

Configuration of the Bazaar

Space planning for the neighbourhood and the key building types



PersiaPhoto

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1 Design decisions

The design problem:

All refugees currently living in the camp used to have a better quality of life. In the current camp, the people have been deprived of most of these qualities. At the moment, the shops are located at the main road in the camp. To at least reinstate one of these qualities, we propose to build a bazaar out of earth. Building with earth is necessary, because we cannot afford to import materials. Furthermore, the refugees should be able to build the buildings themselves and with a few exceptions maybe, the refugees might not be skilled in building.

The problems that arise:

-How do we make a bazaar out of earth?

-What kind of earth (Rammed earth, Adobe, etc) ?

-Which local materials are there in the camp or adjacent areas?

-How can we mimic the traditional bazaars the people used to have in Syria?

-What kind of functions are placed in a (Syrian) bazaar?

-What function should be placed where in the bazaar?

-What is the traditional architecture in Syria?

-Where do we place the bazaar?

-What roads are typically the busiest for pedestrians

-What places do we want to connect with the bazaar (mosque/schools etc)

- Religious constraints?

-How do people find their way in the bazaar? (Highlight junctions)

-How can we make the Bazaar livable?

-How can the bazaar maintain a pleasant thermal comfort?

-How can there be enough daylight?

Design goals

At the moment, almost 80.000 Syrian refugees live in camp Zaatri. As it looks now, these people will not move back to Syria on short term. Now, a market is developed around the main route of the camp which is also used for cars and trucks. Due to the width (50m) of the road, there is no comparison with the width of the path in the bazaar. Therefore, we would like to give these people an urban object which reinstate one of the values the refugees lost in their previous lives, in this case the bazaar. By doing this we want to create a safe and social environment where people can do their daily activities such as doing groceries, going to school, social interaction with other people, eating and traverse. The design will be based on adobe as this is a common material in Jordan.

As a bazaar can be placed on different locations in the camp or in future camps, we decided to develop a method. The method will be digital manual integrated in an app which is divided into three sections (figure 1):

1. Where to locate the bazaar (a node)?
2. Where to place a certain function in the bazaar?
3. How to build/ expend the bazaar (simple and understandable drawings)?

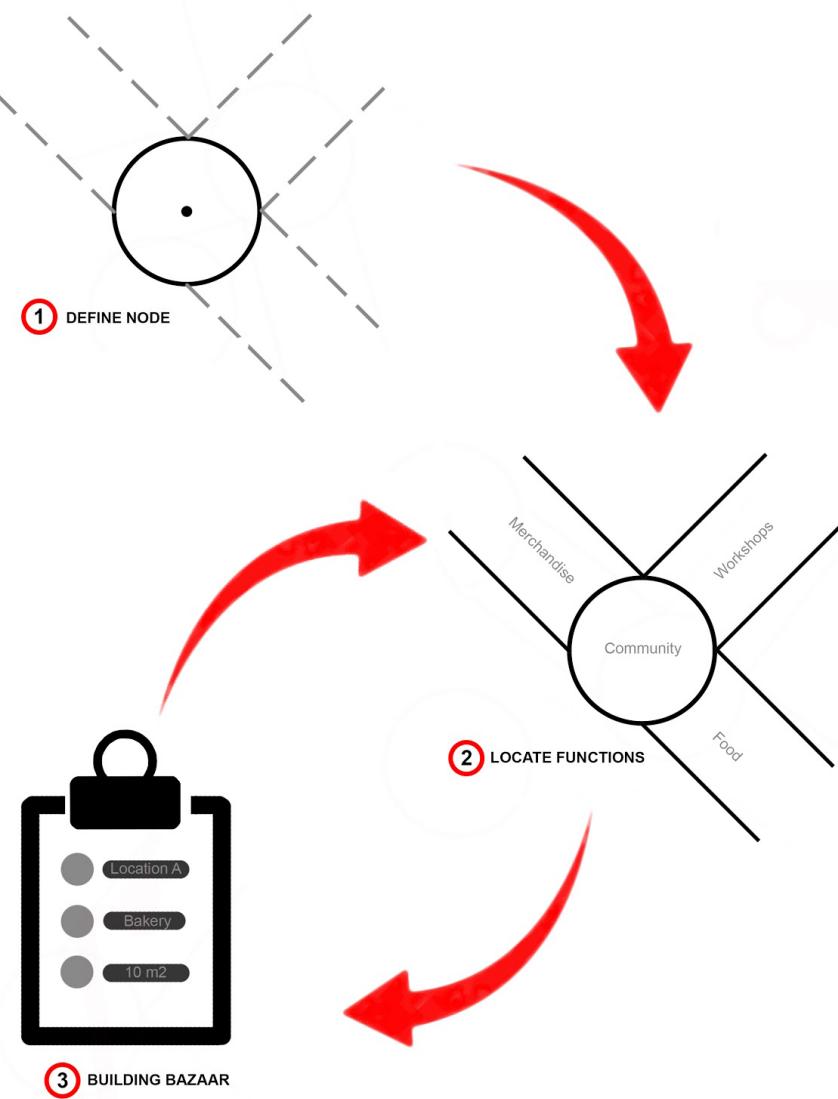


Figure 1: Scheme of vision

The location of the bazaar will be a starting point as it can grow whenever the demand is there. Therefore, an urban map will show the nodes where the start of the bazaar can be built based on pedestrian flows and functions in the camp.

The type of bazaar is based on the street dimensions and functions in the bazaar. This is based on a drop down list in the app as the new entrepreneur can select his/her main function of the company and the needs in e.g. square meters, noise, water, needed supplies. From there, a location around or near the node will be chosen so guilds are not mixed.

The building process is part 3 of the manual. Here, the results of the location is shared and how to build the part of the bazaar by using simple and understandable drawings. These will describe how to make the bricks and how to assemble it in the building. Therefore, we try to avoid language manuals as it should be accessible for all education levels. After the newly built part of the bazaar is added, the database in the app/program is updated and when a new customer wants to add a new shop, all previously added shops are taken into account.

2 Programme of Requirements

As the goal of this project is to create a method for choosing the location of the bazaar, choosing the location of the functions and building the bazaar three sets are described for the programme of requirements: Urban, Position of bazaar around housing and functions in the bazaar.

Urban:

- The Bazaar should be build in streets where there are no cars
- The Bazaar should be build in street with a high pedestrian density
- The bazaar should have access to water
- The main entrance has to be within 100m of a mosque
- The bazaar should have a roof, extensions where the people can work and extension where people can exhibit their products.
- The junctions in the bazaar should be highlighted so people know where they are
- A street should not be wider than 15 meters (including shops on both sides and exhibition spaces) in order to not lose the feeling of a traditional bazaar. (also earth probably could not spawn larger widths), IF this is the case, a subdivision could be made to make a “double street”, see figure 2.

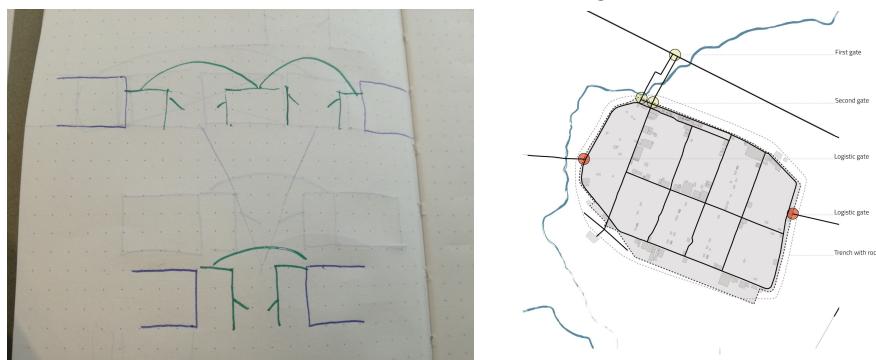


Figure 2: Sketches

- Bazaar should be within 250m from Logistical points of the Zaatari camp.
- The bazaar should be expandable, as stores attract stores.
- The Bazaar is open 24/7

Soft criteria:

- As a bazaar is not only for shopping, but also for social activities, we should accommodate those sort of facilities.
- The bazaar should be in tradition persian/roman style
- Light should get into the bazaar

Position of bazaar around housing

As the realization process of the bazaar is part of an urban development, current houses cannot be impacted or relocated. Therefore, different general possibilities are considered for this project. In the first option, the shops are designed against the houses which narrows the pedestrian road for the bazaar, see figure 3.

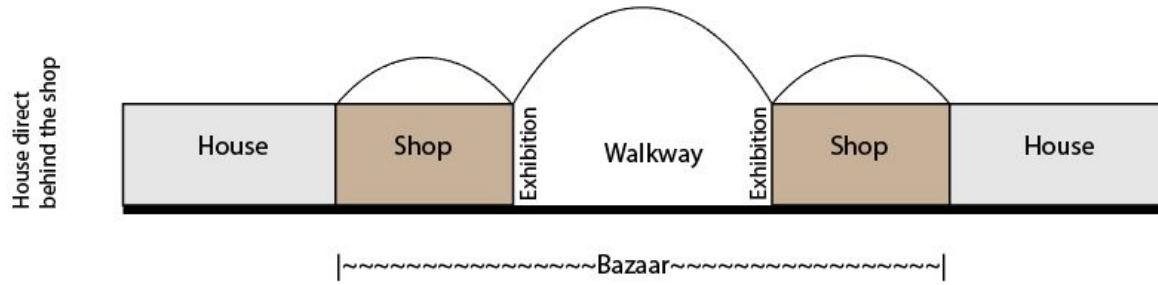


Figure 3: Bazaar against houses

In the second option, a house is added on the shop for the shop owners as the bazaar and its shops need social control. This can be created when residents have view on the walkway and shops, figure 4.

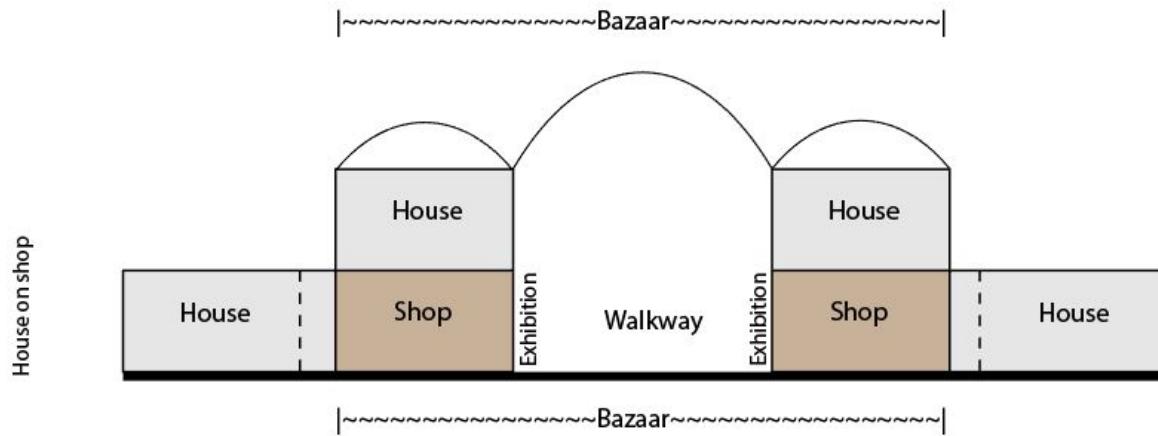


Figure 4: Bazaar with houses on top

The third option is to deepen the bazaar in the ground for climate reasons and for raw material source. Also, for structural reasons this could impact in a positive way. This will be investigated in the 'forming and structuring' phase.

