MASTER

Densification in Za’atari
from camp to city

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Densification in Za’atari
from camp to city

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Public building for refugees

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Eindhoven, 25th of January, 2017
“These are the cities of tomorrow [...] the average stay today in a camp is 17 years. That’s a generation.” Kilian Kleinschmidt
ACKNOWLEDGEMENTS

With this writing, I put the finishing touches on my thesis. It was a period where I learned a lot about architecture as the scientific field, but also on a personal level. I would like to reflect on the people who recently have supported me tremendously and helped.

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Mustafa Anbar
ABSTRACT

Refugee camps like the scale of Za‘atari are becoming more and more (in) formally densified. The hardening and densification between private and public in the camp structure, as well as the lack of regulations, the poorly insulated tents, caravans & cabinets that are also uncomfortable, weather-/ noise sensitive with a limited lifespan, affects the refugees that are living in there for years. Many therefore rolling up their sleeves and renovate-, expand or build their house that is becoming a sprawling makeshift camp. These development are also noticed in Za‘atari, threatening to become an urban wilderness.

The Multi-layered urban space project is a different approach towards densification. The research question to this end is as follows: “How can refugee camps be densified that provide longer-term solutions, solving the existing problems and manifests participatory design?”

This project aims to become a reference point for the development of a new type of architecture in refugee camps, and respecting the existing fabric. By designing a modular, adaptable, multi-layered building that anticipates on the future needs and changes in the refugee camp. The variable and flexible private and public spaces coming together, merge and change simultaneously throughout the years. There are four housing typologies. These are one person apartment, family-, two story apartment and luxurious. The two typologies of public spaces, are active recreation for sport and leisure, and activity area for MOOC lectures, theatre and events where self-development can be fulfilled.

The research question is answered through literature review, morphological-and historical analysis of fourteen camps, case studies and trips to Greece, Calais, Duinkerke and the AZC in Eindhoven.

Future research could be undertaken to calculate the exact costs of the housing unit. This includes the steel structure. Building with EPS reduces supporting structure dramatically, ranging from 40 to 100% what was noticed from ten example projects in Holland. Another research topic would be the further development and prototyping of the magnifying lens facade and water purification panel. These passive techniques, working on sunlight are interesting because of the fuel savings. It is interesting for the refugees, involved parties such as NGO’s and governments.
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1 Background
ground
1.1 INTRODUCTION

Nowadays over 65 million people have fled their homes due to war, conflict, prosecution and climate changes. 40.8 million people were forced to flee their homes but remained in their countries border. 21.3 million refugees worldwide counted by UNHCR. 3.2 million were waiting for an asylum application.[1] These staggering numbers create tensions on many levels. Accommodating and housing are an example that is under pressure. Various solutions have developed worldwide. Hosting countries (un)desirably creating shelter and camps in (un)suitable areas. Primarily focused on the short term and providing primary needs.

The graduation studio Public Buildings for Refugees aims to develop by designing and prototyping design solutions for public buildings, primarily focusing on the long term needs such as public and community facilities. The vision of short-term accommodation has evolved to an average 17 year as stated by UNHCR.[1] This suggests both success and failure for UNHCR. It is based on letting the refugees survive by providing basic care. So housing refugees, providing, food, water and healthcare is not sufficient anymore.[2] Providing adequate community facilities, public space and public buildings to empower self-development for themselves and the community.

“Education is the best weapon through which we can fight poverty, ignorance and terrorism.” Malala Yousafza
1.2 PROBLEM STATEMENT

Refugee camps like the scale of Za’atari are becoming more and more (in) formally densified. The hardening and densification between private and public in the camp structure, as well as the lack of regulations, the poorly insulated tents, caravans & cabinets that are also uncomfortable, weather-/ noise sensitive with a limited lifespan, affects the refugees that are living in there for years. Many therefore rolling up their sleeves and renovate-, expand or build their house that is becoming a sprawling makeshift camp. These development are also noticed in Za’atari, threatening to become an urban wilderness. Inadequacies in current policy are due to:

1. Lack of development planning, and urban planning
2. Lack of action dealing with poor environmental and social conditions existing in the areas
3. External pressure from outside on the involved parties.

Durability and sustainability of existing structures is also an issue.

