INAUGURATE IDEAS IN PROSPECTIVE SYRIAN HOUSING SCARCITY

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Pic Source : AP Photo/Hassan Ammar

CONTEXT

A

POPULATION

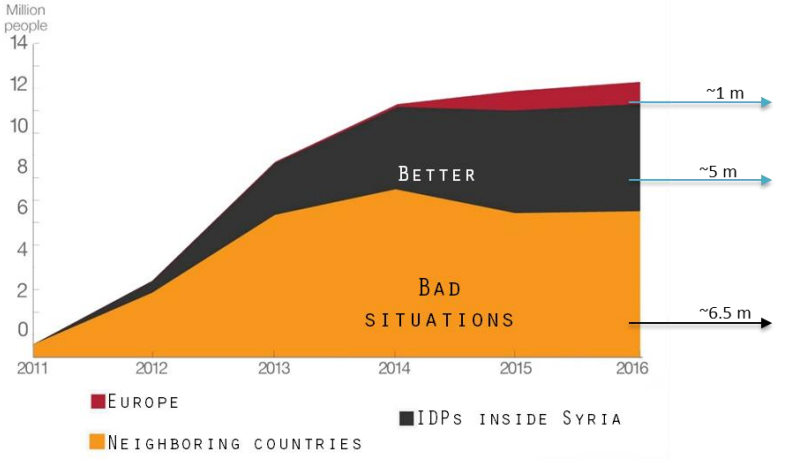
20

Million

REFUGES & IDPs

12

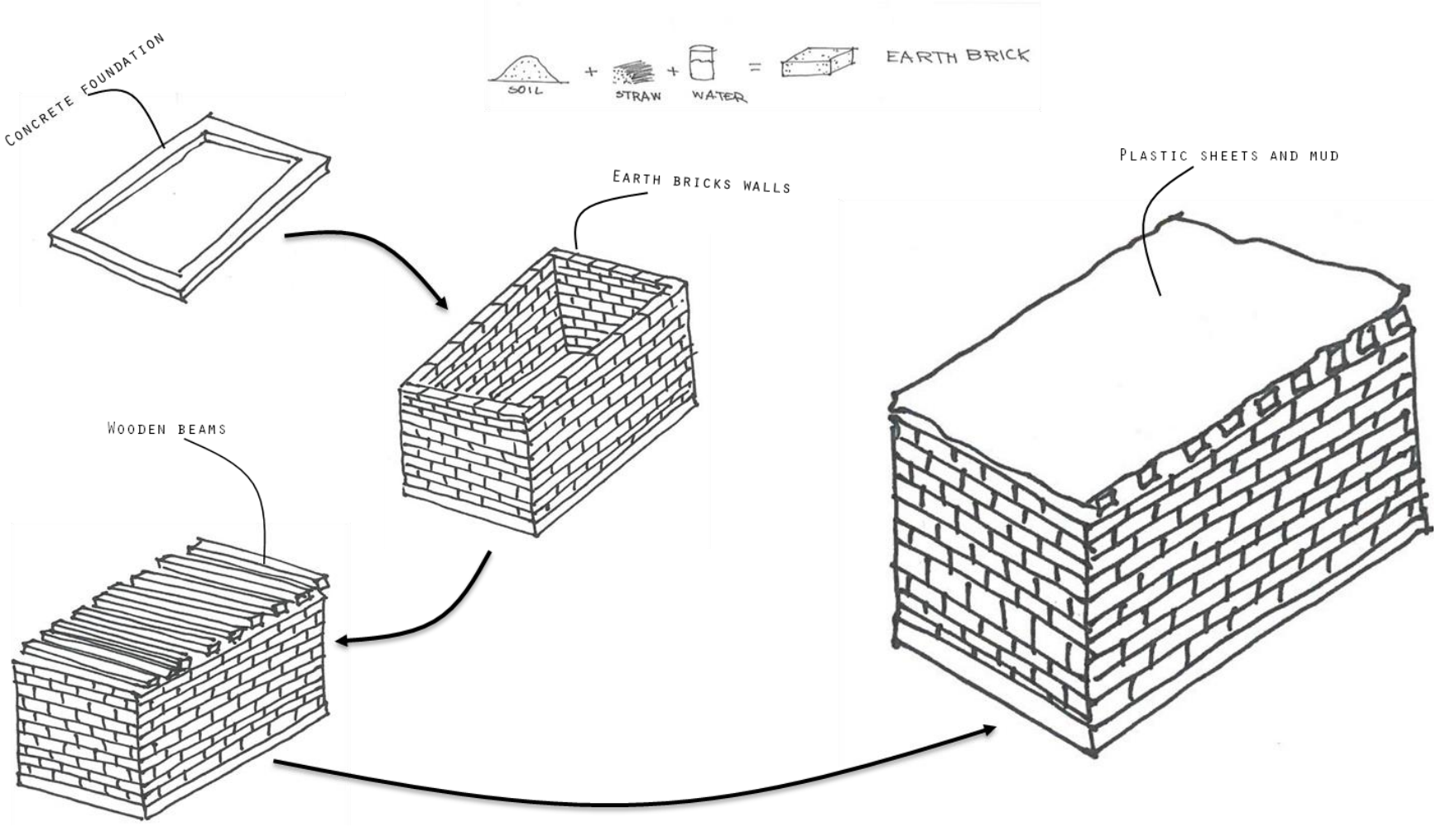
Million



Around 1 million Syrian live in Europe and another 6 million live in neighbouring countries but the largest number were displaced inside Syria traying to build their communities again.