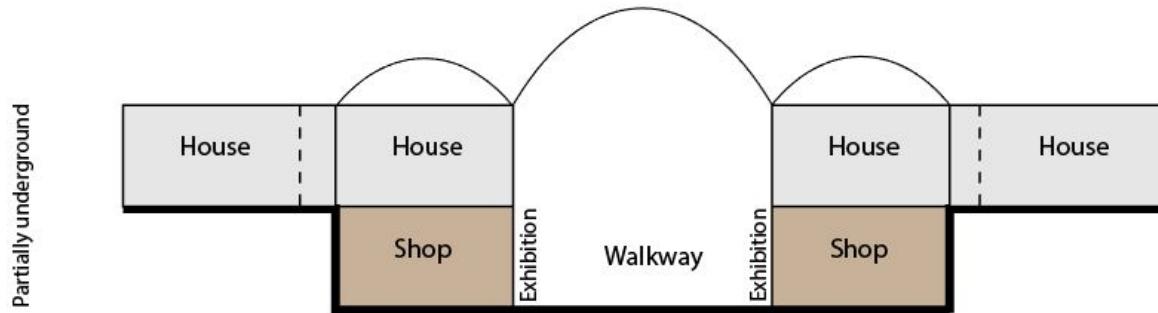


Figure 5: Bazaar deepened in the ground

Lay-out program bazaar

In table 1, the similarities of the functions and clusters are summed as this will be part of the manual. The user will enter his needs before a suggested location shows up.

Category	Function	Noise (generate)		Space m2	Space accessibility	Minimum height	Day light intensity	Publicizing time	Connected to	Similarities
		Water	Space m2							
Community	Tea house	Medium	Medium	Medium (20m2)	Public	2.7	Medium	All day (24/7ish)	Rasteh (lane) or Chaharsough (Junction)	
	Restaurant	High	Medium	Medium (20m2)	Public	2.7	Medium	Day-evening (from dawn after dusk)	Rasteh (lane) or Chaharsough (Junction)	
	School	High	Low	Big (20+ m2)	Semi-Public	2.7	high	Day (From dawn till dusk)	Rasteh (lane)	
	Mosque	Low	Medium	Big (20+ m2)	Public	5	high	All day (24/7ish)	Rasteh (lane)	
	Daycare	High	Low	Medium (20m2)	Semi-Public	2.7	medium	Day (From dawn till dusk)	Rasteh (lane)	
	Cinema/theater	Low	Low	Big (20+ m2)	Semi-Public	5	Zero	Day-evening (from dawn after dusk)	Rasteh (lane)	
	Bathhouse	Low	High	Big (20+ m2)	Public	5	high	All day (24/7ish)	Rasteh (lane)	
	Fountain	Low	High	Small (10m2)	Public	5	high		Chaharsough (Junction)	
Food	Herbs&Spices	Low	Low	Small (10m2)	Public	2.7	low	Day (From dawn till dusk)	Rasteh (lane) or Timcheh (square or junction)	
	Vegetable	Low	Low	Small (10m2)	Public	2.7	low	Day (From dawn till dusk)	Rasteh (lane) or Timcheh (square or junction)	
	Butcher/meat	Medium	Low	Medium (20m2)	Public	2.7	low	Day (From dawn till dusk)	Rasteh (lane) or Timcheh (square or junction)	
	Bakery	Low	Low	Small (10m2)	Public	2.7	low	Day (From dawn till dusk)	Rasteh (lane) or Timcheh (square or junction)	
Merchandise	General Fabrics	Low	Low	Medium (20m2)	Public	2.7	low	Day-evening (from dawn after dusk)	Rasteh (lane) or Timcheh (square or junction)	
	Delicate Fabrics	Low	Low	Small (10m2)	Public	2.7	low	Day-evening (from dawn after dusk)	Rasteh (lane) or Timcheh (square or junction)	
	Phone store	Low	Low	Small (10m2)	Public	2.7	low	Day-evening (from dawn after dusk)	Rasteh (lane) or Timcheh (square or junction)	
	Pharma	Low	Low	Medium (20m2)	Public	2.7	low	Day-evening (from dawn after dusk)	Rasteh (lane) or Timcheh (square or junction)	
Workshops	Coppersmith	High	Medium	Medium (20m2)	Semi-Public	2.7	medium	Day-evening (from dawn after dusk)	Rasteh (lane) or Timcheh (square or junction)	
	Shoe maker	High	Low	Medium (20m2)	Semi-Public	2.7	medium	Day-evening (from dawn after dusk)	Rasteh (lane) or Timcheh (square or junction)	
	Tailor	High	Low	Medium (20m2)	Semi-Public	2.7	medium	Day-evening (from dawn after dusk)	Rasteh (lane) or Timcheh (square or junction)	
	Pottery	High	Medium	Medium (20m2)	Semi-Public	2.7	medium	Day-evening (from dawn after dusk)	Rasteh (lane) or Timcheh (square or junction)	
	Hairdresser	High	Medium	Medium (20m2)	Semi-Public	2.7	medium	Day-evening (from dawn after dusk)	Rasteh (lane) or Timcheh (square or junction)	
	Blacksmith	High	Medium	Medium (20m2)	Semi-Public	2.7	medium	Day-evening (from dawn after dusk)	Rasteh (lane) or Timcheh (square or junction)	
	Jewels	High	Low	Small (10m2)	Semi-Public	2.7	medium	Day-evening (from dawn after dusk)	Rasteh (lane) or Timcheh (square or junction)	
	Bike store	High	Low	Medium (20m2)	Semi-Public	2.7	medium	Day-evening (from dawn after dusk)	Rasteh (lane) or Timcheh (square or junction)	
Houses	Furniture	High	Low	Big (20+ m2)	Semi-Public	2.7	medium	Day-evening (from dawn after dusk)	Rasteh (lane) or Timcheh (square or junction)	
	Houses	Medium	Medium	Medium (20m2)	Private	2.7	medium	All day (24/7ish)	TBD	

Table 1: Programme of requirements for the shop owners

3 Bubble diagrams and REL-Charts

A bubble diagram is set up to understand the relationships between the shops and the logistics within the bazaar and the relationship between the walkway and the shop program. Therefore, three levels of detail for the bazaar logistic lay-out and three different clusters of programs in the bazaar are analyzed. The bubble diagram is set up with the help of 'Space Syntax' in Grasshopper, Rhino.

Variant 1: Relationship logistic and functions within bazaar (simple)

All variants for the function in the bazaar have a viewpoint from the junction as it is an orientation point. All main functions are connected with the junction except for the factory as this is connected directly to the shop, figure 6.

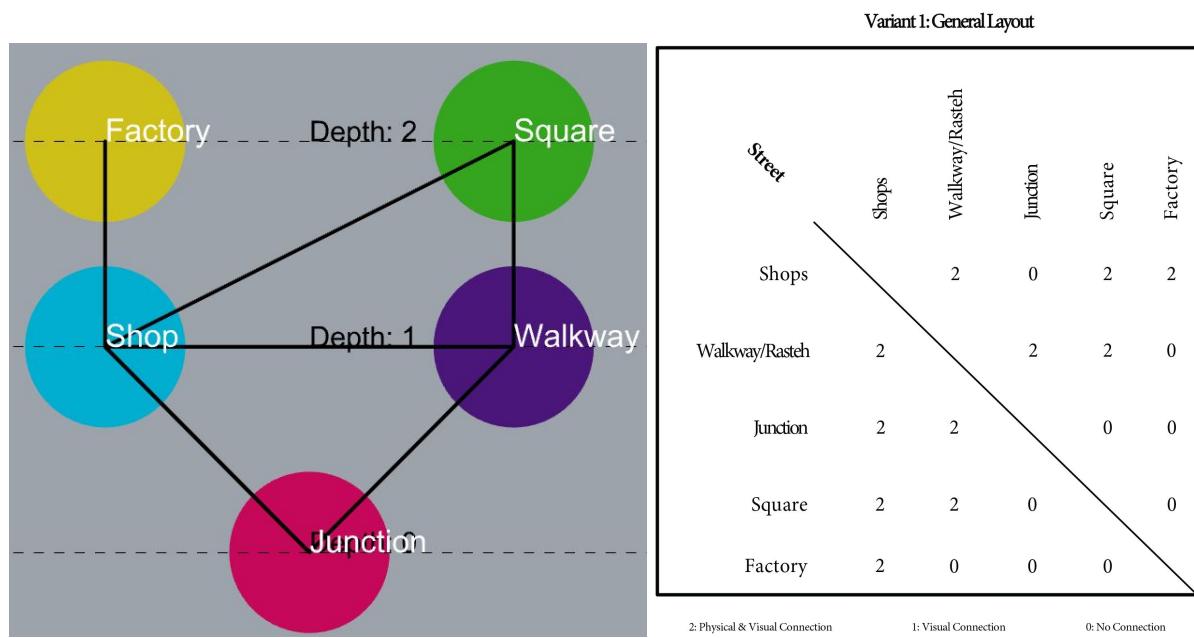


Figure 6: Bubble diagram & REL chart simple

Variant 2: Relationship logistic and functions within bazaar (advance)

In this variant, the shops are divided in cluster groups as this is seen in current bazaars. From here, all cluster streets are connected to the junction and a square with a cluster can be connected to a walkway, figure 7.

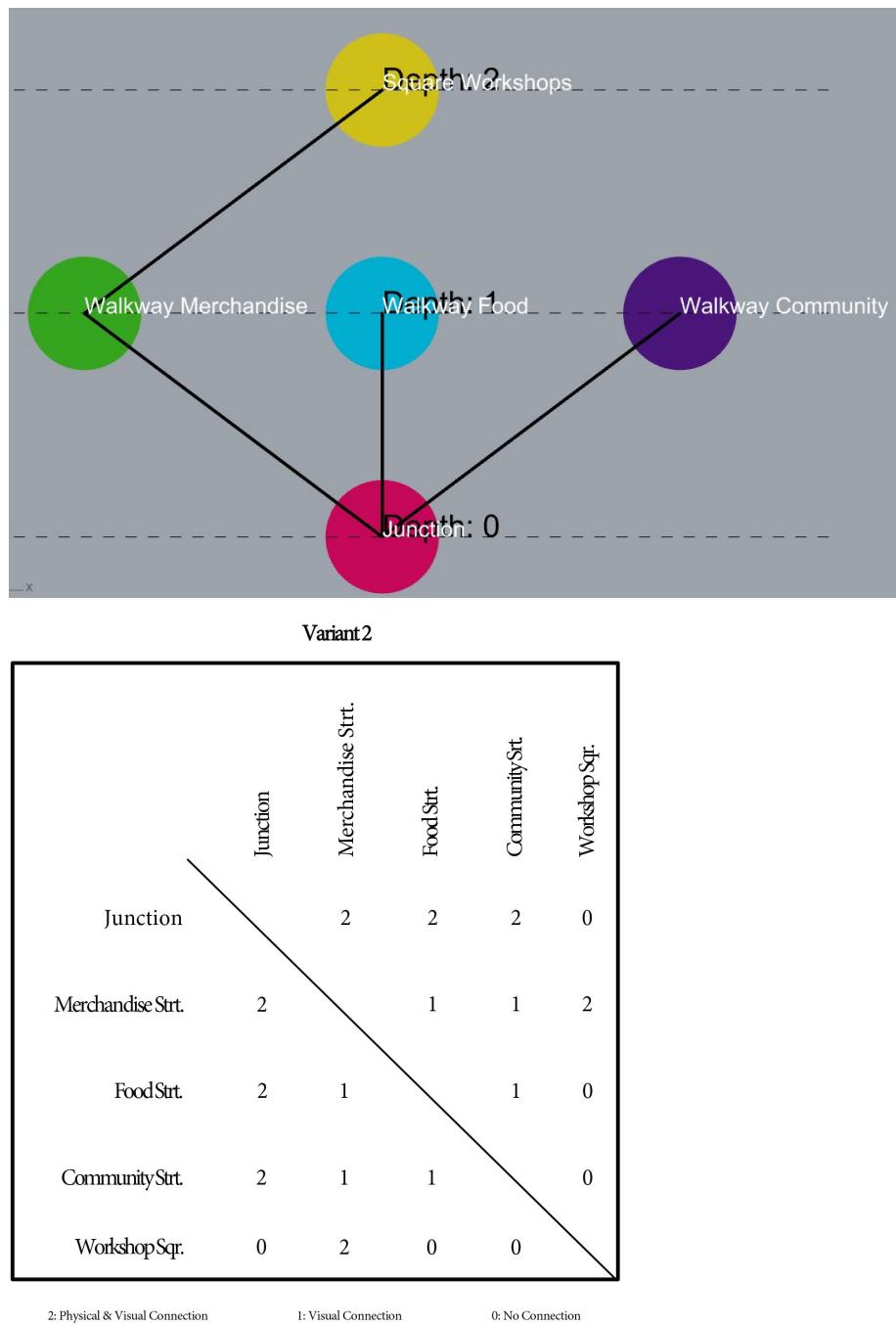
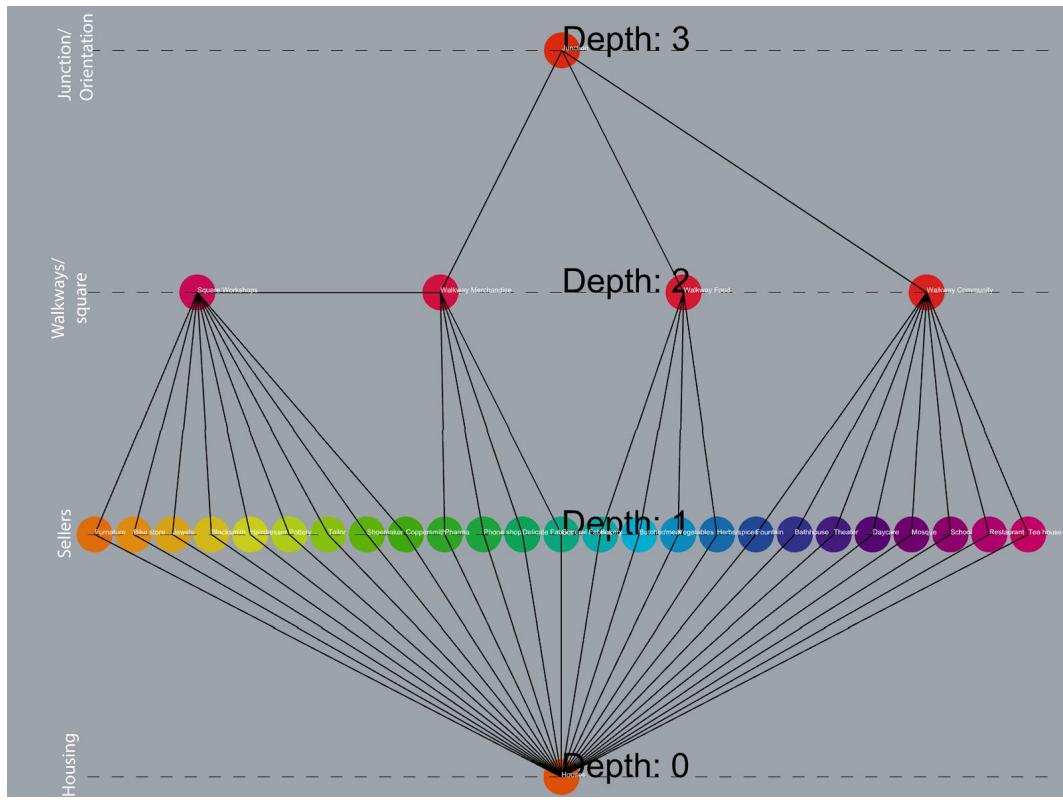