![Existing Housing Structures]

Light Weight Emergency Tent
Floor area: 16.5 m²
Life span: 3 – 6 months

Family tent
Floor area: 23.5 m²
Life span: 1 year

Container / Caravan
Floor area: 11 m²
Life span: 5 years

Better Shelter
Floor area: 11 m²
Life span: 3 years

Fig 1: existing housing structures
1.3 GENERAL AIMS

The main focus group is the lost generation. To be more specific, between 17 to 30 years of which 16.9% are men and 16.1% are women.[3] Refugees in this group are often underrepresented. They are mainly in college or have recently finished it. They are young, educated, full of energy and want to dedicate themselves in society. Everything has come to a standstill once inside refugee the camps. Knowledge, skills, and talent are not used, and it simply dries up. The design intervention will focus on strengthening ties, education, self-development, and transition. In other words, aiming at the highest level of Maslow’s theory. This will be achieved by designing and providing the tools and solutions. These are dynamic and public functions and include;

- (municipal) reception and information points,
- NGO’s commodity distribution centre,
- place- and workshops,
- active recreation where people can play various sports games and other leisure activities,
- Massive Open Online Courses (MOOC) meeting areas and workplaces,
- activity space with a big screen for public events such as MOOC lectures, theatre, cinema and other events,
- exhibition area to demonstrate the created works from the MOOC or workshops,
- leisure areas under canopied structures,
- commercial zones with restaurants and shops,
- UN women centre for various illness, disease and sickness treatments. And finally;
- decent housing. There are four typologies, knowing one person apartment, family-, two story apartment and luxurious apartment.

By designing a site for the long term, refugees could leave their camp in a better state than they entered it, facilitating their move to a durable solution.

1.4 QUESTIONS

The main question for the project is:

HOW CAN REFUGEE CAMPS BE DENSIFIED THAT PROVIDE LONGER-TERM SOLUTIONS, SOLVING THE EXISTING PROBLEMS AND MANIFESTS PARTICIPATORY DESIGN?

The sub questions to answer the main question are:

1. HOW CAN THE MULTI-LAYERED TENT ANTICIPATE FUTURE NEEDS/CHANGES IN REFUGEE CAMPS?
   By answering the question, knowledge is gained about in what ways displacement relates to future needs and changes.

The question clarified:
- Analysing existing camps where urban developments have failed. Also what the characteristics, strengths and weaknesses are to prevent and learn lessons from it.
- Investigating how density could improve the quality of life in refugee camps.

The outcome is used to set the scope for the design and proposing interventions. The research method used here is literature review, morphological-, and historical analysis.
2. **HOW CAN THE INDIVIDUAL RECONCILABILITY OF THE LOST GENERATION CONTRIBUTE TO A BETTER LIVING EXPERIENCE?**

The question clarified:
- Investigating ambitious functions such as the new university, super smart refugee camp, silicon valley conception.
- Investigating the age groups with the biggest problems and anticipating on it. Such as making a statistical analysis of the biggest target group.
- Investigating the transition (design- as programmatic) of the multi-layered housing.

The project will come up with conclusions that could be applied elsewhere in Za’atari and other refugee camps with the same conditions. The outcome is used to set the scope for the design and proposing interventions. The research method used here is literature review, case studies and site visit.

3. **WHAT ELEMENTS OF THE INTERVENTION WHAT IS NEEDED TO MAKE OPTIMAL CHOICES, ALSO ABOUT OTHER VALUES, WHICH CAN BE IMPLEMENTED EFFICIENTLY?**

- Investigate not only on school programs but also on how free time is spent and what they could do.
- Investigating solutions for self-development.
1.5 PROJECT BOUNDARIES AND CONDITIONS

Researching and developing the following points:

- Dynamic target groups, from 17 to 30 years
- Dynamic functions
- Life span
- Sustainability (also locally)
- Modularity
- Adaptability
- Engineering (materials, construction, construction method, construction speed, detail)
- DIY system
- Technical feasibility
“Health and comfort are influenced by buildings and environmental factors, indoors and outdoors. Key is the assessment and control of the effect of the combination of environmental parameters (thermal, acoustical, lighting and air quality) on people and the built environment, in order to turn the negative effect around into a positive experience. Diseases and disorders related to indoor exposure have increased.”

TU Delft - Health & Comfort
2 Assignment
2.1 WOCHENAUFGABES

The wochenaufgaben were interesting assignments. Particularly the first wochenaufgabe functioned as a common thread through my graduation studio.

Wochenaufgabe 1: Recharge yourself

CONCEPT & DESIGN
Recharge yourself is a service point that offers a helping hand on existing problems such as clean drinking water, cooking and making a fire in refugee camps, trips, and survival situations. The service point has the following types of façade: 1. Magnifying lens façade, 2. Solar cooker and 3. Food façade. Each façade has the dimension 2*2.5m and is mounted on a railing system for easy shifting towards the sun.

CONTEXT
The service point will be placed in the middle of nowhere. It can be in the desert or natural landscape. This should be the place to recharge yourself during your trip, camping or survival situation.

CONSIDERATIONS
If the building is taken away either deliberately or by weathering, it still remains its value. The concrete core can continue to operate by itself. This is possible by the two solar panels on the core. The generated electricity is stored inside on 7 12V batteries. Locals and visitors can connect and use their light devices on it such as a cooler, cell phone, spotlight, fan etc. There is also an inverter, which converts the generated electricity to 230V. People here can use the sockets for their laptop and other electric devices. The stored electricity ensures that the core can be used at night as well.

