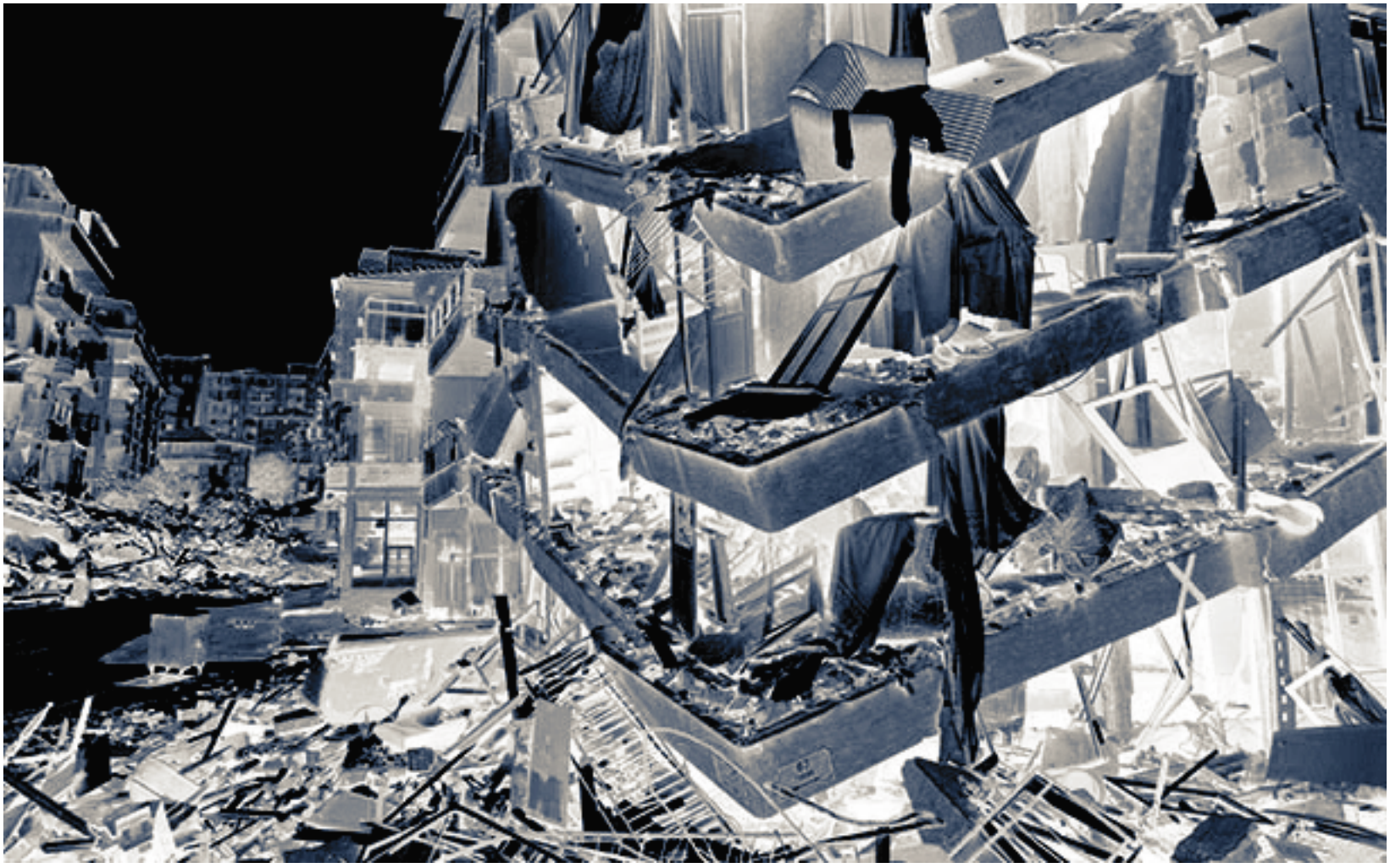
WAITING THE INEVITABLE



POLITECNICO DI TORINO A.A 2020 - 2021

ZEYNEP PEKER
FURKAN UMAN

Are you aware that disasters continue to displace millions of people from their homes across the globe ?