Figure 7: Bubble diagram & REL chart advanced

Variant 3: Relationship logistic and functions within bazaar (detailed)

In this version, the users can move from the junction to the cluster streets where the related shops are orientated. To keep a social controlled area, housing is oriented near the bazaar with possible access to it, figure 8.



Variant 3

	Houses	Furniture	Bike store	Jewels	Blacksmith	Hairdresser	Pottery	Tailor	Shoemaker	Coppersmith	Pharmacy	Phonestop	Delicate Fabric	General Fabric	Butcher/Meat	Vegetables	Bakery	Herbs/Spices	Fountain	Bath house	Theatre	Daycare	Mosque	School	Restaurant	Tea shop	Community square	Merchandise strt.	Workshop strt.	Food strt.	Junction				
Houses	•																									0	0	2	0	0					
Furniture	2	•	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0				
Bike store	2	1	•	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0			
Jewels	2	1	1	•	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0		
Blacksmith	2	1	1	1	•	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0		
Hairdresser	2	1	1	1	1	•	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0		
Pottery	2	1	1	1	1	1	•	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0		
Tailor	2	1	1	1	1	1	1	•	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0		
Shoemaker	2	1	1	1	1	1	1	1	•	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0		
Coppersmith	2	1	1	1	1	1	1	1	1	•	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0		
Pharmacy	2	0	0	0	0	0	0	0	0	0	•	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0			
Phonestop	2	0	0	0	0	0	0	0	0	0	1	•	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0			
Delicate Fabric	2	0	0	0	0	0	0	0	0	0	1	1	•	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0			
General Fabric	2	0	0	0	0	0	0	0	0	0	1	1	1	•	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0			
General Fabric	2	0	0	0	0	0	0	0	0	0	1	1	1	1	•	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0			
Butcher/Meat	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	•	1	1	1	0	0	0	0	0	0	0	0	2	0	0			
Vegetables	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	•	1	1	0	0	0	0	0	0	0	0	2	0	0			
Bakery	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	•	1	0	0	0	0	0	0	0	0	0	2	0	0			
Herbs/Spices	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	•	0	0	0	0	0	0	0	0	0	0	2	0	0			
Fountain	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	•	1	1	1	1	1	1	1	0	0	0	0	0	0	0		
Bath house	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	•	1	1	1	1	1	1	0	0	0	0	0	0	0		
Theatre	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	•	1	1	1	1	1	0	0	0	0	0	0	0		
Daycare	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	•	1	1	1	1	0	0	0	0	0	0	0		
Mosque	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	•	1	1	1	1	0	0	0	0	0	0		
School	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	•	1	1	1	1	0	0	0	0	0	0	
Restaurant	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	•	1	1	1	0	0	0	0	0	0	
Tea shop	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	•	0	0	0	0	0	0	0	0	0
Community square	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	•	1	1	1	1	1	1		
Merchandise strt.	1	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	2			
Workshop strt.	1	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	2		
Food strt.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	2	
Junction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	•		

2: Physical & Visual Connection

1: Visual Connection

0: No Connection

Figure 8: Bubble diagram & REL chart detail.

Shop Variant 1 (Workshop)

The workshops refers to the spaces inside the bazaar in which people from the refugee camp will produce different goods and offer services.

In this configuration the workshops consist of a working space (workshop / factory) and an exhibition space. The exhibition spaces will be open spaces arranged on the sides of the walkway followed by the workshops which will be enclosed spaces which could also provide storage space for the goods displayed on the exhibition spaces in the closing hours. The workshop space ranges between a minimum of 10 m² up to above 20 m².

House containers could be attached to the workshop spaces on the outer part of the bazaar, providing the possibility to the owners of the different workshops to be directly connected to their working space, figure 9.

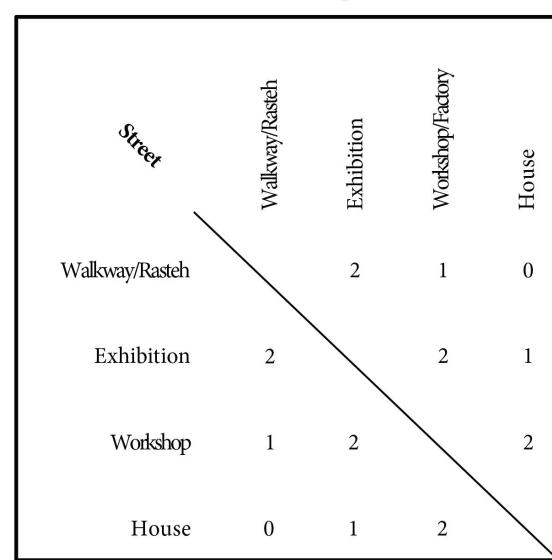
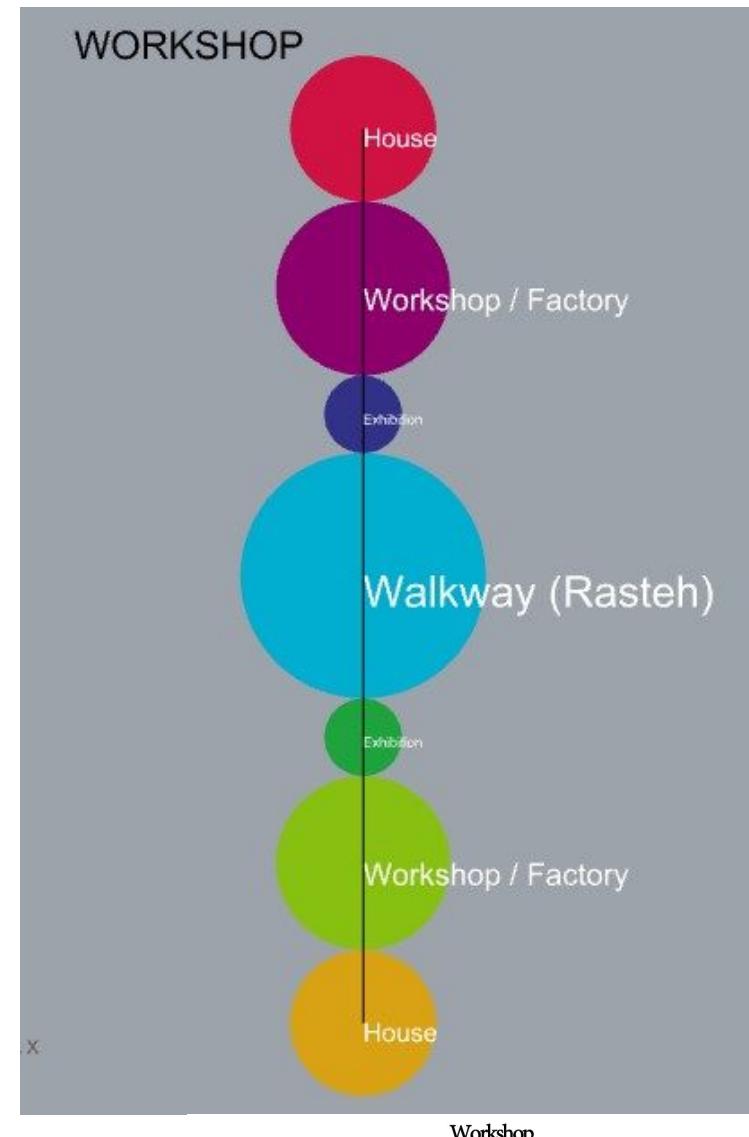


Figure 9: Bubble diagram & REL chart workshop

Shop Variant 2 (Merchandise)

This variant refers to a cluster of functions related to selling goods like pharmacies, general fabric stores, phone stores, etc.

In this configuration the shops consist of a main shop in which different goods will be sold and several services provided (like phone repairs or haircuts among other services), and exhibition spaces which will be extensions of the main shops, with direct connection to people coming from the walkway. In this case people have access to both the main shop and the exhibition area. The shops will have areas ranging from 10 m² to 20m². In this case the houses could also be attached to the different shops from the outer part of the bazaar, figure 10.

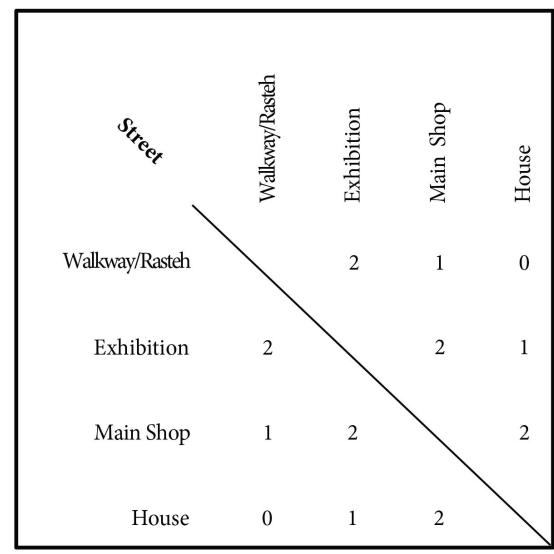


Figure 10: Bubble diagram & REL chart Merchandise

Shop Variant 3 (Community)

This variant refers to a cluster of functions related to meeting activities like restaurants, cafes, tea shops, etc. In this configuration the exhibition spaces disappear to leave room for chairs and tables for people to meet and/or eat. The working spaces refer to the places in which the food is prepared and these spaces require small areas therefore they decrease in size giving away more room to the sitting space, figure 11.