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1. Floor, concrete core & interior. Inside the core: cash machine, 12V batteries, inverter.

Outside the core: washbasin, watertank, wifi network, sockets

2. Wooden base construction & facade panels:
   - Shading panel
   - Magnifying lens panel
   - Solar cooker panel
   - Food panel

3. Railing system for facade panels

4. Roof shading panels dim. 2*4*0.15m

5. Two solar panels on concrete core

Fig 4: exploded axonometric

Fig 5: model

Fig 6: 3d impression
Wochenaufgabe 2: BinAir

The second wochenaufgabe focused on the complexity of a rapid execution of a public building combined with the total prefabrication. Asking for an intelligent, low-cost building system. Had to be carried out in groups. Luuk and I teamed whereas Brian later joined.

We came up with the idea of plastic bins that can be clamped together and filled with earth, water, sand, rocks or whatever is available. Besides this main form, there are windows, doors and ventilation elements that can fit in the wall instead of the plastic bins.

After the desired walls are placed the roof can be constructed. The roof structure is build up of castellated beams that will be connected with bolts and nuts. Subsequently, the bins will be inserted after which it will be connected to the roof structure (with the same clamping profiles). A small crane or another lifting device is needed for this operation. There are also window panels in the roof to admit light.

To provide also a certain level of self-sufficiency, the following systems were applied;

- Water purification systems by sunlight. Delivered (dirty) water will be stored in the plastic bins after the purification.
- Magnifying lens panels for cooking with sunlight. Saving on fuel and electricity use.

These systems can be applied as well for SEK (School, Education, Kids) and SEB (Sanitary, Escape, Bath).
The group assignment was followed up by an individual assignment. This time an more organic, waving design was made.

Fig 8: photo model  
Fig 9: 3d render  
Fig 10: detail roof structure with steel truss

When the wochenaufgabe 2 ended, it formed to the Lighthouse project. The concept with the bins was not interesting for me anymore to continue so therefore continued my own path with ideas and passion. In addition, I continued working on the catalogue.
2.2 CATALOGUE: ANALYSING CAMPS

During the graduation studio a catalogue has been produced where also fifteen camps has been analyzed. As part of a team, I’ve analyzed the Roman camp, Auschwitz, Shuafat, Kapise, Za’atari and Dara Shakran. The analysis of each camps can be read in the catalog. In addition, conclusions map were made also of all the fifteen camp on terrain, constraining elements, infrastructure, urban fabric, (with Luuk de Rouw) and SWOT (Strength-Weakness-Opportunities-Threats) analysis that provided me much information on understanding how are set up and work on various aspects. and inspiration for this project. The conclusion maps can be found on the following pages.
Practically flat terrain
Meadow, surrounded by agricultural fields

Regular slope

Practically flat terrain
Meadow, surrounded by agricultural fields

Practically flat terrain

Meadow, surrounded by agricultural fields

Flattened terrain
Between two hills
Higher ground; concentric ditches

Fig 12: terrain
The terrain of the investigated camps can be divided into three categories. The first and most common one is the practically flat terrain. This terrain provides easy expansion and is well suitable for a grid structure.

In Za‘atari’s case, the location coincides with a major well, important for several nearby villages. Inhabitation at such areas offers danger of contamination or well exhaustion which is an risk to the people living there.

The second terrain is most common on camps which are built in a time where there was a huge need for housing refugees. So they took the not so ideal terrain for granted.

The last terrain is in-between the two. In Azraq they positioned the camp on a regular slope. In this case, a grid structure is still possible, but you can use the gravity in your advance in, for example, the sewer.
Constrained by plot ownership, expansion by negotiation.

Due to the lack of organization the camp expands without taking the constraining elements into account.

No constraining elements except a road on one side.

Constraining elements are present at the north side of the camp.

Constrained by a settlement to the east.

Expansion to the south is possible. In the north there is a border control facility.

Constrained by a road.

Constrained between roads, buildings and neighboring plots.

Constrained by municipal order, and highway.

Surrounded by roads and other buildings.

Fig 13: constr. elements
Camps that are planned are mostly positioned on locations where the camp can be easily expanded without interfering with neighbouring plots or obstacles in the form of buildings or nature.

In most of the investigated camps there is a constricting element in the form of a road on one side of the camp. This results in a camp which expands to the opposite side and along these lines not crossing the road.

In unplanned camps there isn't any organization which supervises the boundaries of a camp as seen in Kapise. And in some examples they also expand beyond the constricting elements but this is mostly done by making agreements with the land owner as can be seen in Glastonbury.
Fig 14: infrastructure
The first example is the camp of Auschwitz. The camp is based on systematic grid with a clear order. Further on, the infrastructure pre-dates the construction of the camp's facilities and housing.

