~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 UPGRAADING OR INCREMENTAL SOLUTIONS.

CAN DIGITAL ANALYSIS OF BUILDING AND URBAN PERFORMANCE FURTHER THE SUCCESS OF SUCH DESIGN INTERVENTIONS?
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
~1200 FAMILIES

NOTE: SITE AREA WAS DOUBLED TO REPRESENT TYPICAL PERMANENT INFORMAL SETTLEMENT.
NO SPACE FOR WATER
ROAD NETWORK UNRESPECTED / BUILT INTO
INABILITY TO PROVIDE INFRASTRUCTURAL SERVICES
ACCESS TO LIGHT + AIR INCREASINGLY LIMITED
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.
BASE MODEL OPTIMIZATION

OPERATIVE TEMPERATURE

12MX6M BASE BUILDING
ZONED VERTICALLY

20 DEG PITCH: 1/2.75 [0.36]
1/2 SLOPE
1/1/53 [.65]
[1/1]
ZONE 3
0.2M CONCRETE BASE
BIGGER BASE
0.5M CONCRETE BASE
SURROUNDING BUILDINGS
OUTSIDE DRY-BULB TEMPERATURE

JAN FEB MAR APR MAY JUN JUL AUG SEPT OCT NOV DEC
[DB]
INCREMENTAL HOUSING
ACH / WIND FACTOR / BUILDING TYPE
[DB]
OPERATIVE TEMP VS OUTSIDE TEMP
INCREMENTAL HOUSING

L BLOCK
One module: 16m²
1 family: 32-48m²
8 families: 256-384m²
Public Space: 64m²
ARCHITECTURE FOR HUMANITY
+
CORDAID

UNIVERSITY OF MANITOBA
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 RADIATION
WIND / VENTILATION
WIND VECTOR GRASSHOPPER ANALYSIS
THERMAL COMFORT
CUMULATIVE HOURS AT OR BELOW TEMPERATURE (°C)

INCREMENTAL

INFORMAL
HOURS AT OR BELOW TEMPERATURE (C)

- 4x8 WF0.0
- 4x8 WF0.2
- 4x8 WF0.4
- 4x8 WF0.6
- 4x8 WF0.8z
ACCESS TO AMENITIES
[WALK SCORE REDUX]
AMENITY_WEIGHTS = {
    "GROCERY": [3],
    "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.
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.