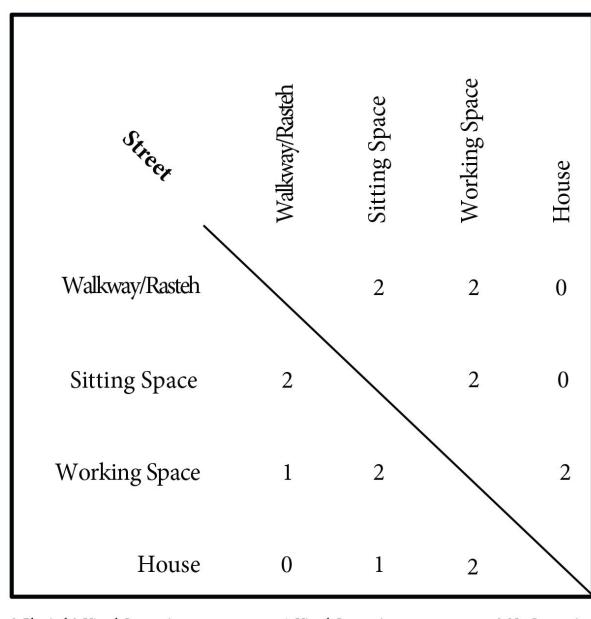
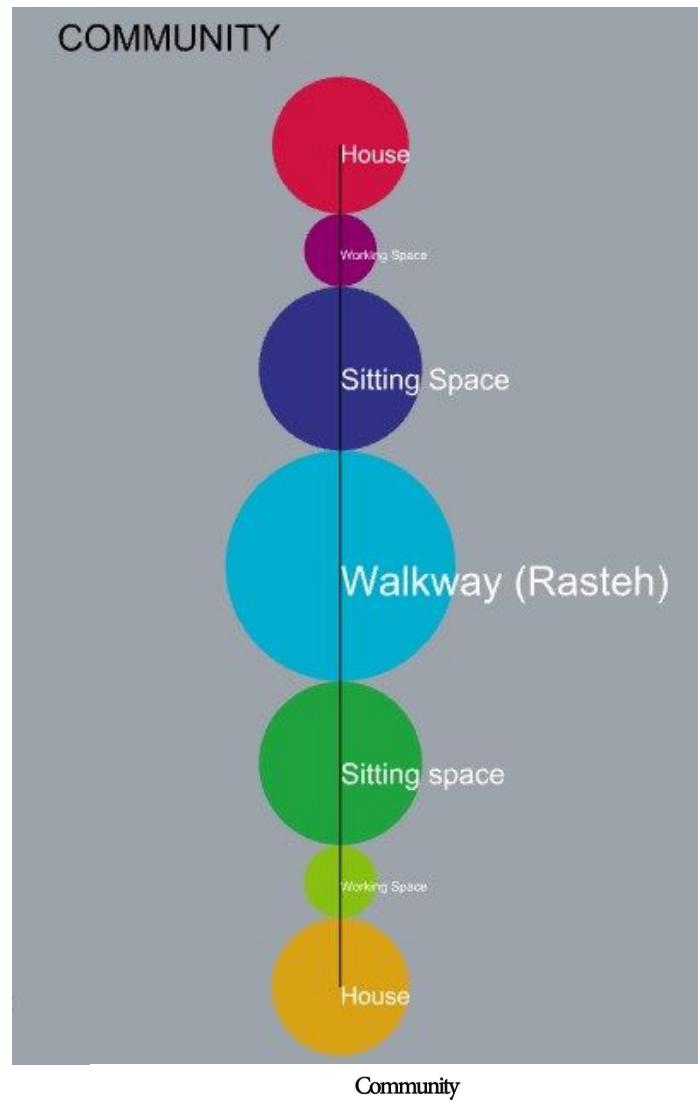


Figure 11: Bubble diagram & REL chart Community

4 Flowchart general

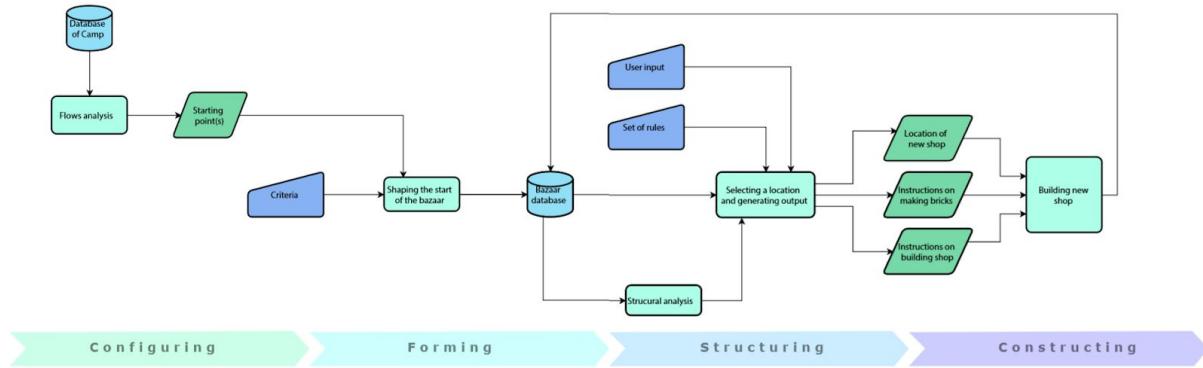


Figure 12: General Flowchart

This flowchart describes the overall design workflow (figure 12), from the task currently at hand, configuring, through forming and structuring of the bazaar and finally constructing it. At this moment, the focus is to find the starting point(s) of the bazaar by analysing the flows in the camp through use of the database available (e.g. the streets, houses, attractor points, demographic information). Once the starting point is decided through the output of the flow analysis and a group discussion, the team can move on by shaping the start of the bazaar. This is important because the initial start of the bazaar should be in line with the vision we have in mind for the bazaar and also it should be attractive for the zaatari refugees. After this, two processes should be going parallel. The first one is the process of structuring the bazaar by doing structural analysis. Meanwhile, the app/program as described in the “Design goals” section, should be developed within grasshopper and python. This app/program will let the user input certain requirements like area and noise production and together with the structural analysis, the database of the current bazaar and a set of rules made by us the app/program will provide the user with the following documents:

1. A precise description of where to build the new shop
2. A manual on how to make the bricks and other building materials
3. A manual on how to make the shop and how to connect it to the current structure

After this, the user can build the shop him or herself and once the shop is finished, it will be added to the database of the current bazaar. Then when a new customer decides to build a new shop and use the app/program to get a location and building manuals, the app/program will now take the original bazaar plus any additions to it into account.

5 Where to locate the Bazaar

This part will describe where the location will be placed within the zaatari refugee camp.

for finding a location we focussed on a methodological approach. If a bazaar showcases to be an effective measure against certain problems in Refugee camps it allows to apply the same method to other refugee camps. The data that we used to get to a location is satellite information, demographic information and logistical information map (often available of refugee camps to help aid). For the search of the optimal location the flowchart underneath was created (figure 13).

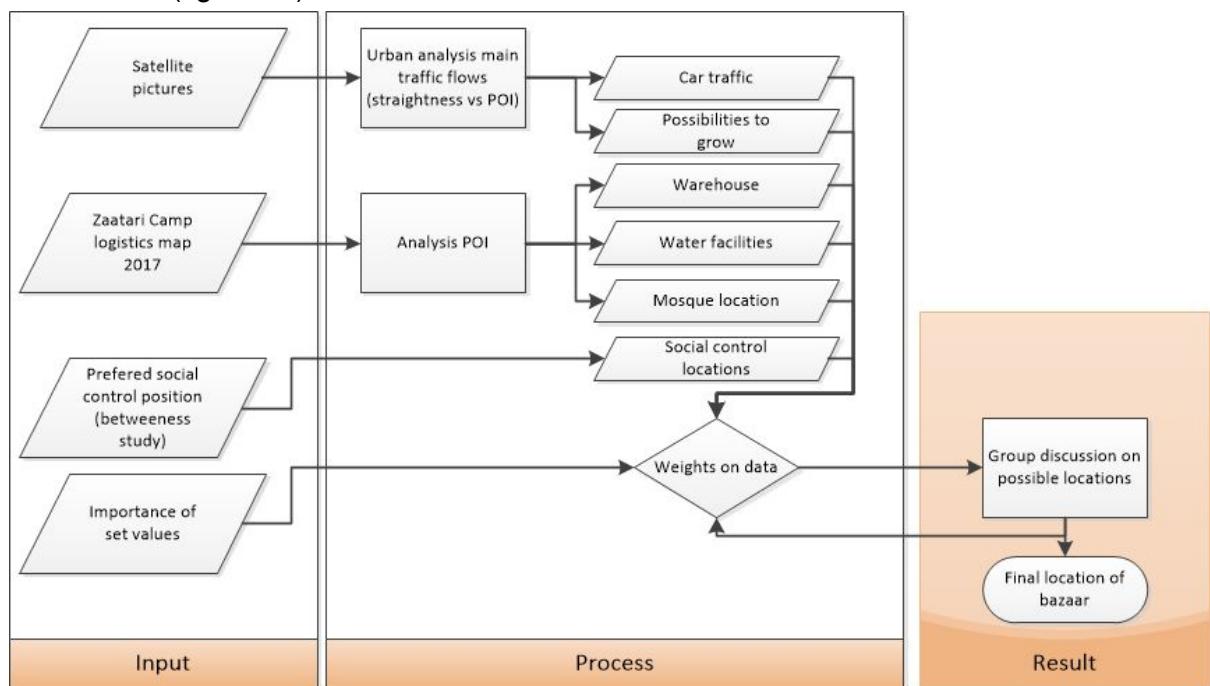


Figure 13: Flowchart, of main design locations of the bazaar.

Satellite pictures are used to estimate car traffic and possibilities to grow for the bazaar. Therefore we needed points of interest within the camp. We mapped these out in figure 14.

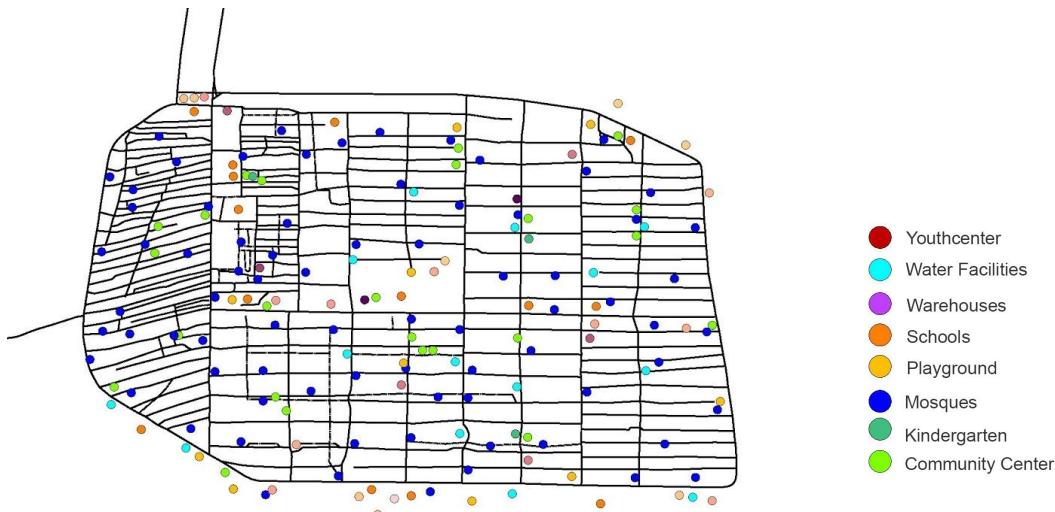


figure 14: points of interest, Zaatari refugee camp

As crime is a major issue within refugee camps we focussed on the application of graph theory to make sure there is social control within the bazaar. Further depth on this study is provided in chapter 5.1.

5.1 Preventing crime by social control

Urban Research: graph theory to prevent crime

Crime is a problem in Za'atari. Informal power structures of organized crime, and semi-formal power structures of street leaders parallel the formal UNHCR system since 2013. Many street leaders are not against the use of exploitation, violence and theft to keep their position. Smuggling, theft, violence sexual- and gender-based violence, and armed-forces recruiting have been observed in Za'atari (Ledwith, 2014).

When looking at crime bazaars might form a risk, Criminological research suggests that the location of where crimes happen are far from random (Weisburd, 2012). While bazaars might reduce the crime issues partly as it might create a wider sense of community, - which voluntarily limit the populations propensity to commit deviant acts (social control theory). The risk of theft happening within a bazaar is higher than the occurrence of theft on someone's private property. Social control needs to be guaranteed.