The second principle is illustrated by camp Kapise. The camp is build-up organically, the shelters are positioned in between the two existing roads, leaning against the hills. In this case settlement pre-dates the construction of any centralized infrastructure.

The third principle is demonstrated by camp Za’atari, which is located in the desert. The camp is based on the main roads which also define the contours of the camp. The main roads function as a border for the residential plots.
ONCUPINAR
Clear plot distribution with tent shelters (that
include kitchen, sanitation)

ZA'ATARI
Divided into 12 districts for clear organization
and distribution (including 10,000 water
facilities)

DOMIZ
Plots with improved shelter

AZRAQ
Subdivided into multiple villages with own
facilities and services

SUJJO
Plots with improved shelter

GLASTONBURY
Distinctive centralised functions
Water facilities

CAMPING VILLAGE
Divided into 10 districts. Each district has its
own typology and functions

KAPISE
Closeness to the main roads

KARA TEPE
Asphalted road

CALAIS
None

LEGEND
PLOT DEVELOPMENT STRENGTHS
The analysis purposes on; inner- as outside plot
(re)development, (re)organisation, expansion,
opportunities, functions, (inner)fences, housing, roads
and land use.

WATER SANITATION AND HYGIENE STRENGTHS
The analysis purposes on; water supply, shower and
sanitation points

Fig 15: strengths
STRENGTHS

In general, the camps have the following three points that stand out positively:

1. Camps have some level of site organization. Most of the camps that were analyzed characterize themselves into districts and plots placed in a specific grid.

2. Improved shelters make their appearance. Areas with tents are slowly being upgraded with more temporarily shelters and structures.

3. Developed refugee camps have adequate water facilities. It applies particularly to Glastonbury, Za’atari, Oncupinar, Domiz, Azraq and Sujjo.
LEGEND

- PLOT DEVELOPMENT WEAKNESSES
  The analysis purposes on: inner- as outside plot (re)development, (re)organisation, expansion, opportunities, functions, (inner)fences, housing, roads and land use.

- WATER SANITATION AND HYGIENE WEAKNESSES
  The analysis purposes on: water supply, shower and sanitation points

Fig 16: weaknesses
WEAKNESSES

The analyzed camps have the following three weak points that stand out generally:

1. Strategic development of the camps is in general very weak. There are various reasons for this. Think of the constantly changing circumstances influencing each party (from politics to NGO's). Every party has its vision, wishes, needs, etc.
2. Limited and insufficient placement and distribution of water facilities.
3. Communal areas do not occur or are scarce. The “designed” area are very basic, more empty, open space.
**LEGEND**

- **PLOT DEVELOPMENT OPPORTUNITIES**
  The analysis purposes on: inner- as outside plot (re)development, (re)organisation, expansion, opportunities, functions, (inner)fences, housing, roads and land use.

- **WATER SANITATION AND HYGIENE OPPORTUNITIES**
  The analysis purposes on: water supply, shower and sanitation points

- **Fig 17: opportunities**

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**ROMAN**
- Ability to develop and expand into a town, just like Colchester, Chester, Winchester and Manchester in the UK

**Glastonbury**
- Further development area

**Kapise**
- Expansion towards both camps with borders. Reorganisation and redevelopment of space
- More and improved water points and sanitary per plot

**Auschwitz**
- Removing inner fences and area to develop

**Shuafat**
- Improve secondary roads and NGO area with provided services
- More water supply points

**Calais**
- Enough area for further development opportunities
- Improve water supply, shower and sanitation points

**Za'atari**
- More facilities and diversification in business area

**Domiz**
- New, long-term land use and diversification
- More and improved water-, sanitary on site

**Kara Tepe**
- Clear plot development and distribution
- More and improved water points and sanitary per plot

**Azraq**
- New, long-term land use and diversification. Breaking inner fences and creating a public, connecting area

**Slujo**
- Upgrade residential tents to caravans.
- Improve and redevelop market area in the north
- More and improved water-, sanitary on site

**Legend**

- PLOT DEVELOPMENT OPPORTUNITIES
  The analysis purposes on: inner- as outside plot (re)development, (re)organisation, expansion, opportunities, functions, (inner)fences, housing, roads and land use.

