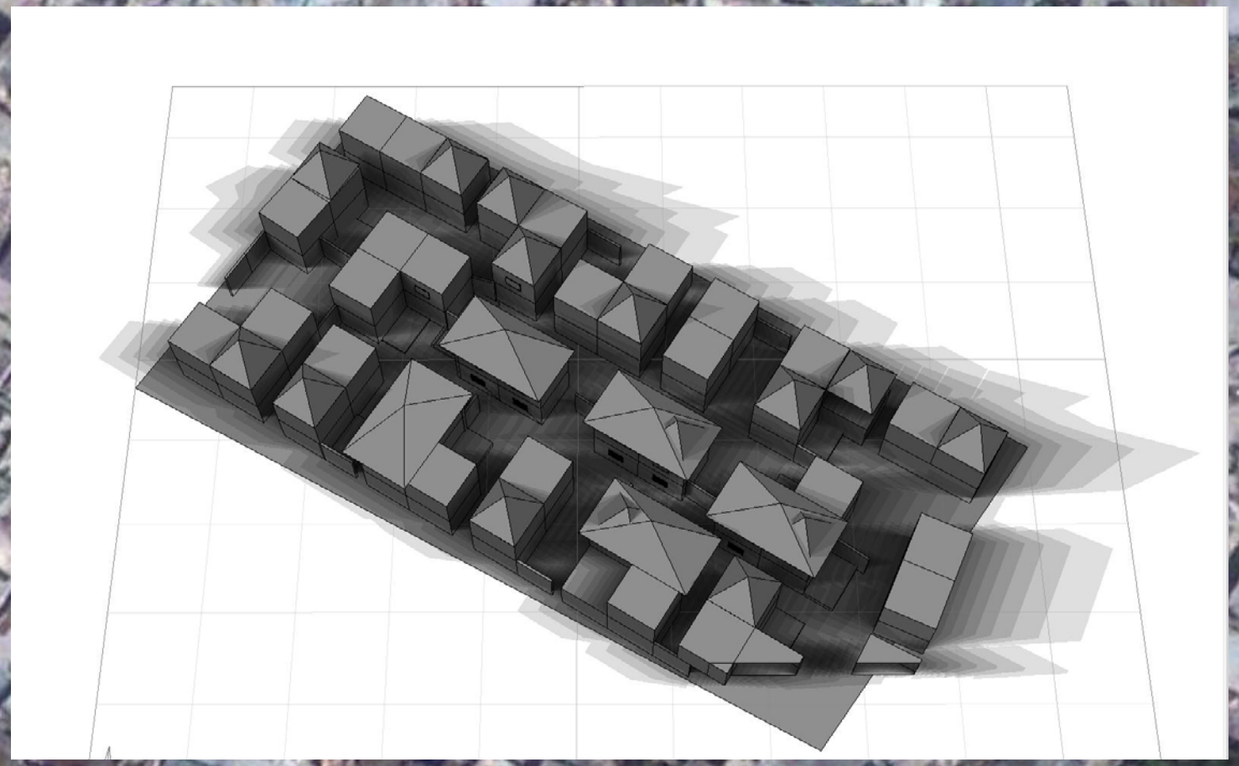



Radiation, kWh/m2
0
124
248
372
496
620
744
Radiation Map Nodes Analysis
panelgroup00: Mean Radiation =310.13 kWh/m2
panelgroup00: 99.9% of Area between 0 & 744
panelgroup00: 0.1% of Area > 744 kWh/m2; 0% of Area < 0 kWh/m2