Social control is the control of the behavior of individuals and groups by society. Social control ensures that people adapt to behavior that is expected of them in the group. Behavior in groups is determined by social norms.

When creating a bazaar, clustering of functions might result in timeframes without social control. To guarantee the maximum amount of social control a study is done in daily movements within refugee camps based on population and expected destinations within daily routines. In graph theory, betweenness centrality studies are used. This is a measure of centrality in a graph based on shortest paths.

Betweenness study

To find the best location of our bazaar (focussing on social security) we studied daily pedestrian traffic that is likely to happen. Hereby we used the roads as network edges. We calculated expected trips between Origins (households) and Destinations (e.g. Mosques, water facilities, schools), using a betweenness centrality study. This is mathematically defined as follows:

$$\text{Betweenness}[i]^{r,dr} = \sum_{j,k \in G - \{i\}, d[j,k] \leq r \cdot dr} \frac{n_{j,k}[i]}{n_{j,k}} \cdot W[j] \cdot \frac{1}{e^{\beta \cdot d[j,k]}}$$

Multiple variables can be defined while doing an betweenness study. When looking at our chosen variables the search radius, was always the closest distance to a poi, the detour ratio was based on surveys of pedestrian flow which state that people usually take a 10 to 20% maximum variation of the shortest route.

5.2 Results

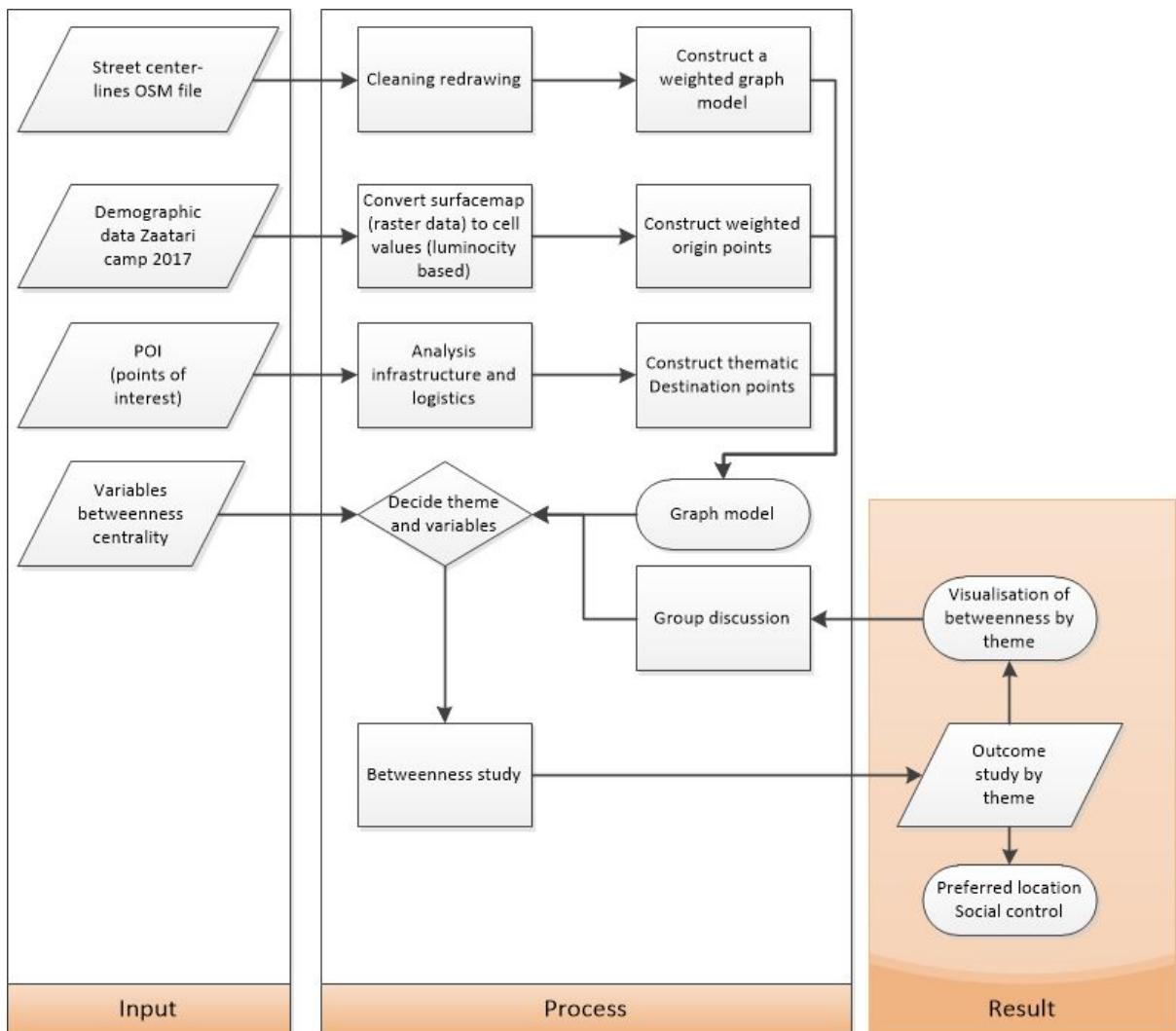


figure 15: Street intensity study

Figure 15 summarizes the final study of pedestrian flows within the zaatari camp. Hereby, we imported the street network from online street maps. Following this, we mapped to total population to the surface and connected these to the networks. This allowed them to travel to POI. (showcased in figure 14). Eventually, we weighed the results of the betweenness studies resulting in the image (figure 16) below.

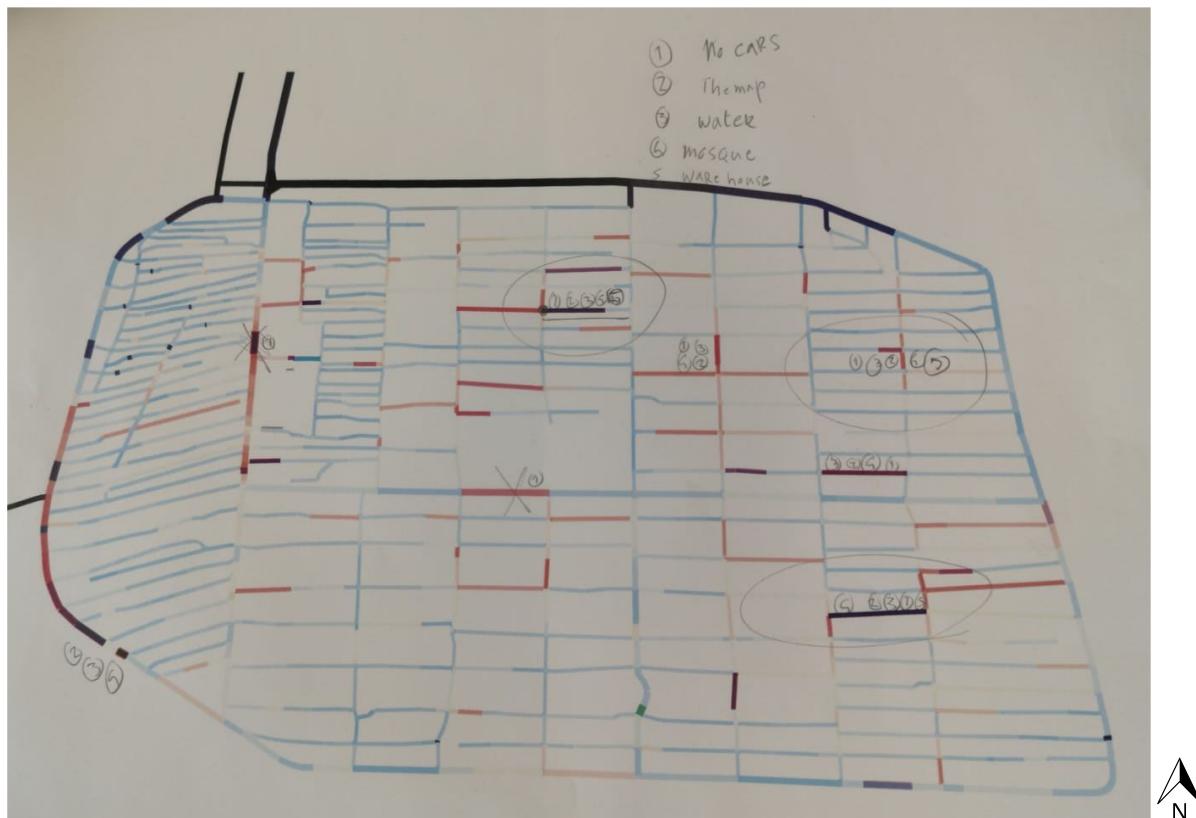


figure 16: Decision drawing where to design an example bazaar.

A darker road in figure 16 means that this road is used more intensively. These intensively used roads are a good place to start a bazaar. The most intensively used roads are checked with the rules of our masterplan. 1. No cars 2. High pedestrian density (the map) 3. Access to water 4. Within 100m of a mosque 5. Within 250m from a logistic point. The streets with a circle around it are the streets that meet all the requirements. As a group we decided to start our bazaar at the most left circle because these is one of the streets which is most intensively used and closest to the most dense district (the district in the west are more dense than the district in the east).