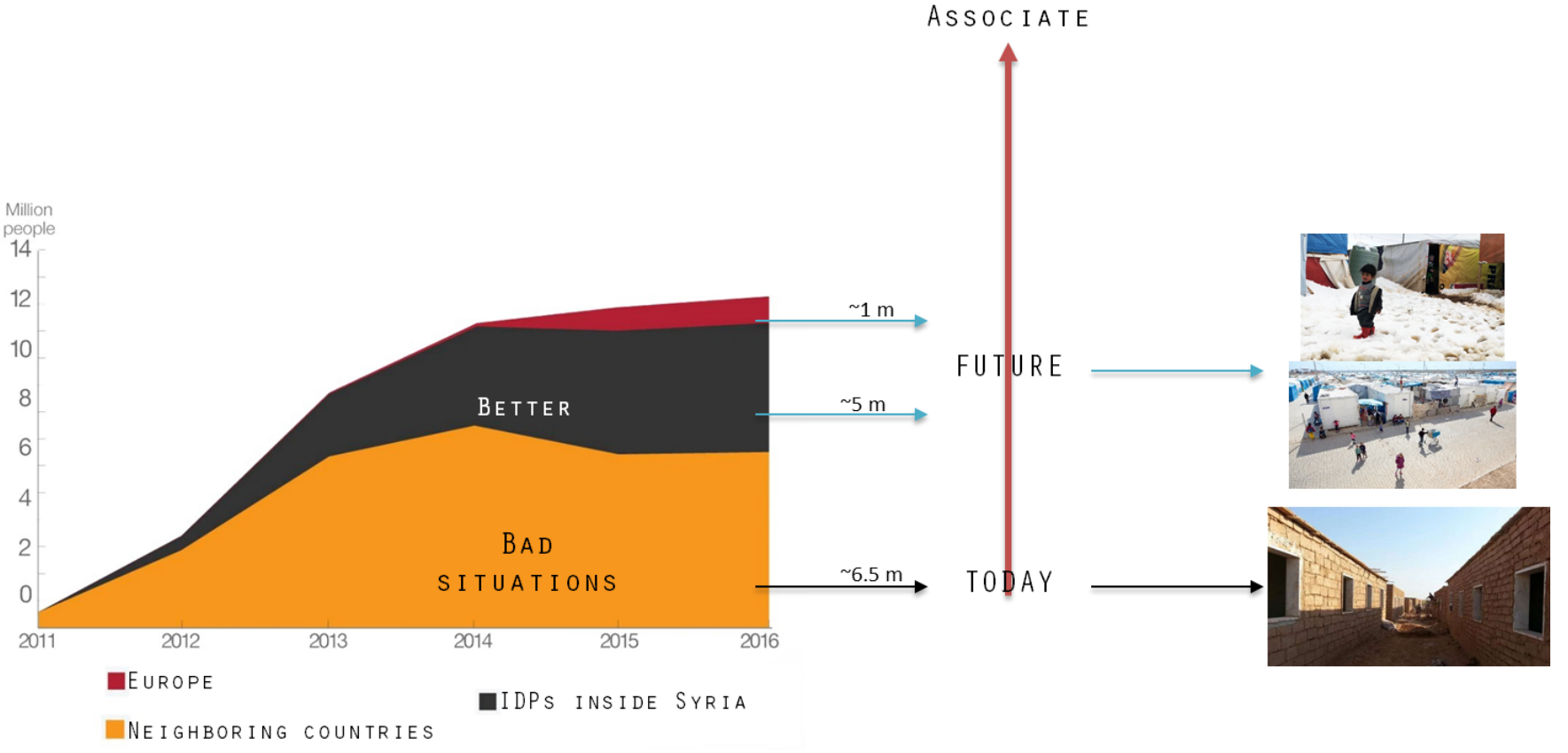
Source UNHCR; PEW Research center, EuroStat

IDPs BUILDING IN SOUTHERN PART OF SYRIA



IDPs in northern part of Syria build in primitive way, concrete foundation that support earth bricks walls that covered later with mud and plastic sheets.

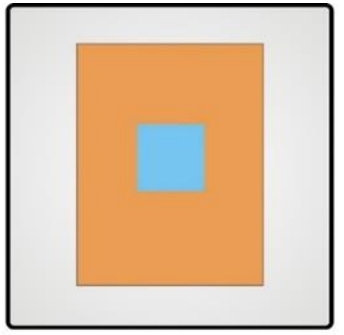
PROJECT SCOPE



The question here, how can we develop this design further and make out of it a potential design for housing scarcity in Syria?