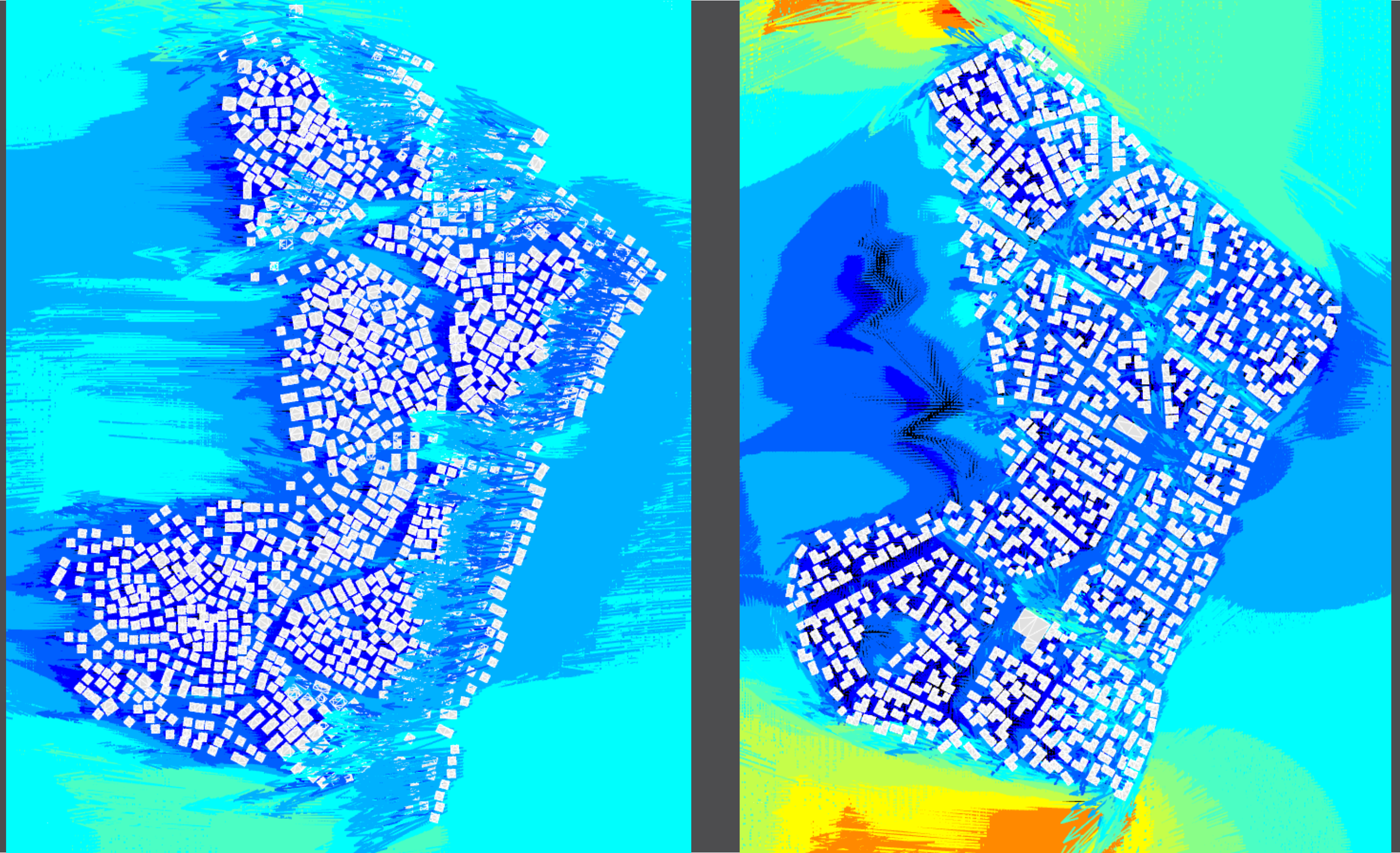
SHADING



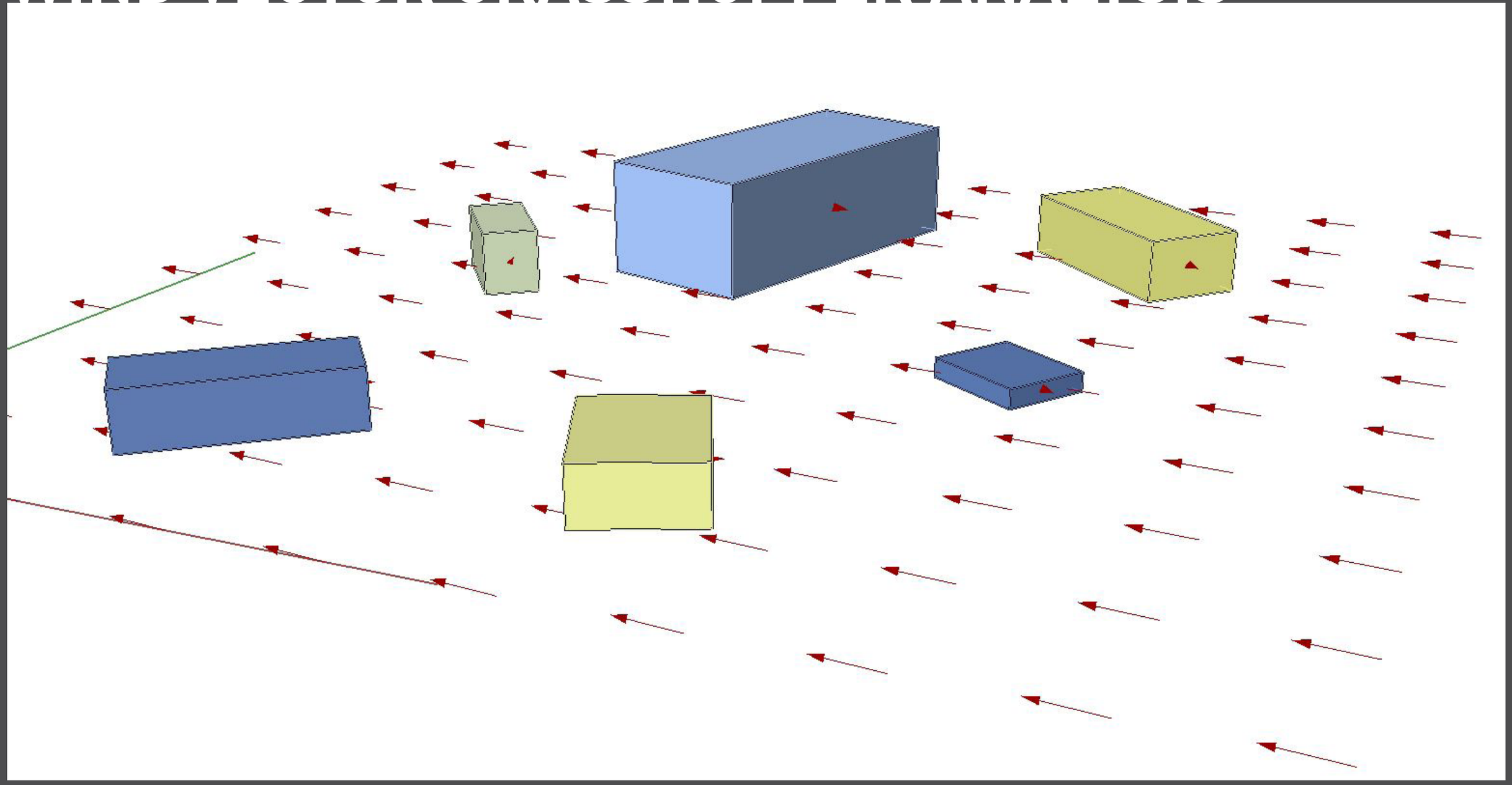




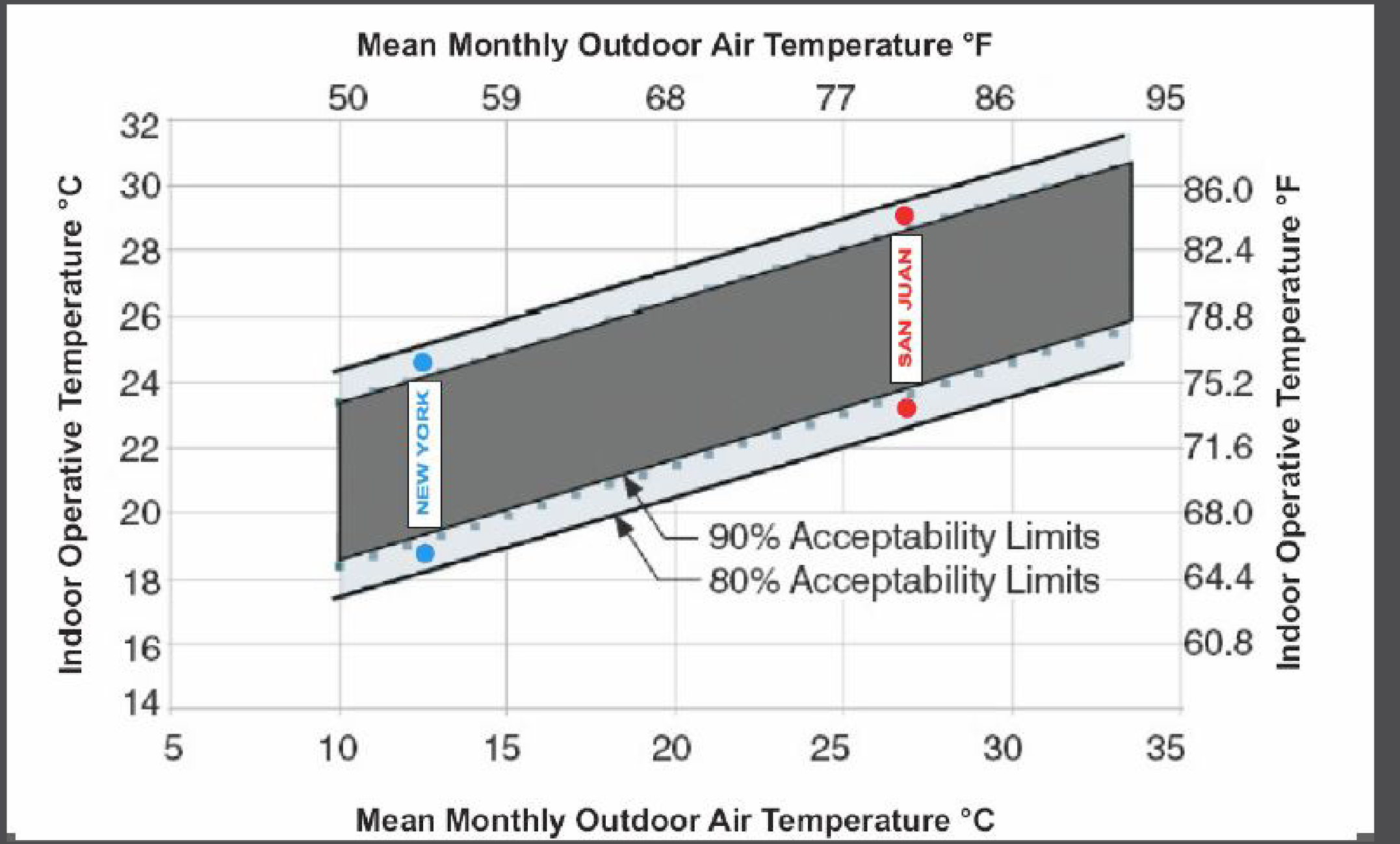
WIND / VENTILATION



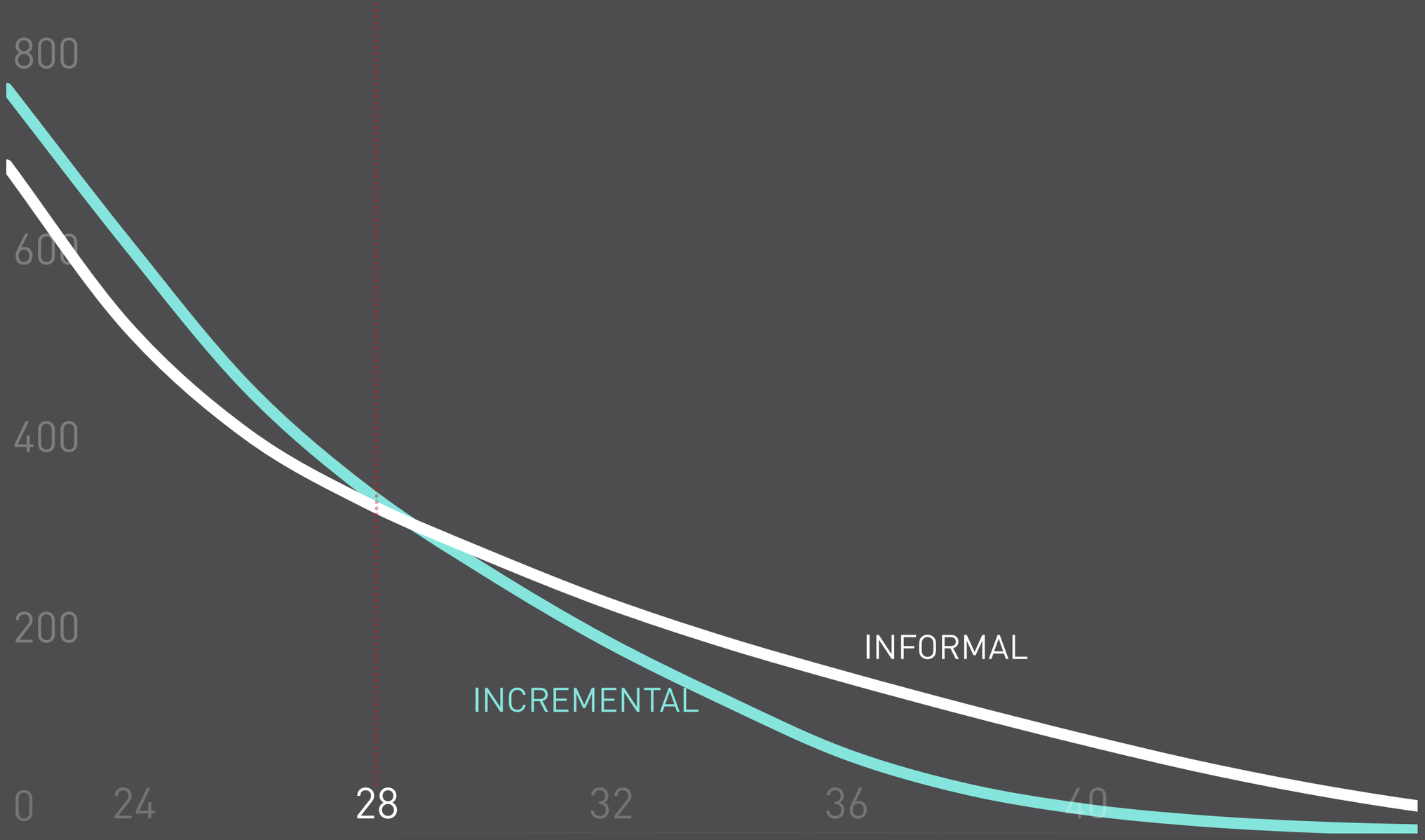
WIND VECTOR GRASSHOPPER ANALYSIS