- WATER SANITATION AND HYGIENE OPPORTUNITIES
  The analysis purposes on: water supply, shower and sanitation points
OPPORTUNITIES

The temporary, either permanent character of the camps offer the following opportunities:

1. More long-term facilities and diversification in housing, health, sanitation, services, security, work, education, opportunities, public spaces and so on.
2. Improve secondary roads.
3. Sustainable interventions in its widest sense of the word. Camps are more than providing safety, shelter, water and food.
Fig 18: threats

ROMAN
- Threats from outside

AUSCHWITZ
- Gas and crematorium rooms outside the camp, creating escape routes
- Health risks due limited sanitation and hygiene

SHUAFAT
- Insulated from environment by 4m high concrete barrier
- Health risks due limited water supply and high density

GLASTONBURY
- Vulnerability to recession and business cycle
- Dealing with the huge amount of human waste

KAPISE
- Danger of traffic accidents because being close to the main roads
- Health risks due limited sanitation, water and high density

Camping village
- Vulnerability to recession and business cycle
- Health risks due limited sanitation and high density

CALAIS
- Continued plot development and camp expansion with high density
- Flooding

ZA'ATARI
- Large area complicates the security of the camp
- Flooding

DOMIZ
- Long distance to facilities and humanitarian services
- Tension due unfair and long distance of water facilities

DARA SHAKRAN
- Lack of privacy due to high density
- Health risks due limited sanitation, water and high density

KARA TEPE
- Many catastrophic issues on situation, living, security, sanitary- and hygiene conditions
- Health risks due limited sanitation, water and high density

LEGEND
- PLOT DEVELOPMENT THREATS
  The analysis purposes on; inner- as outside plot (re)development, (re)organisation, expansion, opportunities, functions, (inner)fences, housing, roads and land use.
- WATER SANITATION AND HYGIENE THREATS
  The threat analysis purposes on; water supply, shower and sanitation points
THREATS

Camps are ceaselessly under danger. This is mostly a rule rather than the exception. The following points can be concluded:

1. High density is causing tension, health-, sanitary and hygiene issues.
2. High vulnerability due to limited privacy and high pressure.
3. Too dependent on NGO’s and other parties. This has negative effect on the self reliance.
Fig 19: urban fabric
The basic layout of refugee camps can be traced back to the Roman Military Camp in general. The structures partitioned in strokes and placed on the principle framework. Two entrances are crossing each other in the center which is an open space. This open space is in front of the main service buildings. After that, the buildings are placed hierarchically from the center to the borders. So the most important services (like the organization and managing board etc.) are located in around this center. Important for this camp is the repetition of the grid each time. Mainly formal and disciplined camps are primarily to these principles. In this kind of camps, there is always good security.

Za’atari is comparable with the Roman camp within its urban texture. The streets determine the structure. The shelters came after the infrastructure. However, the size and density of this camp create complexity. This camp is build up in a very short time and was intended to be temporary. Also, the tents are placed randomly, which creates the density of the blocks.

Shuafat is a former refugee camp that evolved into a city. This city has a little more diversity in its grid due to its uncontrolled growth over the years. The central open space has moved to the outer corner. The rest of the camp has become a densified area full of building structures. After some experiences, different camps arose that are designed more appropriate. This design looks similar to a fragment of a city with several villages. Azraq Refugee Camp is, for example, an upgrade of the Za’atari Refugee Camp. The villages are separated from each other, and every village has its services. In comparison with Za’atari, the planning and building process took longer. Although, the principles of the camp are quite the same, with the main “market” street in the middle of the camp.
2.3 THREE CASE STUDIES

ARDOCH ROMAN FORT - PERTHSHIRE - SCOTLAND

Although this is a fortress and not a camp it is important to mention this. Many IDP-, refugee camps have derived their design from the fortress principle. The Ardoch Roman was built in the late 70s AD. It was built in the Roman conquest of Britannia, under the lead of Emperor Claudius. The Ardoch fort was important due to its a key strategic route towards the North of Scotland. It was one of the six marching camps was built. This fort and Roman forts, in general, have been constructed for marching into hostile territory. An additional earthwork protected the forts. Each dugout ditch was 1-2 meters wide.

The Roman fort was according to a firm and regular plan. It was separated into two unequal divisions (known as principalis).[4] Each entrance was a gate. The camp was intended to accommodate a consular army. It therefore mainly houses tents for the soldier and generals. Only necessary facilities were set such as market, services, hospital, storage and friendly spaces. Many of temporary Roman encampments developed into cities. Examples are Colchester, Winchester, Manchester, and Chester. In contrast to Ardoch, this did not happen. Nowadays only the earthworks remained visible.

Fig 20: aerial photo  
Fig 21: the surviving ramparts  
Fig 22: the surviving ramparts

Fig 23: Roman fort

SHUAFAT REFUGEE CAMP - WEST BANK - ISRAEL/PALASTINE

The Shuafat refugee camp was built in the West Bank in 1965 by Palestinian refugees.[5] It started with 450 housing units. It is the only Palestinian refugee camp in Jerusalem. Nowadays it has developed into a slum housing over 80,000 refugees. Due to its demographic location, lots of tension and issues are occurring from both the Israeli and Palestinian side. The camp and refugees are under Israeli control and authority.