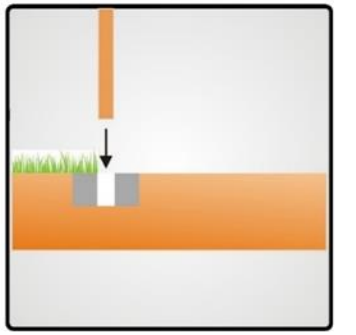
Source UNHCR and Skynews report

WORK FLOW



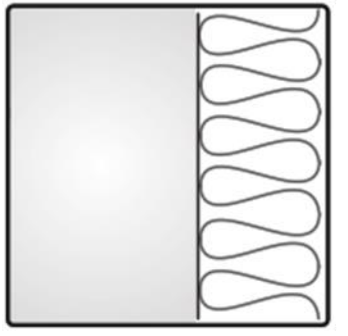
MATERIAL IMPROVEMENT

MODULARITY



INSTALLATION

ORIENTATION IMPACT



WALL (MATERIAL) PROPERTIES

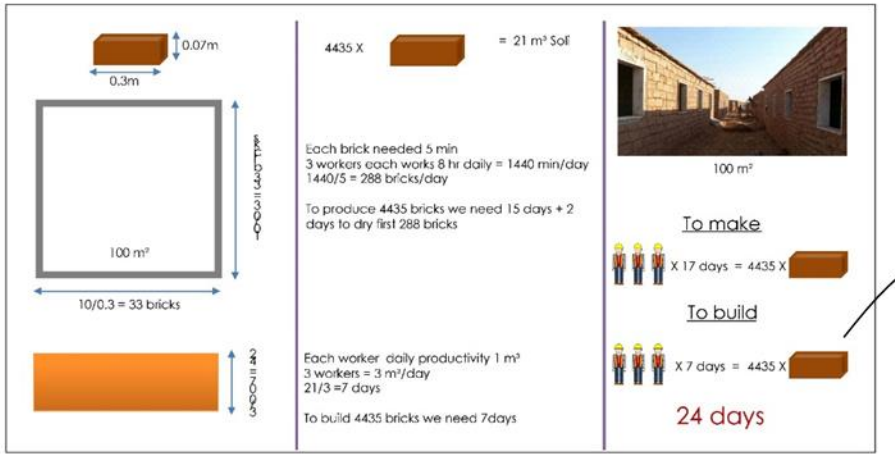
1- Material development

2- Material using in modular system

3- Housing system installation

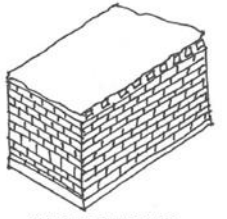
4&5- Climate design

MATERIAL INVESTIGATION



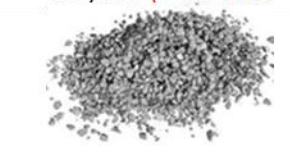
IKEA TENT

5 HOURS

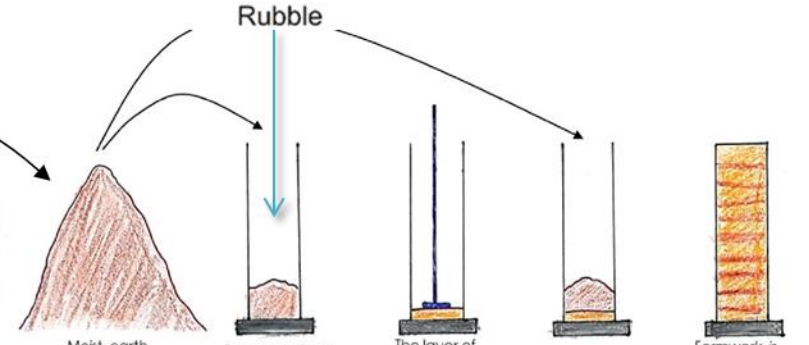


REFUGEES' BUILDINGS

24 DAYS

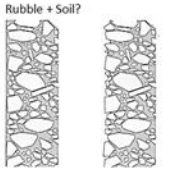


At least 3 mil homes destroyed (> 80 Mio ton)



Advantages +

- Gravel added to reduce water runoff
- Faster to make and to build
- Nedded less skillede people and less manpower
- It can be done either on or off site
- Better compression strength compared to earth bricks
- Compression strength is more able to upgrade.



Pre-fab rammed earth components

6 Mpa

To build a house with 100 m2 total area as the refugees in Syria do, we will need around 24 days which is a thing regarding to housing in crisis. HOW can we speed up this procedure to find something better than IKEA tent and faster that the refugee' approach?

From the other hand, Syria has more than 80 mio ton of rubble that need to move away. If we took the same raw material (earth) and mix it with rubble which they can make a perfect combination and then compress it together. By doing so, we will get more durable and durable material comparing to earth bricks.

RAMMED EARTH AND RUBBLE EXPERIMENT

UP TO 50% OF THE RUBBLE COULD BE REUSED

To approach the new material properties, variant prototypes was built and investigated. I test many different rubble sizes and rubble/soil ratio and I found out that we can use until 50% of the rubble in Syria.

PRE-FAB RAMMED EARTH ADVANTAGES Vs. SITE RAMMED EARTH

Refugees buildings

Not skilled laborers

Not organized Construction site

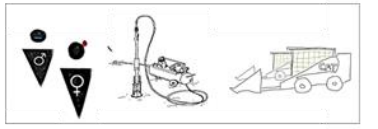
Complex system in respect of ordinary people

Rammed earth

less skilled laborers

Concentrate the work in one place

Simplified construction procedures (IKEA-Model



FASTER & Flexible

No need for Formwork on site. That lead to saving the assembly and deconstruction time.

Avoid weather affection on construction process .

Faster to concat on site with other building components.

Repeatability -it's easy and faster as well to make many copies of the same precast product.

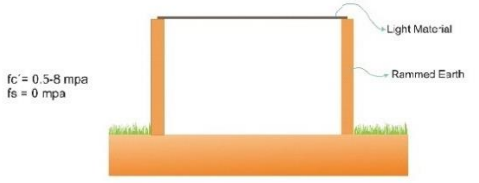
By using the previous defined system, we can reduce manpower need, and avoid having messy construction site.

Moreover, this prosses can be speed up and simplified by defining specific building component and repeat them.