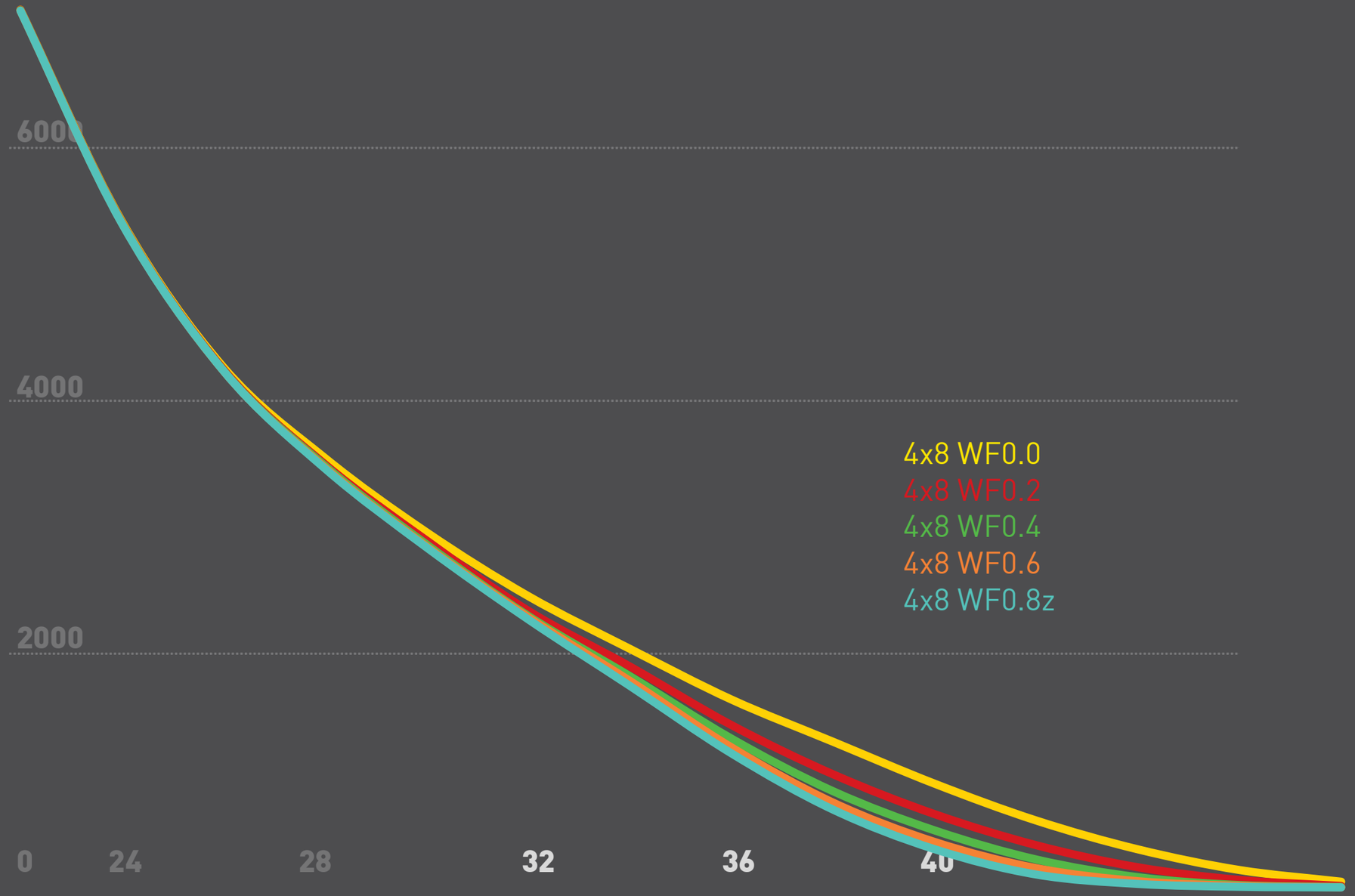
THERMAL COMFORT


Mean Monthly Outdoor Air Temperature °F
50
59
68
77
86
95
Indoor Operative Temperature °C
32
30
28
26
24
22
20
18
16
14
Indoor Operative Temperature °F
86.0
82.4
78.8
75.2
71.6
68.0
64.4
60.8
NEW YORK
SAN JUAN
90% Acceptability Limits
80% Acceptability Limits
5
10
15
20
25
30
35
Mean Monthly Outdoor Air Temperature °C

CUMULATIVE HOURS AT OR BELOW TEMPERATURE (C)