Only one NGO is permitted to work inside the camp, that is the United Nations Relief and Works Agency for Palestine Refugees (UNRWA). Health services is provided by Israel inside the camp. Water is a big issue. It is pilfered from the Israeli water system, but due to a disagreement between Israel and UNRWA over who should pay to provide it, the supply is periodically cut off by Israel.[6] Residents then go search for new tap points into the infrastructure.

The camp nowadays has evolved to an overcrowded and improvised slum. Self illegally constructed housing has developed to apartments of up to eight stories.


BURJ EL BARAJNEH REFUGEE CAMP - PALESTINE
The camp was established in 1949 by the League Federation of Red Cross and Red Crescent Societies (IFRC) to accommodate Palestine refugees from the Lake Huleh area of northern Palestine. URWA began providing services for the refugees in 1950. Due clashes between the Lebanese Armed Forces and Islamic extremists groups, the camp got pulverized by 95% due bombardments and massive fights. Nowadays around 27,000 refugees are living in the camp. The Government of Lebanon and involved parties decided recently to rebuild the camp.

The reconstruction team set goals before designing and reconstructing the camp. These were:
- The rebuilding of residential and non-residential units in the same neighbourhood pattern as before, with common area improvements and infrastructure.
- Improving existing homes.
- Improving and increasing open public spaces.
- Rehousing the refugees that lived in the camp before its demolition.
- Rebuilding the UNRWA buildings and services.

Two main goals of the redesign of the camp included:
1. increasing public space from 15% to 37%.
2. Including the community to produce a local product. The redesign is not temporary but a permanent one.

Fig 28: The camp in 1950’s
Fig 29: The camp in 2006
Fig 30: Photo after the destruction
Fig 31: Photo after the rebuilding.
However, the camp has returned to it’s previous, informal makeshift habitat. Nowadays it looks the same again as figure 29.
cation
Altitude 1.000 km
Altitude 110 km
3.1 PHOTO’S LOCATION

Photo’s of the location were taken on friday morning 13th of january 2017. Friday and saturday are weekends, therefore it looks deserted. View 2 and 9 were retaken on tuesday afternoon 17th of january 2017.

Fig 32: marking view 1, 2, 3

Fig 33: view 1
Fig 34: view 2

Fig 35: view 3
Fig 36: marking view 4, 5, 6

Fig 37: view 4
Fig 38: view 5

Fig 39: view 6
Fig 40: marking view 7, 8, 9

Fig 41: view 7
3.2 ZA’ATARI’S FACILITIES MAP

Fig 44: map of Za’atari, scale 1:10.000
3.2 ZA’ATARI’S FACILITIES MAP

- GSEducationalVersion
- 95,03 m²
- Water facilities
- Child friendly space
- Registration
- Security
- Distribution points
- Warehouse
- NGO office
- Education
- Playground/Recreation
- Mosque
- Community
- Youth center
- Services
- Parking
- Under construction
- Temporary
- Kitchen
- Entrance

Fig 44: map of Za’atari, scale 1:10,000
3.3 NGO’S IN ZA’ATARI

REGISTRATION
CAMP MANAGEMENT
COORDINATION
PROTECTION
CHILD PROTECTION
SHELTER
WATER & SANITATION
CORE RELIEF ITEMS
NUTRITION
FOOD SECURITY
HEALTH
MENTAL HEALTH & PSYCHOSOCIAL SUPPORT
REPRODUCTIVE HEALTH
GENDER BASED VIOLENCE
COMMUNITY SERVICES
EDUCATION

Fig 45: map of
3.4 WEATHER

MAFRAQ CLIMATE & TEMPERATURE

Mafraq’s altitude is on 686 meters and is situated near the subtropical desert scrub biome. Meaning it’s climate is very dry and where a low amount of species can be found.\[7\] The climate variables are retrieved from climatemps.com.

- Av. maximum temperature is August with 33°C, yearly average is 24°C.
- Av. temperature is in August with 25°C, yearly average is 17°C.
- Av. minimum temperature is in January with 2°C, yearly average is 9°C.
- Highest rainfall in mm is in January with 36mm, annual is 150mm.
- The dryest periods are in June, July, August and September.
- Av. daylight hours / day is in June with 14.15 hours, yearly average is 12 hours.
- Av. sunlight hours / day is in July with 12.45 hours, yearly average is 9.3 hours.