Source :

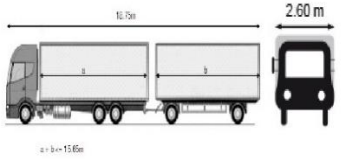
- **A Skynews report from Syria**
- **Refined Earth – Martin Rauch**

PRE-FAB RAMMED EARTH COMPONENTS DIMENSION



Transportation

- To the site:



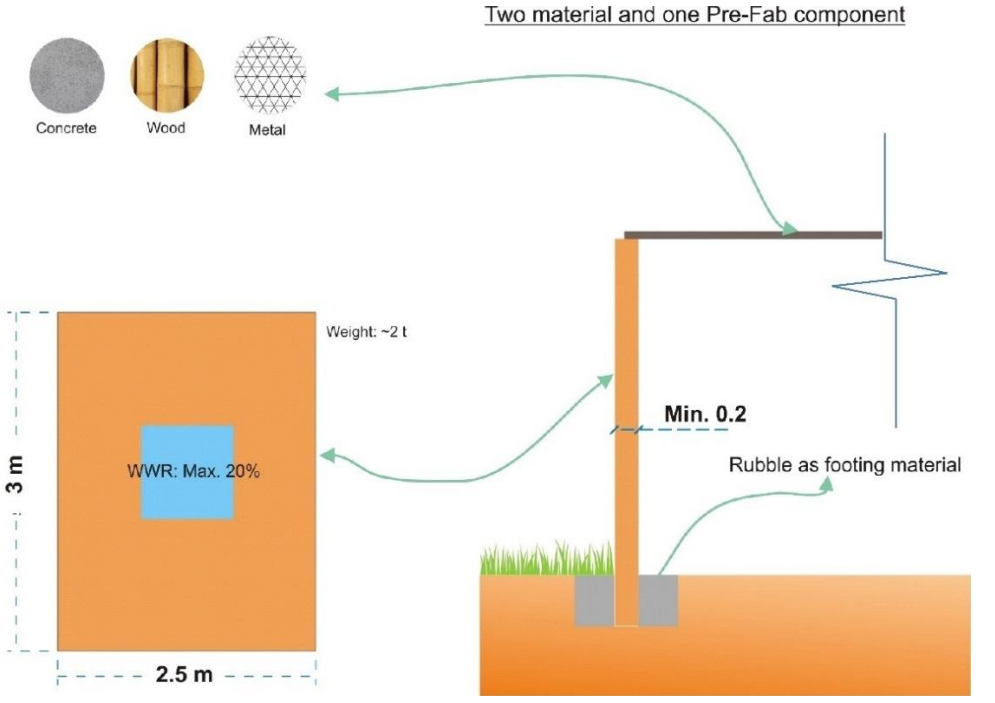
Bigest lorry allowed to derive in Syria with overall box width 2.5 m

Max. Width< 2.5 m

Wieght< 3 Ton

- In the site:

Reasonable Price and no special skills are required

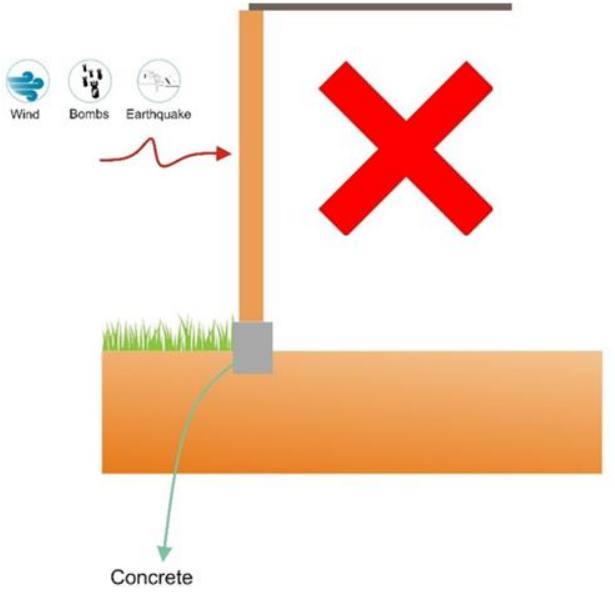


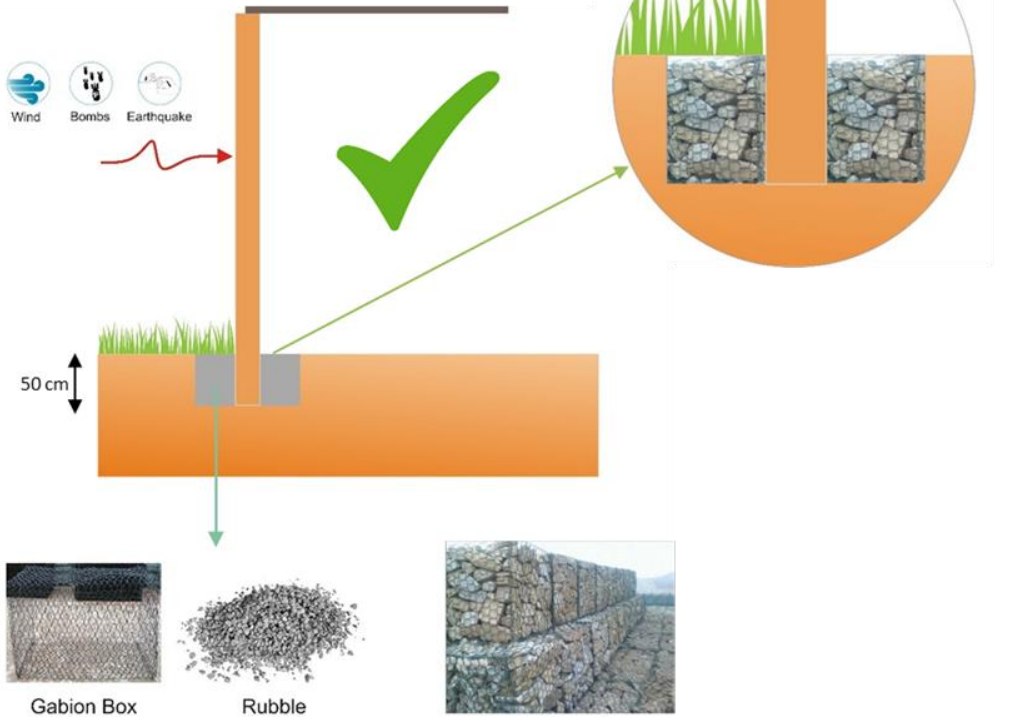
The component need to be small enough to transport and light enough to build by using skilled-free equipment.