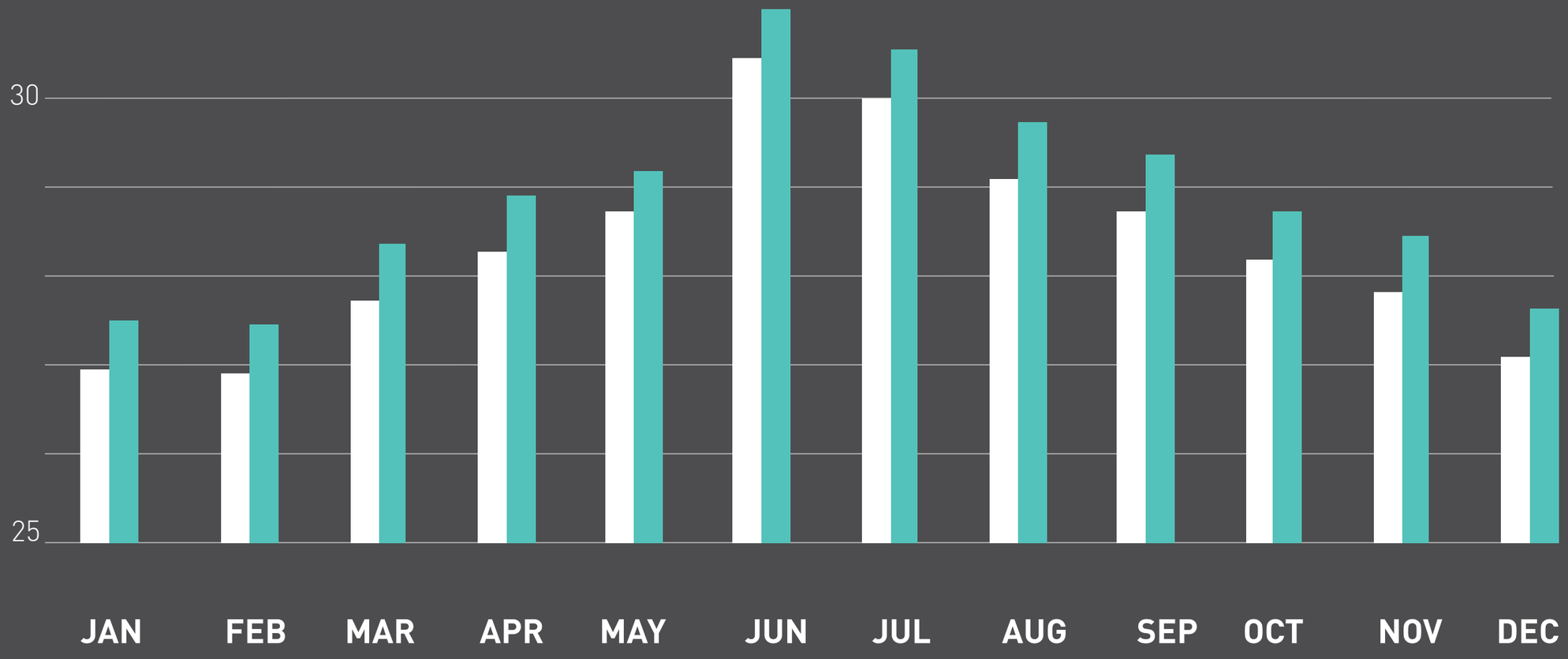


HOURS AT OR BELOW TEMPERATURE (C)

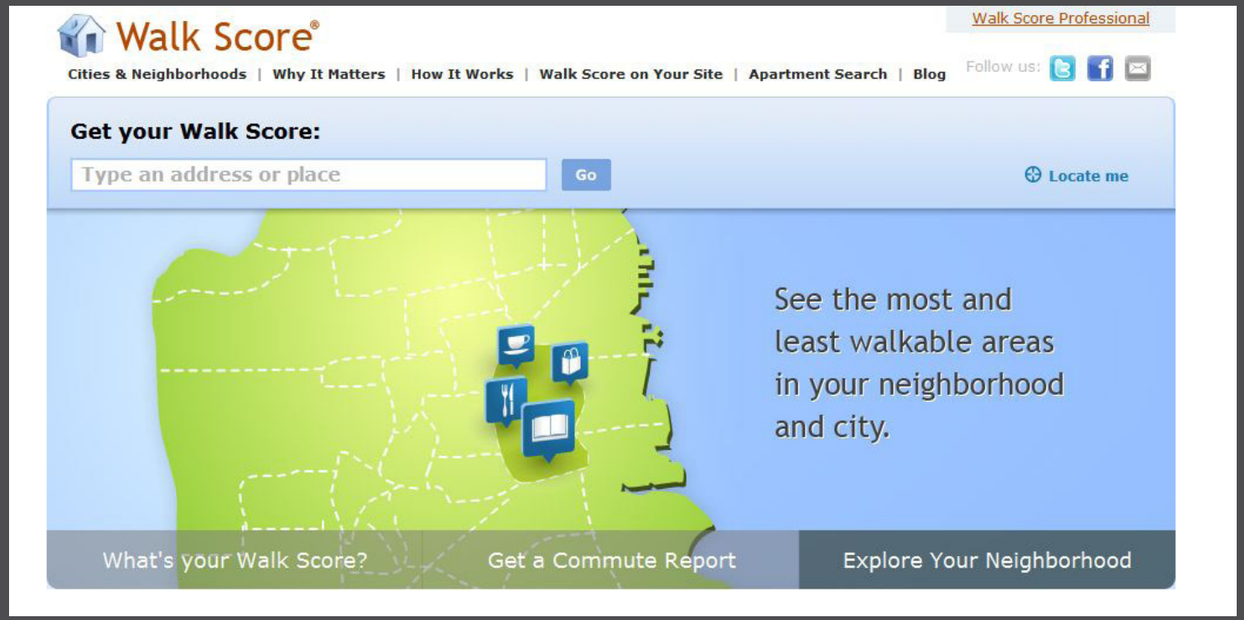


AVERAGE MONTHLY BUILDING TEMPERATURE (C)