6 First Design Sketches

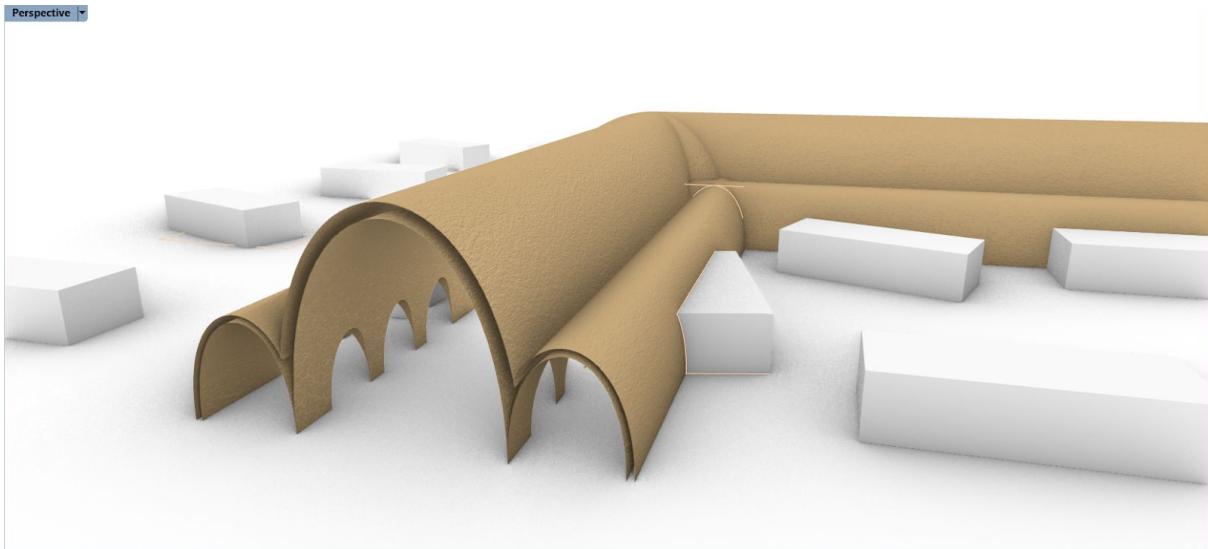


Figure 17: Visualisation of bazaar with a lower roof at the junction

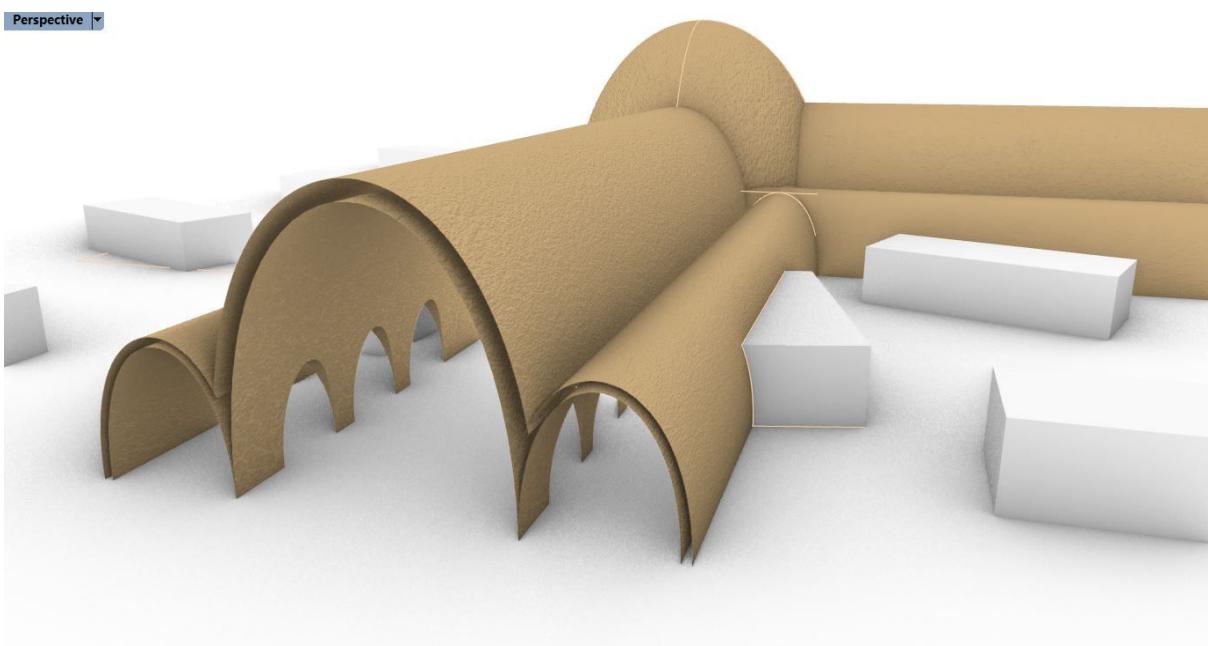


Figure 18.: Visualisation of bazaar with a higher roof at the junction.

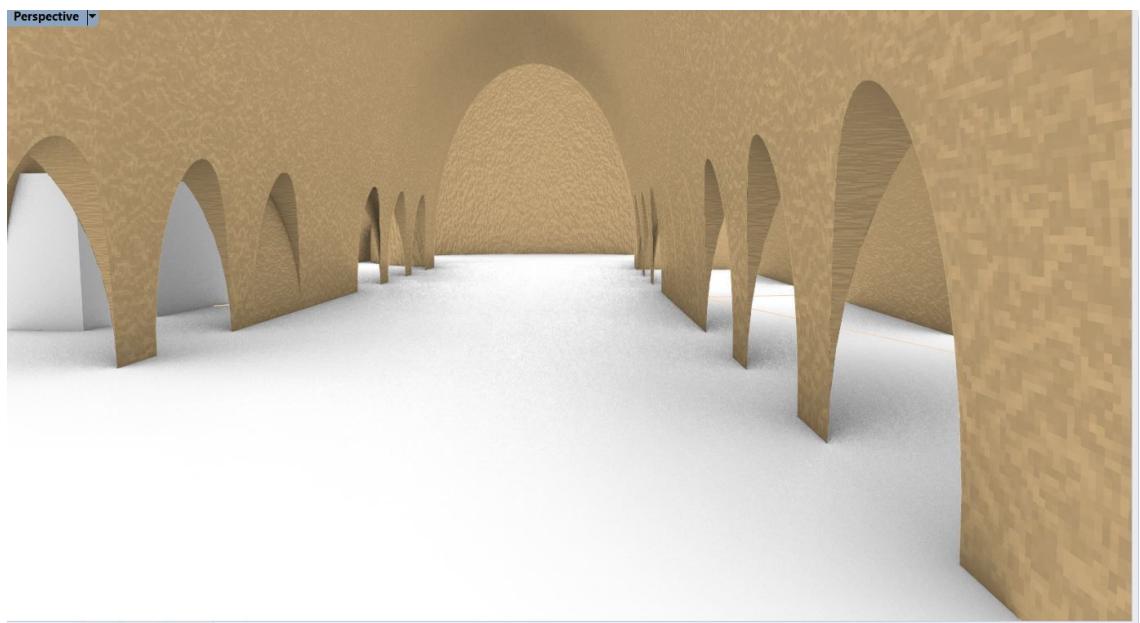


Figure 19: Visualisation of the inside structure

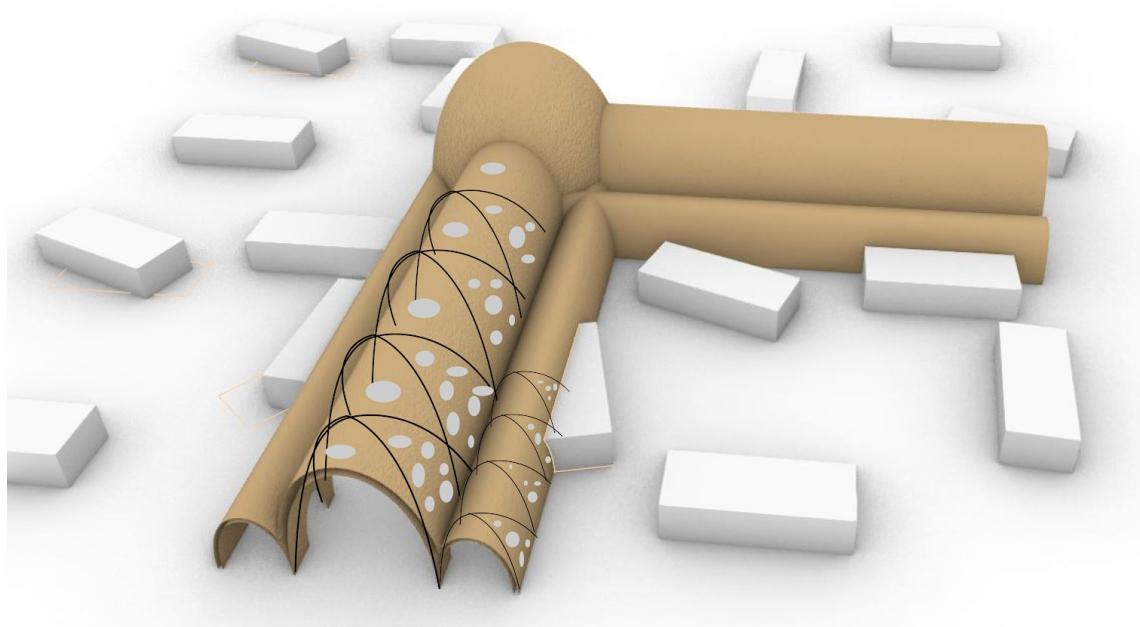


Figure 30: Placement study of possible locations for light.

Reference

Picture front page: <https://origiran.com/vakil-bazaar-shiraz/>

Ledwith, Alison. 2014. Zaatar: The Instant City. Boston, MA: Affordable Housing Institute.

Weisburd, D., Groff, E. R., & Yang, S. M. (2012). The criminology of place: Street segments and our understanding of the crime problem. Oxford University Press.

Appendices

Appendix A: Research function bazaar

Appendix B:

Appendix A: Research style and function

bazaar

Part of research is quoted from the sources! Still for further research.

Iranian/ Persian architecture

-Dates back from 5.000BC

Geometry

Iranian architecture makes use of abundant symbolic geometry, using pure forms such as circles and squares, and plans are based on often symmetrical layouts featuring rectangular courtyards and halls. (wiki)

From the book; Persian Architecture

Architecture and structures are rarely separated. They are usually built or meant to be viewed in relation to each other (book Persian architecture). Bazaars were built and maintained by the government, by public-spirited donors, or by the merchants themselves. The handsomest bazaar of all was the Qaysariya of Isfahan, built by Shah Abbas I at the beginning of the seventeenth century. It had a monumental portal that opens on the great maydan, faced with handsome mosaic faience (When an architectural surface is entirely covered by a pattern arrangement of small pieces of tile which have surface glazes of different colors)

Pisé: moddeld mud.

Openings, arches and associated elements (PDF traditional Syrian architecture)

Openings, Arches and Associated Elements In general, openings are divided into two groups: the first consists of doors and windows, the second consists of arches. In general, the openings in traditional architecture are small on the external facade and larger on the inner facade, looking onto the courtyard; this architectural style is environmentally healthy and takes privacy into consideration; an essential factor in eastern architecture. The openings in mud architecture are limited to doors and small windows, the largest of which is 1.2 x 0.9 m. Very small openings range from 20 to 40 cm wide and are 40cm high; these are only used for ventilation. The lintel used in mud architecture is usually straight, though some arched lintels can be found in the villages around Damascus: these are made with a one-piece wooden lintel crossing the width of the opening.



Openings:

Stone buildings: the borders of these openings are either straight, curved or pointed.

Arches

Arches are frequently used in urban architecture and are widely used in the architecture of important buildings and religious structures. They are found in the entrances and passages of these buildings, and are used in houses on a smaller scale, mostly in the iwan. Arches were used in rural

stone architecture, especially in the architecture of southern area and the Damascus area, to shorten



spans.

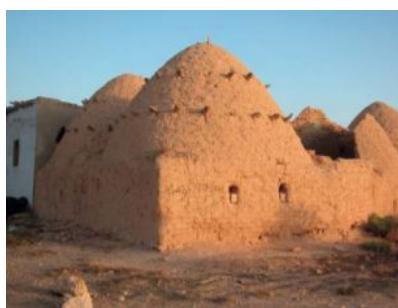
Vaults

Roofing using vaults is an old way of covering large halls, crossing areas and passages; no matter how long they are, as can be observed in traditional souks. There are two types of vaults in traditional architecture: 1- Barrel Vaults: also known as half cylindrical vaults. 2- Cross Vaults: consist of two consecutive crossing and orthographic vaults. Stone is the main material used in building vaults; both types of vaults have the same building principle.



Mud Cupolas

Mud cupolas are used in covering spaces of mud construction. They are found in the countryside of the northern areas of Syria. Mud is the main building material used in this type of architecture and it is also used in rendering and binding.



Stone Cupolas

Architects used cupolas as a substitute for the flat roof. Stone cupolas were considered one of the most important architectural features used in roofing: it covers the main spaces in mosques, churches, baths and some great houses. They were used in all Syrian cities and in some villages that used stone for building. These cupolas take on different shapes: semi spherical, onion shaped or ribbed; they can also be an egg shape, depending on the dimensions of the space and the ratio of its length to its width.



Isfahan Bazaar

A spatial structural analysis of the Isfahan bazaar and its transformation through time shows that it has a linear structure, and many of its spatial elements are formed around the central axis. Among all the main buildings around the bazaar, the Atiq mosque and Naghshe Jahan square are the more important places at the beginning and end of the bazaar axis.

The primary elements of the bazaar are the “**Dokkan**” (shop), “**Hojreh**” (small shop), “**Rasteh**” (bazaar street), “**Tim**”, “**Timcheh**”, “**Qaysariye**”, “**Chaharsouq**”, “**Saray**”, and “**Caravanserai**”. **The secondary elements** are the “**Madrasah**” (schools), “**Masjid**” (mosques), “**Hammam**” (bathhouse), and “**Assarkhaneh**”. Most of the “**Sarays**” in the bazaar are double-storied so that the second floor has a continuous porch overlooking the courtyard.

Bazaar in the city

The bazaar complex generally includes other buildings, such as the religious Madrasah, educational centers, Saghakhaneh, and mosques. These famous centers in the city are formed around the bazaar axis and complete the bazaar structure.