Regarding to the Syrian construction code, the dimension of this component was defined (2.5 width, 3 heights and 0.25 thickness)

OVERTURNING RESISTANCE AND RUBBLE USING

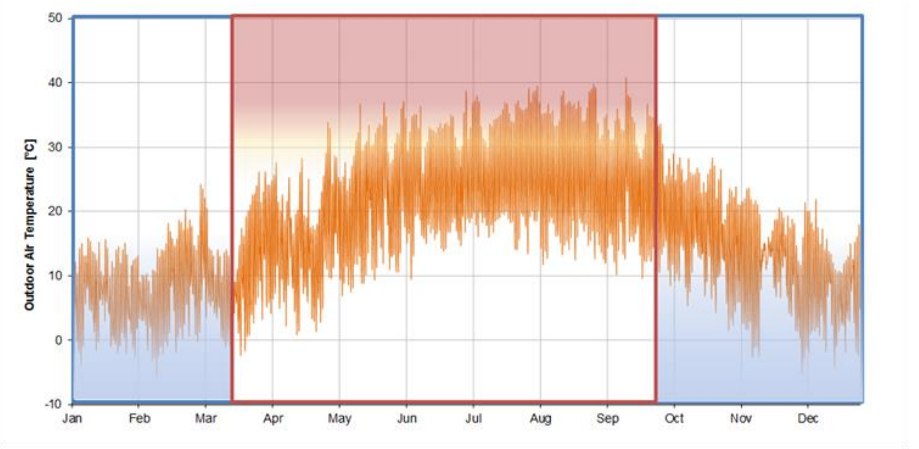
STRONGER& SUSTAINABLE

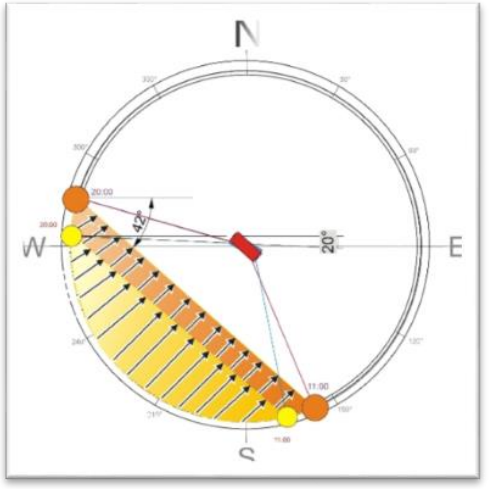


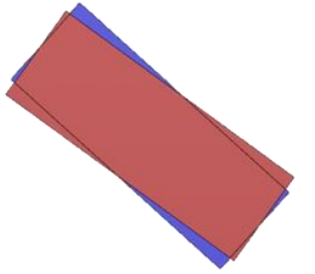


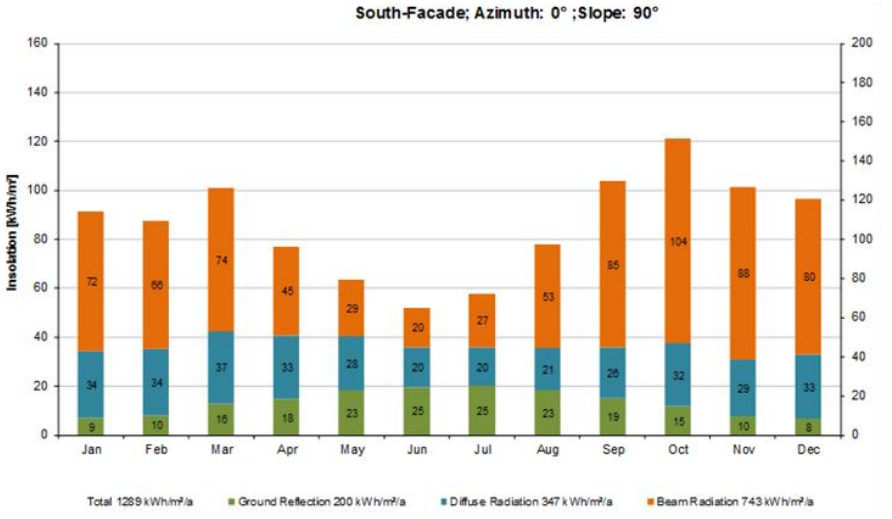
NOT ONLY I integrated the rubble as building material, but also used it in construction process as footing material that can be done in very simple way.