INCREMENTAL
INFORMAL



ACCESS TO AMENITIES
[WALK SCORE REDUX]



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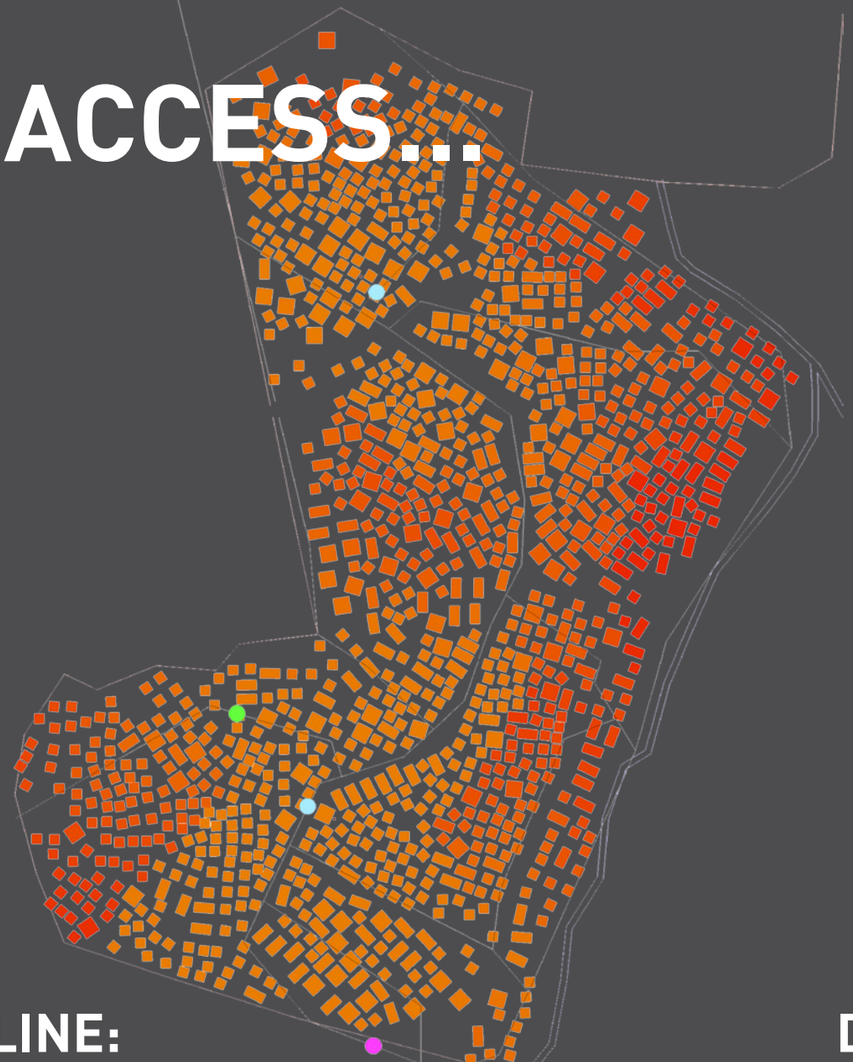
"RESTAURANTS": [.75, .45, .25, .25, .225, .225, .225, .225, .2, .2],
"SHOPPING": [.5, .45, .4, .35, .3],
"COFFEE": [1.25, .75],
"BANKS": [1],
"PARKS": [1],
"SCHOOLS": [1],
"BOOKS": [1],
"ENTERTAINMENT": [1],
```

NEW AMENITY WEIGHTS

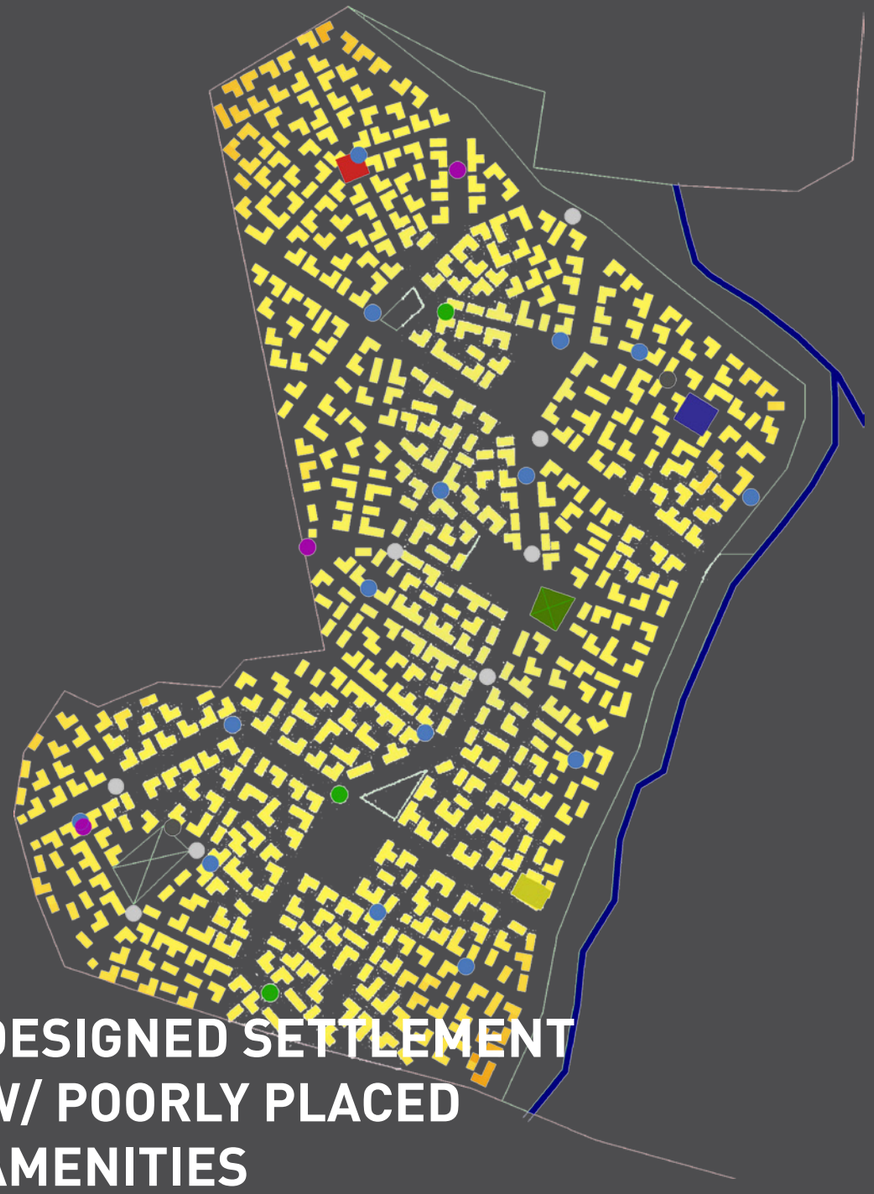
GROCERY	WATER
RESTAURANTS	RESTAURANTS + INFORMAL MARKETS
SHOPPING	MECHANIC
COFFEE	MARKET
BANKS	BANKS / MICRO-CREDIT
PARKS	PARKS
SCHOOLS	SCHOOLS
BOOKS	HEALTH CLINIC + COMMUNITY CENTER
ENTERTAINMENT	ENTERTAINMENT [+ BAR/CLUB]

LATRINES: TO MANY FOR SCRIPT.

INCREASING ACCESS...