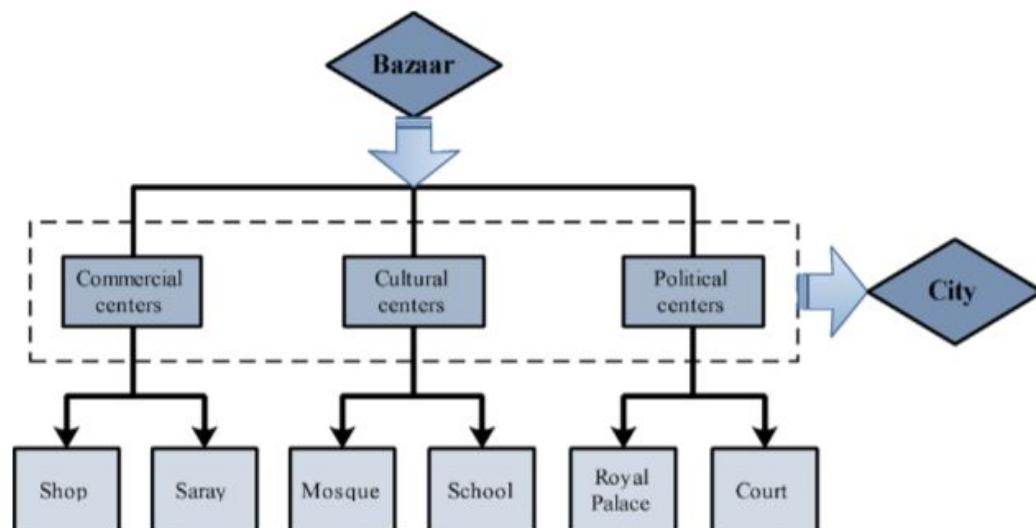
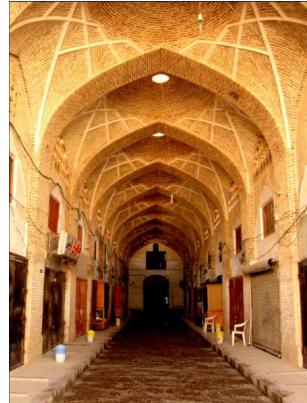


Figure 8 Different functions at the Isfahan bazaar.

Tabriz



Kerman



Isfahan



Isfahan: The floor of the shops are entirely stone-carpeted and the roofs brick-made.

Shiraz



Yazd



Kashan



Shiraz: constructed by brick and gypsum. The bazaars meet at a cross point, high dome-shaped ceiling.

Kashan: With a fantastic mudbrick architecture it's one of the jewels of the city. Roof of mudbrick

Arak (~1800)



Zanjan



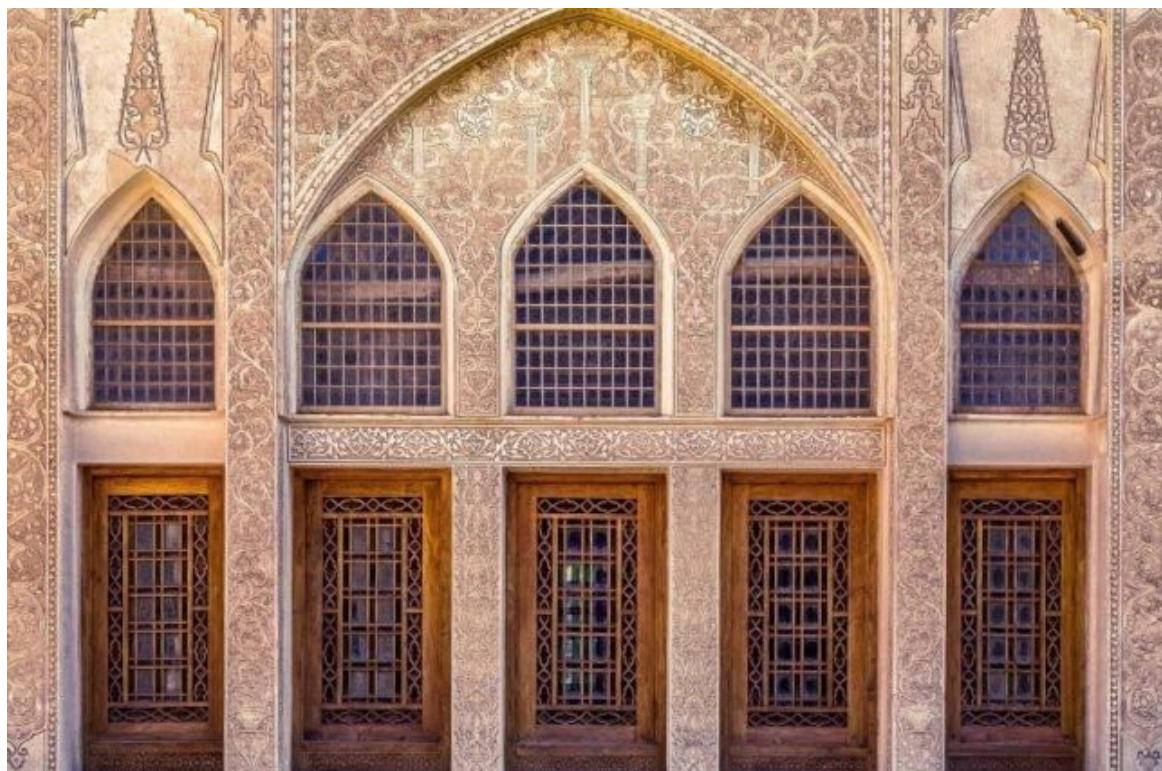
Khoy



Arak: combination of modern and traditional architecture. Has domed arches. Each of the bazaar's domes has a lightwell which provides lighting and air conditioning for the bazaar. Stone, brick and wood have been used in the construction of this bazaar. The bazaar has 500 shops as well as several mosques, bathhouses, schools and traditional water reservoirs.

(<http://www.karavansera.com/bazaar.html>)



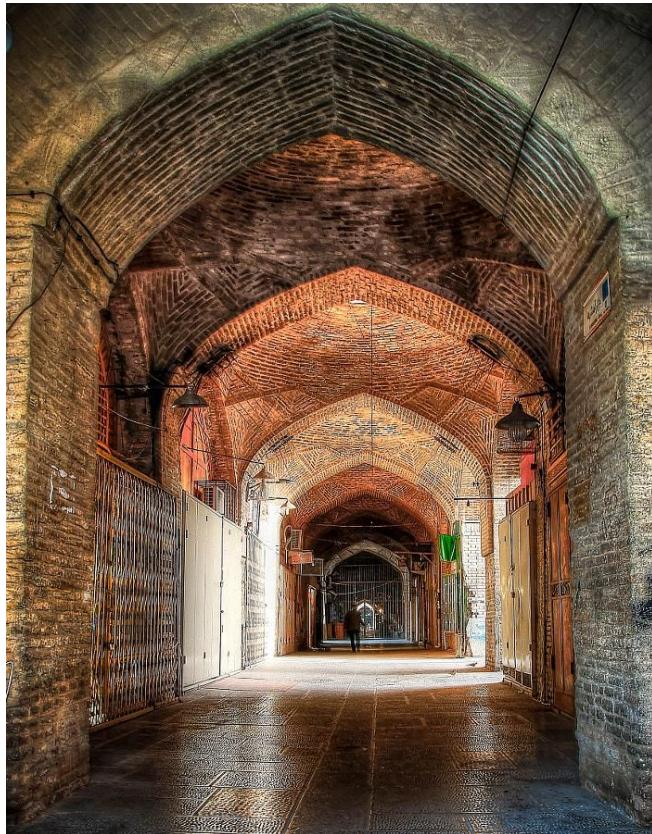




Bazaar of Kashan



Vakil Bazaar



Bazaar Isfahan



Daraa, Syria



Aleppo, Syria

Function:

Key: Bazaar has to be cooler than the outside air for a comfortable meeting and selling location.

Physical characteristics of bazaar

<http://iranatour.com/blog/physical-characteristics-of-bazaar/>

Rasteh: The main element of a bazaar are major and minor rastehs (lanes) stretching from the gateway into the city covering several sections until arrival at the city's main square. There are stores located across both sides a rasteh.

→ Conclusion: (Food) Shops on both sides (sometimes with factory at the back)

Caesarea: It entails certain segments of the bazaar for the sale of precious and delicate goods such as jewelry, silk, etc.

→ Conclusion: Shops on both sides (sometimes with factory at the back)

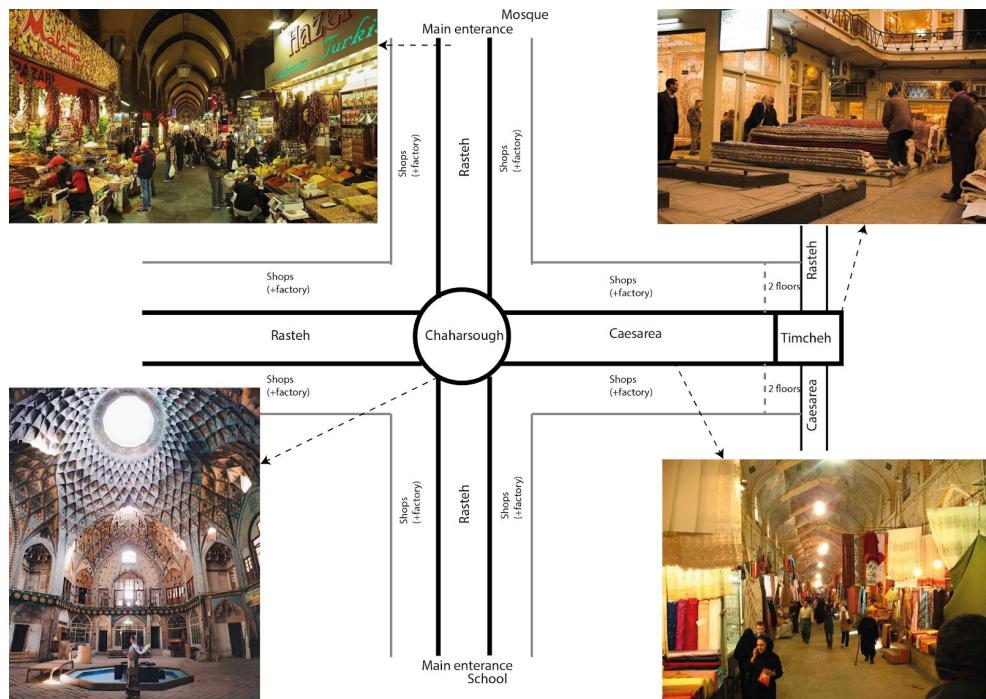
Chaharsough: It is usually the intersection of two main rastehs of the four bazaar, resembling vault ribs. Chaharsoughs were covered with tall domes hosting the daily presence of jarchis, nightly meetings of the sheriff and sometimes punishing the criminals.

→ Conclusion: Junction with water fountain covered by dome, community meeting space

Timcheh: Referring to a small caravansary, it housed indoor spaces for the chambers of tradesmen, usually built in two or three floors. This space was often covered with domes and special decorations. These days it is used for furniture sell and small factories.