POLITECNICO DI TORINO
MASTER OF SCIENCE IN ARCHITECTURE FOR SUSTAINABLE DESIGN
A. A. 2020/2021

WAITING THE INEVITABLE

SUPERVISOR: ROBERTO GIORDANO
CANDIDATES: ZEYNEP PEKER
FURKAN UMAN

INDEX

CONTENTS

ABSTRACT 0

PART 1 / INTRODUCTION

1. DISASTER 11 - 28
   A) The disaster typologies
      A.1) Events and datas dround the world

PART 2 / RESEARCH AND THEORATICAL BACKGROUND

2.1 DISASTER PHASES 31 - 48
   A) Pre Disaster
      A.1)Prevention / Mitigation / Prepadness
   B) Post -Disaster
      B.1) Consequences of disaster
      B.2) Response / Recovery / Reconstruction
      B.3) Displacement crisis
      B.4) Disaster debris & Waste management
2.2 SHELTERS 49 - 70
   A) Cases around the world
      A.1) Identifiying the strenghts and weakness
      A.2) Shelter Approaches

PART 3 / THE CITY OF ISTANBUL

3.1 1999 ISTANBUL EARTHQUAKE 73 - 80
   A) Response, Recovery and Reconstruction choices
3.2 TURKEY 81 - 92
   A) The geographical context - Turkey,Istanbul
   B) The disaster management in Turkey
3.3 POSSIBLE EARTHQUAKE SCENARIO IN ISTANBUL 93 - 106
   A) The damage study - Istanbul
   B) The location study - Istanbul
      B.1) Istanbul Ataturk Airport

PART 4 / A NEW CONCEPT OF DEVELOPMENT

4.1 LESSONS LEARNED 109 - 110
4.2 DISASTER PREPARED ISTANBUL 111 - 112
4.3 WHAT HAPPENS NEXT ? 113 - 116
4.4 DISASTER RELIEF CAMPS 117 - 125
4.5 DESIGN ANALYSIS 127 - 140
   A) User study
   B) Design criteria
   C) Material study
      C.1) Cnc router
4.5 COMMUNITY INVOLVEMENT 141 - 142

PART 5 / DESIGN PROPOSAL

5.1 TOGATHER - SHELTER KIT 145 - 162
   A) The assembly steps
   B) Statistics
   C) Recycle - Reuse
   D) Spaces and functions analysis
5.2 INCREMENTAL PROCESS OF THE SHELTERS 163 - 176
   A) The plan proposal
   B) Improvement of the quality of life
      B.1) The water supply and management
      B.2) The energy solution