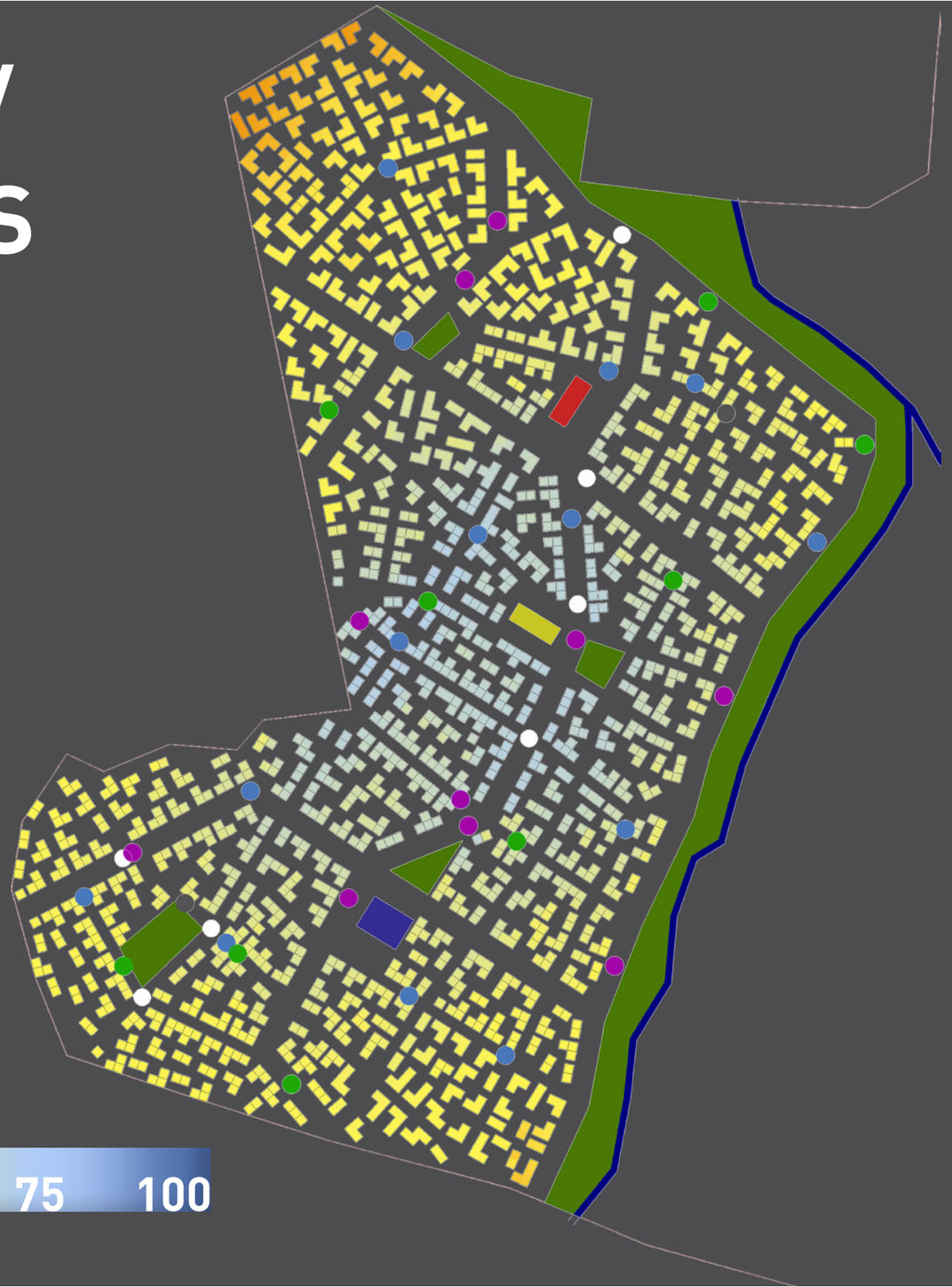
BASELINE:
FEW AMENITIES



DESIGNED SETTLEMENT
W/ POORLY PLACED
AMENITIES

DESIGNED SETTLEMENT W/ BETTER PLACED AMENITIES

WATER
RESTAURANTS + INFORMAL MARKETS
MECHANIC
MARKET
BANKS / MICRO-CREDIT
PARKS
SCHOOLS
HEALTH CLINIC + COMMUNITY CENTER
ENTERTAINMENT [+ BAR/CLUB]



CONCLUSIONS

1.

BASIC SUSTAINABLE DESIGN PRINCIPALS CAN MAKE SIGNIFICANT IMPROVEMENTS TO THERMAL COMFORT AND DAYLIGHT ACCESS IN ZONES OF INFORMALITY.

BIGGEST IMPROVEMENTS:

+ ADDED SPACE BETWEEN BUILDINGS INCREASES VENTILATION AND DAYLIGHT
+ ROOF SPACE AND VENT COUPLED WITH FLOOR VENTS FOR BUOYANCY
+ ORIENT BUILDINGS TO 45° FROM WIND PATTERNS IMPROVES AIR FLOW
+ OVERHANGS LOWER OPERATIVE TEMPERATURES AVERAGE 1-3°

2.