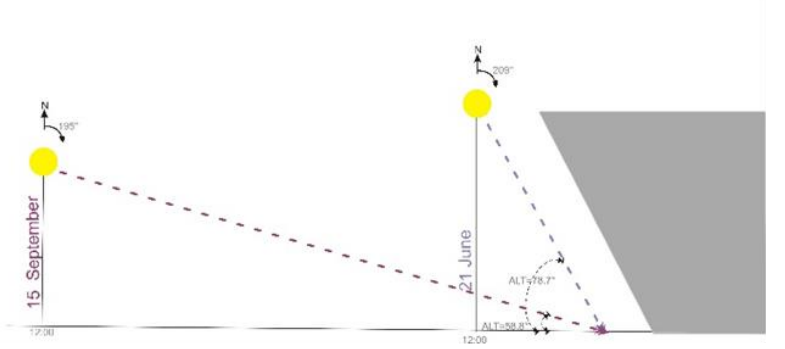
ORIENTATION IMPACT ON ENERGY DEMAND









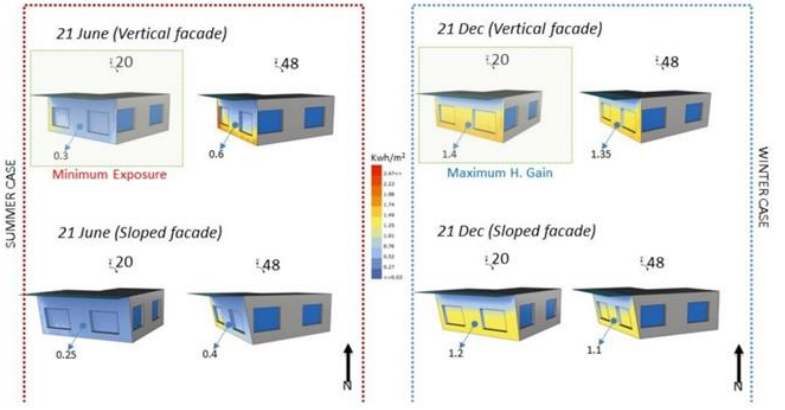


To approach the optimized orientation that maximize heat gain in winter time and minimize solar exposure in summer time, the sun altitudes was investigated to find altitude range in summer and winter time

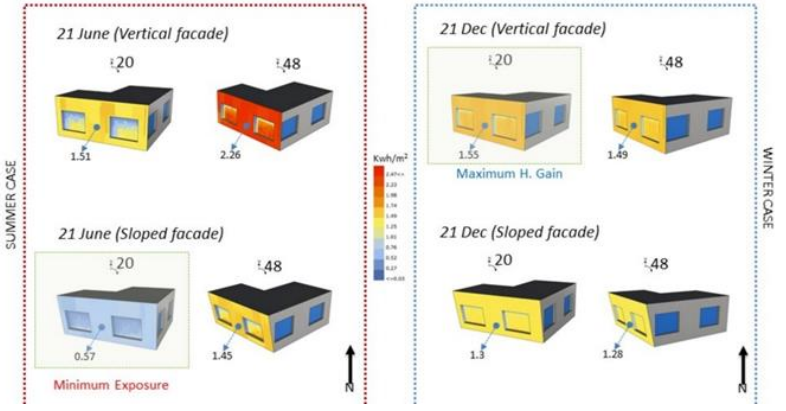
Resulted altitudes applied next on sun path, where the sun rays were equivalent to load profile. Perpendicular load will represent the highest sun radiation on the investigated facade (south facade)

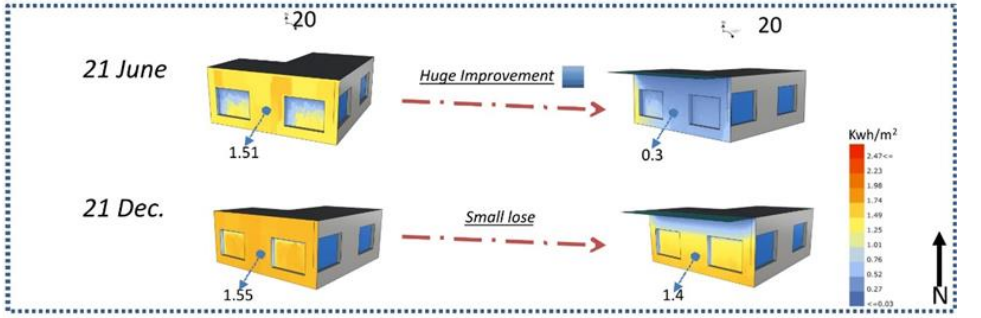
ORIENTATION AND SHADING

Radiation, South facade 21 June with shading (1.75 m). (11:00-20:00)



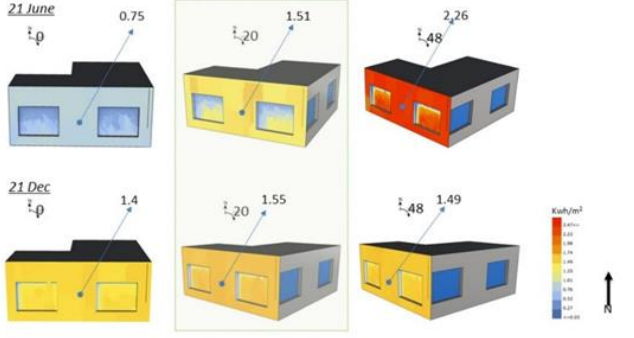
Radiation, South facade (11:00-20:00)