Fig 46: graph monthly temperature

Fig 47: graph monthly rain

Fig 48: graph monthly day/sunlight hours per day
3.5 ZA’ATARI IN NUMBERS

Numbers retrieved from UNHCR’s information sharing portal on www.data.unhcr.org

80,000  Syrians
461,000  refugees passed it since 2012
531  hectares
17,000  caravans
8,000  tents
79%  from the Daraa province
3,100  shops
57%  are youth (<17 year)
20%  are <5 year
360  water trucks delivery per day
$500,000  to run camp per day
1,500  jobs, mainly NGO’s
120  mosques
3  hospitals
320  children born per month
9  schools
500,000  pitas distributed per day
16,130  worth of electricity used per day
3.6 STRUCTURES IN ZA’ATARI

There are primary eight type of structures used in Za’atari. They include shelter typologies, offices, clinics, ad hoc additions, and storage areas. They have little relevance to local building typologies. Therefore occupants often combine or adjust their homes to better deal with the climate of the region. A better solution would be to look at the architecture of the region to discern a better initial shelter. For example, mud walls which are often found in the areas as they act as thermal conductors during the day, and insulate at night.[8]

Fig 49: Campstructures in Za’atari.

Within the Zaatari camp setting, there are three primary forms of individual shelter. The model unit, the tent, and the concrete block wall. When a family arrives at the camp, they have distributed either the unit or the tent. On average six people are living in one unit. As the occupants live there longer, they will begin adding the structure by either creating additional rooms out of concrete walls or combining units with other family units to form familiar complexes.[8]


Fig 50: Shelter forms in Za’atari.
Proposal
1. Location

The urban fragment is located on the corner towards the market street and crossroad. The size is approximately 10,500m². What also makes this site interesting is that it is embedded between the UN women area and NGO’s. A block type housing is placed diagonally. It generates two district spaces that interact with the environment. On the city-side, a rectangle and L-shaped volume are placed, matching the camps “urban” tissue. These two buildings function as a deepened shopping street towards the existing market street and the public area on the building site.
2. Slicing the building block

Openings are made for walkways, facilitating the relationship with the surrounding context.
The north facade has an opening to the NGO’s where a new, safe & green corridor is created that also reliefs the busy market street.
There are two types of public spaces;
1. active recreation (sport & leisure) inside the building block and
2. activity area (MOOC lectures, theatre, events) outside the building block.

Every upper floor is already accessible by the stairs. This is needed for preparatory work such as deposition of the fencing and steel structures to build apartments.
3. Programming

Public functions are programmed on the ground floor. These are recreational spaces, NGO’s, UN women centre, storage, information point, public spaces, a workshop, and parking. Existing programs has been enhanced such as commercial activities and NGO’s. Much needed functions such as public spaces, workshop, activity- and recreation area have been added for refugees to come together to relax, sport, get informed, communicate and educate.

Fig 51: one person apartment of 50m2
4. Formal densification

Housing starts on the first floor. By stacking the units under a 30° angle, a zigzagging shape occurs for privacy and sun shading. The layer above is not placed directly on it but an offset of one meter. This creates a dynamically shaped building that also improves the resident’s privacy and sun shading below. Due to the building method, residents can easily build, expand or downsize their housing which is very sustainable. There are four housing typologies; from one person unit to luxurious multiple apartments.

Fig 52: family apartment of 100m2
5. Future densification

Depending on time, scale and the situation in the Middle East, Zaatari will densify whereas horizontal expansion is not possible anymore. By multi-layering, the building can anticipate future needs and changes in the refugee camp or city. It can go up to 6 stories high. A shade sail is used as roofing.

Fig 53: family apartment of 100m2, vertical
Fig 54: luxurious apartment of 150m²
4.2 SUSTAINABLE MEASUREMENTS

SELECTIVE ENERGY MANAGEMENT
The climate in Za’atari is suitable to use the solar radiation. A passive facade has been adopted towards the restaurants. These are a water purification & cooking system on solar radiation. Next to it a magnifying lens panel on solar radiation for cooking is made as well. Throughout the day, the restaurants can cook their meals for free and save on gas and electricity.

Fig 55: (left) water purification system and (right) magnifying lens panel

DAYLIGHT AND ARTIFICIAL LIGHT
A lot of attention is spent on the daylight design. Especially on the orientation and configuration of the building, the optimization of the size, the shape and location of the window, the type of glazing and passive solar protection. Each housing typology has its daylight configuration. Overexposure by daylight has been minimized by shifting the story above a meter to front and to left. This creates a passive shading device preventing overexposure by sun during the day.
NATURAL VENTILATION
The use of buoyancy (or the “chimney effect”) and the wind is used for the benefit of the natural ventilation. Besides aerodynamics, issues such as acoustics and fire safety have also taken into account.