5.3 ATATURK AIRPORT TOGATHER CAMP 177 - 188
   A) The camp layout strategies
   B) The possible layout of the shelters

PART 6 / CONCLUSION 190 - 191

PART 7 / BIBLIOGRAPHY 193 - 206

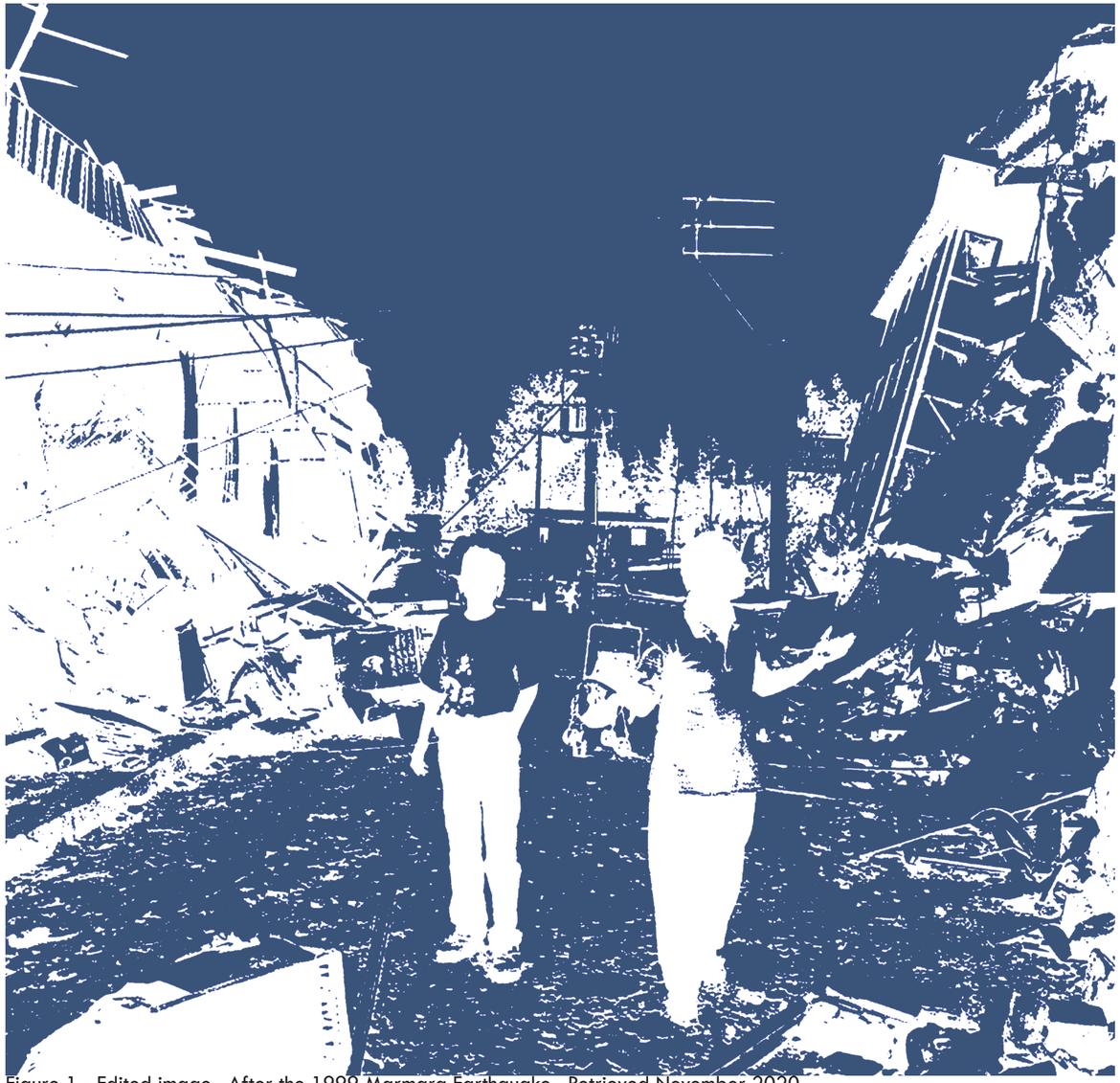


Figure 1 - Edited image , After the 1999 Marmara Earthquake , Retrieved November 2020

ABSTRACT

The world is facing everyday with disasters and emergencies. We all face the risk of the disasters happening and affecting our lifes.Disasters have happened for millions of years and will continue to happen in the future but the frequency of these disasters is increasing every year all around the globe. Many disasters are becoming more dangerous due partly to climate change and their impact increases intensly. These tragic events cause; loss of lives, damage to environment,to the economy , social and cultural life.

The research is based on a possible earthquake scenario of 7.5 mw earthquake that can happen in Istanbul.This case is crucial to analyze the risk and the possible impact that the city of Istanbul will face. Unfortunately, most of the buildings in Istanbul are not safe due to bad quality of materials and poor construction techniques.
In a case of 7.5 magnitude earthquake thousands of people will be homeless in just few minutes.