	Rotation			Facade shape		Shading	
	0°	20°	48°	Vertical	Sloped	V. & Shading	S. & Shading
Summer	✓	!	✗		✓	✓	
Winter	✗	✓	!	✓		✓	
Rank	–	●	–	–	–	●	–

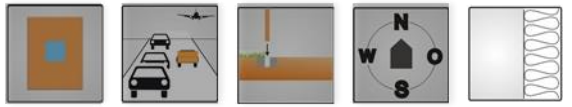
Radiation, South facade (11:00-20:00)

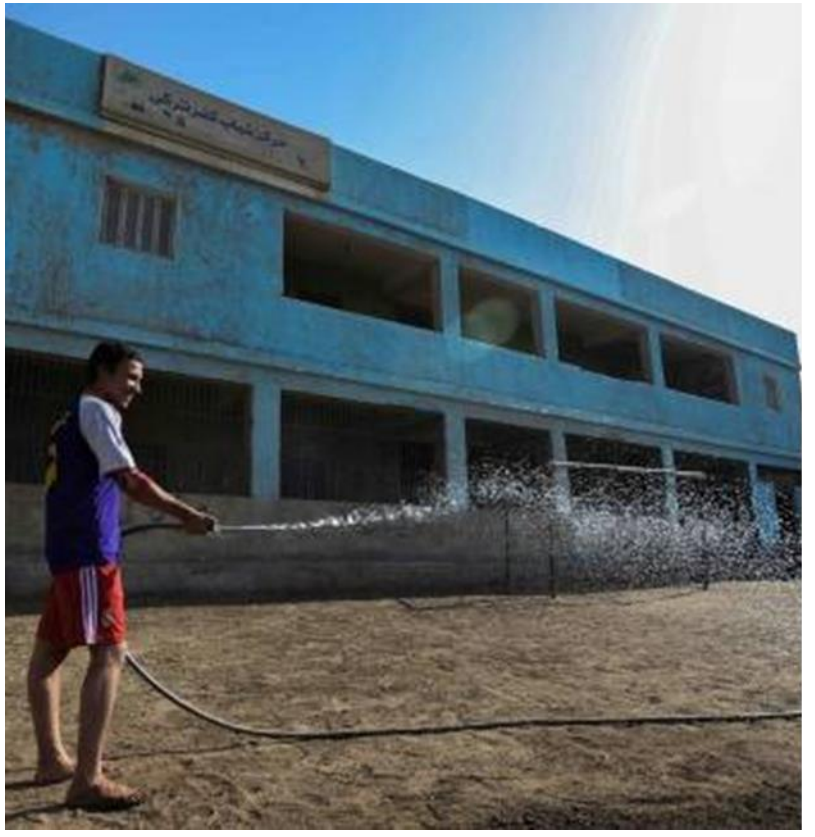


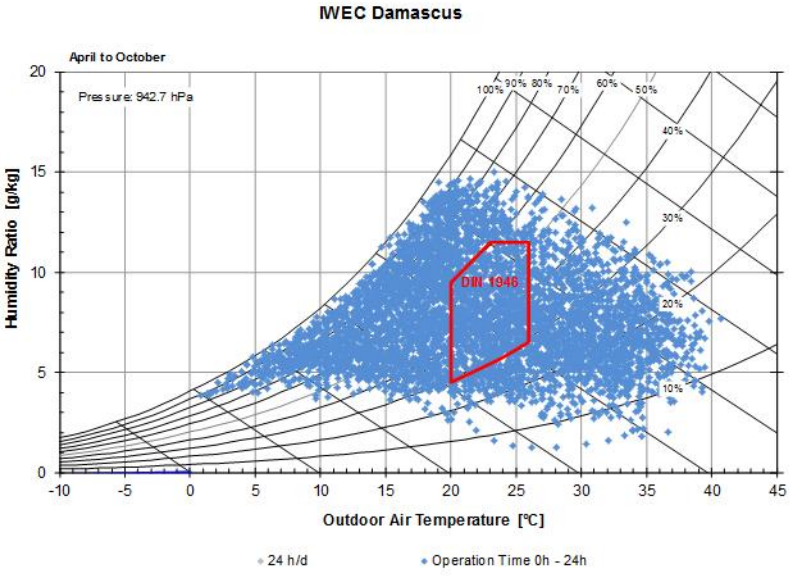
To validate the sun path calculation, the solar radiation on three different orientation was investigated with Grasshopper tool (0°, 20° and 48°).

20° rotation combined with overhang shading is the perfect combination that reduce significantly sun exposure in summer time with little loss of heat gain in winter time