ATRIUM
Inside the building block is a 6,000m³ atrium. Functioning as a public space for active recreation. Central is the multifunctional sporting field where 11 sports can be played. Around the playing field is a podium continuing on each floor. A shading sail is placed on the roof that is ventilated naturally through the edges. The semi-transparent material prevents UV radiation by 80% and daylight by 50%.
4.3 STRUCTURAL ASPECTS

One thing that was certain at the beginning of this concept was the choice of materialisation; EPS. It is an interesting building material with great benefits. It outperforms almost all the qualities of existing, known traditional materials. EPS has great protecting, structural and insulating properties. Furthermore it is lightweight, easy adjustable, stable, reusable and many more. It is a particularly cheap material to build with.

The availability and supply of EPS 110SE is widely present in Jordan. More than 11 companies have been found in Za’atari’s province Mafraq and in Amman, that is one hour away.

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Table 1: comparison table of five building materials

Building with EPS reduces supporting structure dramatically, ranging from 40 to 100% what was noticed from ten example projects in Holland. Steel will be used for supporting structure because of its dimensional stability and IFD building concept that reflects this project.
5.1 PLANS, GROUND FLOOR

scale 1:500
Plans, second floor

scale 1:500
Plans, third floor

scale 1:500
5.2 VIEWS AND SECTIONS

scale 1:500

north-west entrance view

south-west market street view

north-east view from public space
Views and sections
scale 1:500

south facade
north facade is mirrored south facade

longitudinal cross section
west facade
east facade is mirrored west facade

section AA
5.3 DETAILS

scale 1:20
EPS 110SE plates provided with polyurethane glue/foam attached to HEA200 column. Finished with 8mm basic polyurethane coating bearing plate. Anchoring steel structure with M12 adjusting nuts with washers on base plate
700*1.200mm reinforced concrete foundation beam
200mm EPS 110SE foundation plates
Detail 2: corner/balcony 1:20

1. Stainless steel clamping system for railing. Mounted on steel structure with bolts and nuts. Fitted with 8mm edge strip and rubber seal.
2. Various of finishes (stucco, plaster, timber) on 8mm basic polyurethane coating
3. Airtight sealant corners
5. 22mm wooden flooring
sound absorber (baffles) with stainless steel wire mesh for greenery to grow on such as ivy plants. Same mounting type as for the railing.

22mm wooden flooring

console with side plates for connecting the podium structure

anti-root foil

320mm thick earth for the green bufferzone
Detail 4: roof 1:20

1. Welded lug with closed end sling connection for the shade sail
2. Steel Ø50mm column mounted on steel structure with bolts and nuts. Fitted with 8mm edge strip and rubber seal.
Visuals
Existing situation, during morning
More developed situation, during afternoon with an open activity
Future situation, during night with performances
7 Photo
Photo model
end
BIBLIOGRAPHY


TABLE

Table 1: Author

Images

Fig 1:  - http://www.debaanderij.nl/index.php/pages/product/7/LW-Family-Tent-UNHCR.html

Fig 2 - 11: Author

Fig 13 - 14: Author, L. de Rouw

Fig 15 - 19: Author, Public Building for refugees, TU/e Catalogue, urban plan

Fig 20 - 31: Author, Public Building for refugees, TU/e Catalogue, urban plan

Fig 32 - 43: W.A. (photographer wishes to remain anonymous)

Fig 44 - 48: Author

ABSTRACT

Refugee camps like the scale of Za’atari are becoming more and more (in)formally densified. The hardening and densification between private and public in the camp structure, as well as the lack of regulations, the poorly insulated tents, caravans & cabinets that are also uncomfortable, weather-/noise sensitive with a limited lifespan, affects the refugees that are living in there for years. Many therefore rolling up their sleeves and renovate-, expand or build their house that is becoming a sprawling makeshift camp. These development are also noticed in Za’atari, threatening to become an urban wilderness.

The Multi-layered urban space project is a different approach towards densification. The research question to this end is as follows: “How can refugee camps be densified that provide longer-term solutions, solving the existing problems and manifests participatory design?”

This project aims to become a reference point for the development of a new type of architecture in refugee camps, and respecting the existing fabric. By designing a modular, adaptable, multi-layered building that anticipates on the future needs and changes in the refugee camp. The variable and flexible private and public spaces coming together, merge and change simultaneously throughout the years. There are four housing typologies. These are one person apartment, family-, two story apartment and luxurious. The two typologies of public spaces, are active recreation for sport and leisure, and activity area for MOOC lectures, theatre and events where self-development can be fulfilled.

The research question is answered through literature review, morphological- and historical analysis of fourteen camps, case studies and trips to Greece, Calais, Duinkerke and the AZC in Eindhoven.

Future research could be undertaken to calculate the exact costs of the housing unit. This includes the steel structure. Building with EPS reduces supporting structure dramatically, ranging from 40 to 100% what was noticed from ten example projects in Holland. Another research topic would be the further development and prototyping of the magnifying lens facade and water purification panel. These passive techniques, working on sunlight are interesting because of the fuel savings. It is interesting for the refugees, involved parties such as NGO’s and governments.

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