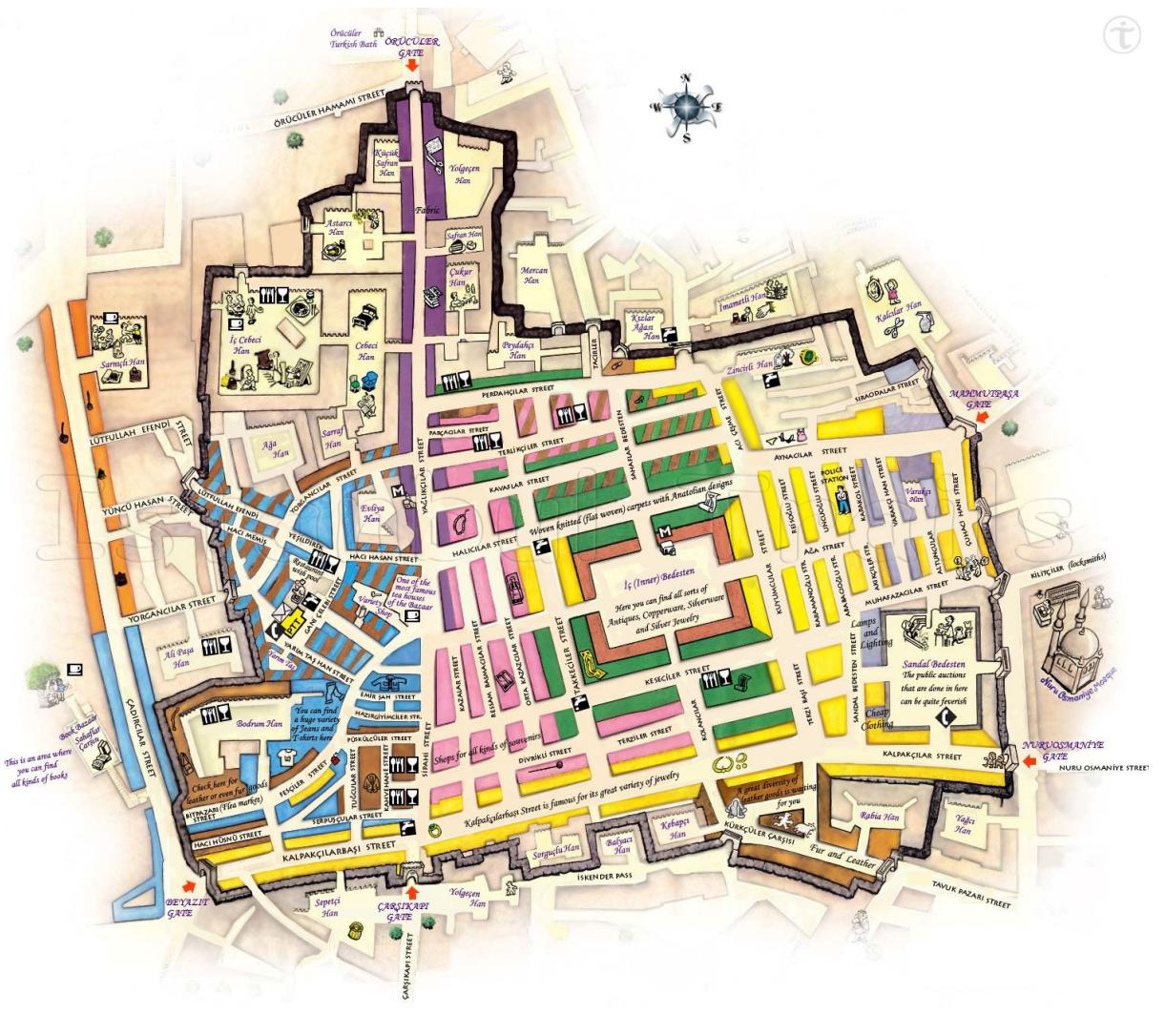
→ Conclusion: Small square special for furniture and carpet sellers. Factory was located on the second floor

E.G.



As a key element of any city, bazaars led to social evolution. Many revolutions and uprisings in Iran took place within bazaar merchants. Even if they did not give rise to uprisings, at least made great efforts to realize them. Governments generally care a lot about this segment of society and its demands were fulfilled, since it contributed to the economic pulse of the nation. Merchants in many cases forced the rulers to retreat from their positions.

E.G. Map of the grand bazaar istanbul:

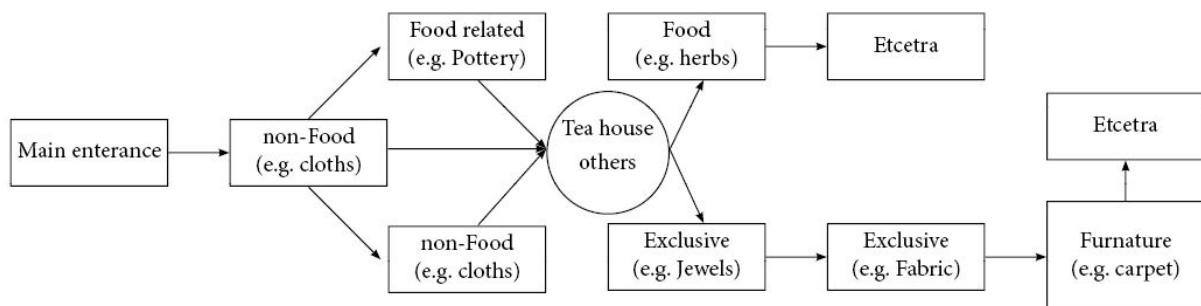


Program in and around the bazaar:

- Open 24/7
- Main entrance at a mosque
- Around the entrance pop-up shops appear (season)
- Junction/ square (Chaharsough)
 - Shops & manufacturers
 - Jewellers & pottery
 - Furniture & Carpets
 - Leather & Clothes
 - Tea & Herbs
 - Food
 - Restaurant
 - Food
 - Tea house (community space)
 - Toilet facility & Faucets (small fountain)

Main guide line of program in a bazaar:

- Chaharsough (junction):
 - Water points/ faucets
 - Community place
 - tea houses/ restaurants
 - events
- Rasteh (road):
 - Typology of sell are together
 - Near the entrance is non-food
 - More inside the bazaar food will be sold due to temperature difference
- Rasteh/ Caesarea (road):
 - Fabric/ silk are orientated near the carpet/ furniture
 - Jewels and pottery are orientated near the fabric/silk
- Timcheh (small square mostly multi level):
 - Furniture/ carpets
 - Big objects are sold



Appendix B: Building Techniques & Material Study

Part of research is quoted from the source! Still for further research.

Vocabulary

- Loam: a fertile soil of clay and sand containing humus.
- Humus: the organic component of soil, formed by the decomposition of leaves and other plant material by soil microorganisms.
- Clods of earth: Lumps of earth
- Making Earth a Building Material

Methods

- Placing earth-clouds into water so that they become plastic and easy to work with. They should be placed into large flat containers with the layer of earth between 15 to 25 cm high and then covered with water. Then after 2 to 4 days a soft mass is obtained which can be easily moulded by hand, machine, etc.
- The mixture can be prepared in different ways, it can be mixed by using the feet, using animals to step on the mixture, using a hoe or using machines.

http://www.earth-auroville.com/maintenance/uploaded_pics/cseb.pdf

The soil, raw or stabilized is slightly moistened, put into press and then compressed either with a manual or motorized press. It can be compressed in many different shapes and sizes.

Example: the Auram press 3000 (16 types of blocks).

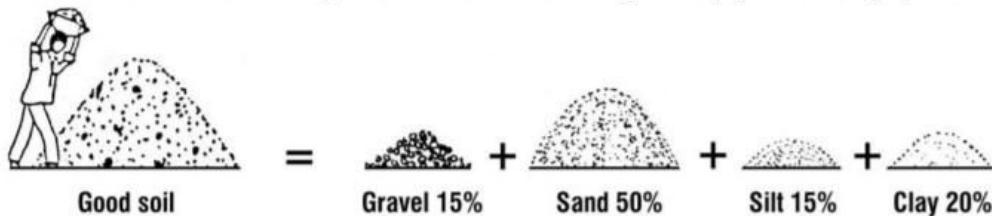
Stabilization provides better strength and water resistance.

Cement stabilization, the blocks must be cured for four weeks after manufacturing. After this, they can dry freely and be used like common bricks with a soil cement stabilized mortar.

Soil

Topsoil and organic soils must not be used.

A soil is an earth concrete and a good soil for CSEB is more sandy than clayey. It has these proportions:



According to the percentage of these 4 components, a soil with more gravel will be called gravelly, another one with more, sand, sandy, others silty or clayey, etc. The aim of the field tests is to identify in which of these four categories the soil is. From the simple classification it will be easy to know what to do with this soil.

Soil Identification (Points to Examine)

- Grain size distribution, to know quantity of each grain size
- Plasticity characteristics, to know the quality and properties of the binders (clays and silts)
- Compressibility, to know the optimum moisture content, which will require the minimum of compaction energy for the maximum density
- Cohesion, to know how the binders bind the inert grains
- Humus content, to know if they are organic materials which might disturb the mix

Soil Stabilization (*1)

Commonly used: Cement and lime. Resins or natural products can be used

Selection of stabilizers depends on type soil quality and requirements of project.

Cement: preferably for sandy soil and achieve strength fast

Lime: for clayey soil, but takes time to harden, will give strong blocks

The average stabilizer proportion is rather low:

	Minimum	Average	Maximum
Cement stabilisation	3 %	5 %	No technical maximum
Lime stabilisation	2 %	6 %	10%

These low percentages are part of the cost effectiveness of CSEB.

BASIC DATA ON CSEB

Dry compressive strength at 28days (+10% after 1 year + 20% after 2 years)	4 to 6 Mpa = 40 to 60 Kg/cm ²
Wet compressive strength at 28 days (after 3 days immersion)	2 to 3 Mpa = 20 to 30 Kg /cm ²
Dry bending strength (at 28 days)	0.5 to 1 Mpa = 5 to 10 Kg /cm ²
Dry shear strength (at 28 days)	0.4 to 0.6 Mpa = 4 to 6 Kg /cm ²
Water absorption at 28 days (after 3 days immersion)	8 to 12% (by weight)
Apparent bulk density	1700 to 2000 Kg/m ³
Energy consumption (Ref. Development Alternatives 1998) (To be compared with kiln fired bricks (wire cut) = 539 MJ and country fired bricks = 1657 MJ	110 MJ

ADVANTAGES OF CSEB

■ A local material

Ideally, the production is made on the site itself or in the nearby area. Thus, it will save the transportation, fuel, time and money.

■ A bio-degradable material

Well-designed CSEB houses can withstand, with a minimum of maintenance, heavy rains, snowfall or frost without being damaged. The strength and durability has been proven since half a century.

But let's imagine a building fallen down and that a jungle grows on it: the bio-chemicals contained in the humus of the topsoil will destroy the soil cement mix in 10 or 20 years... And CSEB will come back to our Mother Earth!

■ Limiting deforestation

Firewood is not needed to produce CSEB. It will save the forests, which are being depleted quickly in the world, due to short view developments and the mismanagement of resources.

■ Management of resources

Each quarry should be planned for various utilisations: water harvesting pond, wastewater treatment, reservoirs, landscaping, etc. It is crucial to be aware of this point: very profitable if well managed ... disastrous if unplanned!

■ Energy efficiency and eco friendliness

Requiring only a little stabilizer the energy consumption in a m³ can be from 5 to 15 times less than a m³ of fired bricks. The pollution emission will also be 2.4 to 7.8 times less than fired bricks.

■ Cost efficiency

Produced locally, with a natural resource and semi skilled labour, almost without transport, it will be definitely cost effective! More or less according to each context and to ones knowledge!

■ An adapted material

Being produced locally it is easily adapted to the various needs: technical, social, cultural habits.

■ A transferable technology

It is a simple technology requiring semi skills, easy to get. Simple villagers will be able to learn how to do it in few weeks. Efficient training centre will transfer the technology in a week time.

■ A job creation opportunity

CSEB allow unskilled and unemployed people to learn a skill, get a job and rise in the social values.

■ Market opportunity

According to the local context (materials, labour, equipment, etc.) the final price will vary, but in most of the cases it will be cheaper than fired bricks.

■ Reducing imports

Produced locally by semi skilled people, no need import from far away expensive materials or transport over long distances heavy and costly building materials.

■ Flexible production scale

Equipment for CSEB is available from manual to motorized tools ranging from village to semi industry scale. The selection of the equipment is crucial, but once

done properly, it will be easy to use the most adapted equipment for each case.

■ Social acceptance

Demonstrated, since long, CSEB can adapt itself to various needs: from poor income to well off people or governments. Its quality, regularity and style allow a wide range of final house products.

To facilitate this acceptation, banish from your language "stabilized mud blocks", for speaking of CSEB as the latter reports R & D done for half a century when mud blocks referred, in the mind of most people, as poor building material.

SOME LIMITATIONS OF CSEB

- Proper soil identification is required or lack of soil.
- Unawareness of the need to manage resources.
- Ignorance of the basics for production & use.
- Wide spans, high & long building are difficult to do.
- Low technical performances compared to concrete.
- Untrained teams producing bad quality products.

- Over-stabilization through fear or ignorance, implying outrageous costs.
- Under-stabilization resulting in low quality products.
- Bad quality or un-adapted production equipment.
- Low social acceptance due to counter examples (By unskilled people, or bad soil & equipment).

(*1) Organic Waste & Bricks

53 % Organic waste, 12.85 % plastic waste, 10.22 % textile waste, 9 % cardboard waste

-Solid Waste Composition Analysis & Recycling Evaluation: Zaatri Syrian Refugees Camp, Jordan

<https://www.youtube.com/watch?v=drG-LXxZLZ8>

ecomaquinas.com.br

-organic waste in bricks, also a plant for creating such bricks?

12.85 % plastic waste

By Fusion process: a technology to recycle plastic waste: Replast blocks for construction?

<https://www.youtube.com/watch?v=xaxrixBFAic>

<https://ea-hr.org/zaatari-classroom/>

<http://www.masteremergencyresilience.com/>

<https://issuu.com/3xnarchitects/docs/intheinterim> : To be checked