WALL PROPERTIES



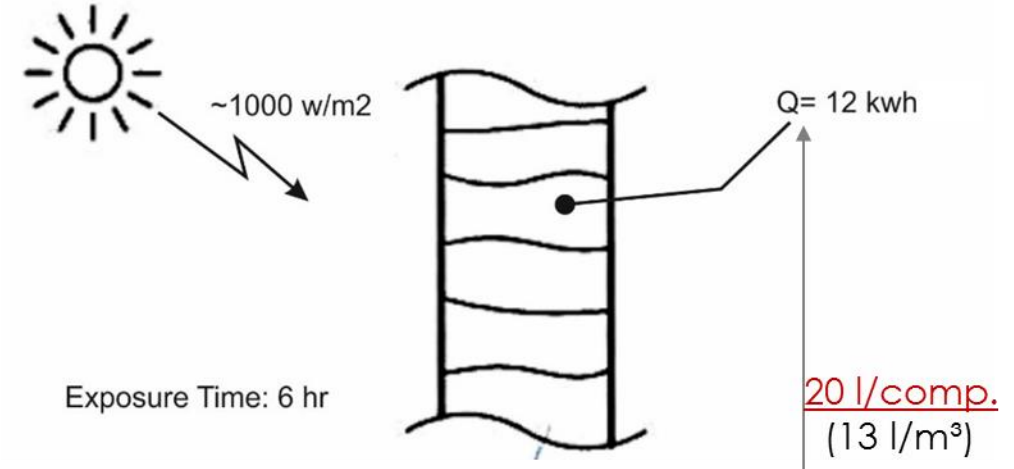




Evaporative cooling is a typical cooling strategy used often in Syria and specially in hot days, where people spray water in front of their houses to cool down soil surrounding their houses. By looking on the psychrometric chart of Damascus; when the temperature exceeds 30 degrees, the air starts to be very dry. the potential of improving the indoor/outdoor comfort by adding water to the air is high.

Pic Source: elwatannews.com

WATER ABSORPTION



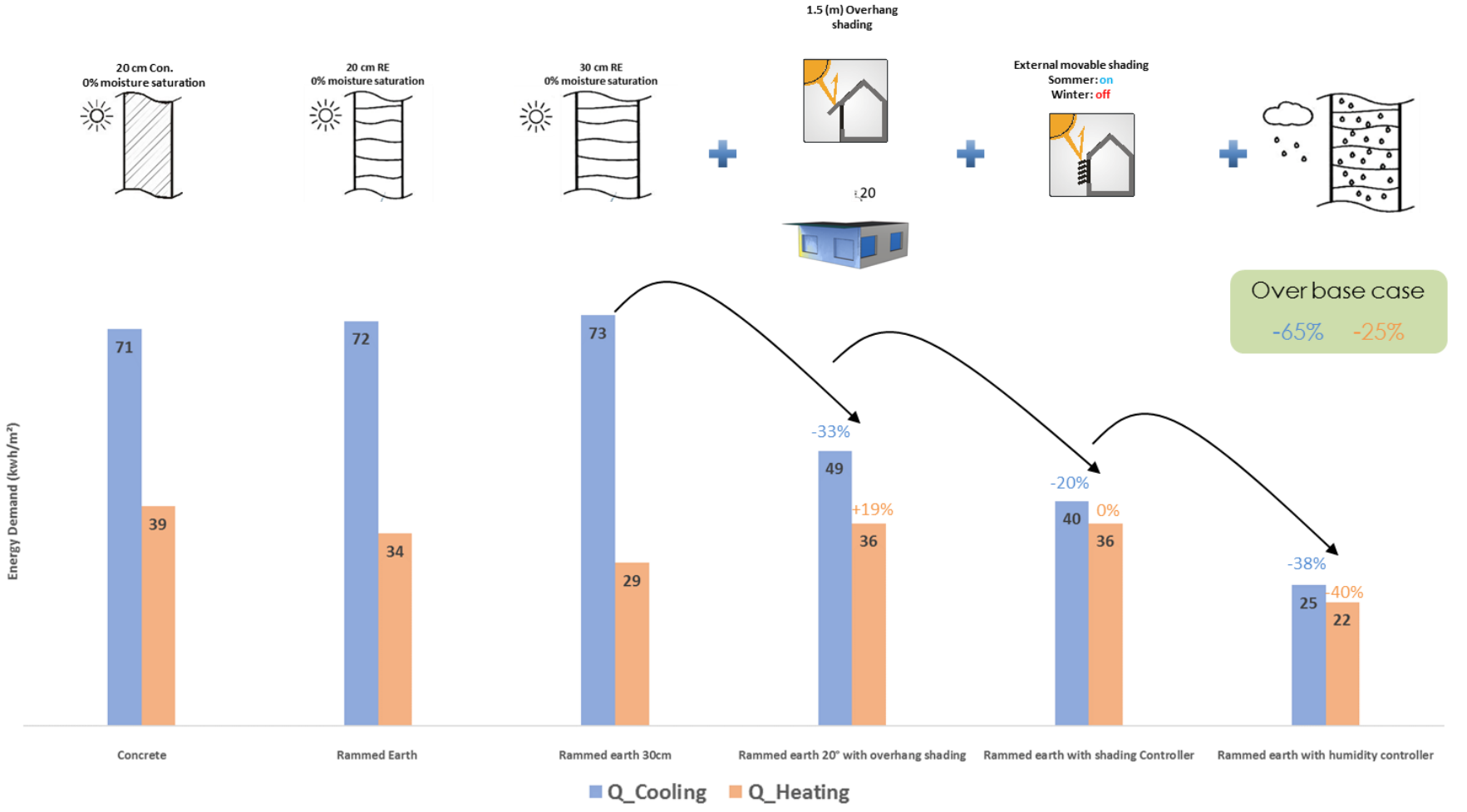
$$Q = C_{pE} \times m$$

30 gr (water)
38.5 l/m³

Since the building material contain soil, material behaviour when the soil saturated with water was investigated.

The water saturation impact on energy demand can be assessment as the water will drive the stored heat during the day time faster from the building components (walls).

FINAL ADJUSTMENT



by synthesis between perfect orientation, shading devices and spraying water on building components, we can reduce energy demand up to 50% over the base case.

THE END .....

THAN K YOU !!!!

Special mention to those who supported me along the way, in a small or big way :

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Sources :
Tammam Azzam's version of Klimt –The Kiss