LOCATIONS OF AMENITIES AND CONNECTEDNESS TO URBAN NETWORK SIGNIFICANTLY INFLUENCE QUALITY OF LIFE, AND DIGITAL TOOLS CAN ASSIST IN IDENTIFICATION AND ASSESSMENT OF LOCATIONS.

[DUH]

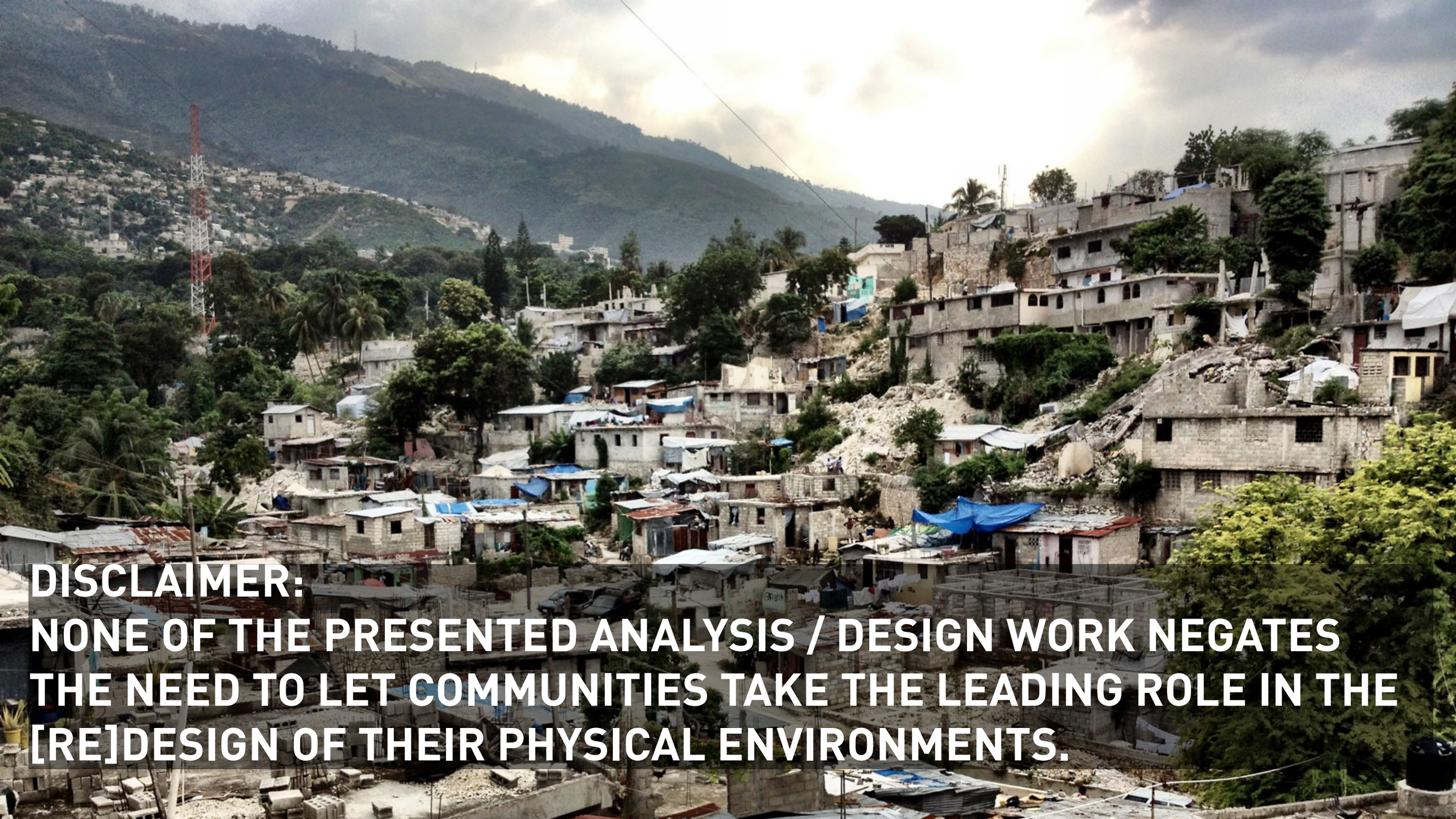
BUT SERIOUSLY:

THIS ANALYSIS PROCESS COULD PROVIDE SIGNIFICANT DATA FOR DECISION MAKING

DIFFICULT TO CREATE NEW FORM INDEPENDENT OF THE MYRIAD OTHER FACTORS REQUIRED TO MAKE ARCHITECTURE AND URBAN DESIGN DECISIONS.

AS HAITIAN RECONSTRUCTION OCCURS, THESE TECHNIQUES WILL BE USEFUL TO ASSESS AND MODIFY PROJECT PROPOSALS.

THE UN IS ON BOARD.



DISCLAIMER:
NONE OF THE PRESENTED ANALYSIS / DESIGN WORK NEGATES THE NEED TO LET COMMUNITIES TAKE THE LEADING ROLE IN THE [RE]DESIGN OF THEIR PHYSICAL ENVIRONMENTS.