The aim is to provide accomadation in a shelter camp for who needs safe living space immediately after the disaster occurs, referred as a emergency shelter . But generally speaking , mostly in the poor countries these emergency shelters are tents or containers that they have no accessibility to electricity or clean water. And people that can not afford new homes end up living in these shelters for a very long time and later these shelters are abandoned to decompose. The shelter camps are often places that survivors don't feel comfortable or safe.The former Istanbul Airport has been selected to form a shelter camp.

Analyzing the lessons learned from the previous disasters ,the intent of the research and design is a sustainable approach for post-disaster emergency response ,shelter ,shelter camp and recovery with the participation of the people.

INTRODUCTION

DISASTERS CAN DESTROY WHOLE COUNTRIES IN MINUTES

LEAVING THOUSANDS OF PEOPLE HOMELESS

DISASTER

What is an Emergency ?
For understanding better the terminology disaster, first we have to define **emergency;** defined as a situation requires immediate action and response.

What is a Disaster ?

A disaster can be natural or man made but generally the consequences are the same, it has a detrimental impact on humans,properties,environment and ecosystems.

United Nations defines disaster as “a series of disruption of the functioning of a society,causing widespread human,material or environmental losses which exceed the ability of affected society to cope using its own resources”

Disasters can be categorized in 2 categories;

Natural disasters;

May be categorized in three subcategories;

1)Sudden Impact , 2) Slow Onset, 3)Epidemic diseases

1.Geophysical and hydrometrological events are examples of the sudden impact disasters.These events include earthquakes,cyclones,tsunamis atc.Their effects can be seen in close surroundings or in larger regions.

•Earthquakes
•Windstorms (hurricanes, typhoons, cyclones);
•Heavy precipitation or snow
•Tsunamis
•Landslides,Avalanches
•Floods
•Wildfires

2.Slow Onset disasters occur slowly and gradually ,because of that their impact can be observed overtime.

•Droughts
•Environmental degradation
•Deforestation
•Global warming
•Desertification

3.Epidemic diseases such as the one that we are experiencing right now corona virus.It includes also cholera, measles,malaria etc. They do not trigger large scale displacement but they threat the displaced populations much more.

Man-Made Disasters;

Can be categorized in two subcategories;

1) Industrial/Technological Disasters
2) Complex Emergencies

1.Industrial/Technological Disasters can occur because of the poor planning and management or neglection of the safety procedures.

•Structural collapses of builidings,bridges etc.
• Accidents that can cause explosions or radiation releases
•Accidents related to hazardous materials
•Major fires, explosions
•Aviation disasters
•Maritime

2.Complex Emergencies can create large displacements, insecurity, violation of human rights.

• riots,terrorism
• conflict,war

Figure 2 - Edited image , Corso Umberto,Central Italy Earthquake by Reuters

Consequences of disasters;

Another option to categorize the catastrophes is according to their impacts;

- Environmental impact
- The fatality rate
- The displacement data
- The economic impact

The most evident result is the destruction of the buildings properties. People often loose their homes, and become homeless. But the most devastating consequence of a disaster is losing a family member/s or friends. The survivors of these tragic events develops severe anxiety and depression.

The economical impact is very wide , rebuilding the cities takes a long time and money. And affected families need medical services, food supply and a place to stay in very short time.

In another definiton of disaster 'a disaster is defined as a process or event in which a potentially destructive agents from the natural, modified or constructed environment or both coincides with a population in a socially and economically produced condition of **exposure** and **vulnerability**, producing a perceived disruption of the normal relative satisfactions of individual and social needs for physical survival and social order and meaning (Oliver-Smith, 1998).

"Exposure is the degree to which people,infrastructure, housing, production capacities and other tangible human assets aresituated in hazard-prone areas ."
(UN GENERAL ASSEMBLY 2016)

The disaster risk is defined by the degree of exposure to the natural hazards and by the population vulnerability.

'To define the vulnerability, it is also very important to know the cultural and economical situation of the population. It will help to foresee their capacity to manage and recover from a disaster of probable dangers of harms '(Tucker & Nelson, 2017). Risk from rapid onset hazards is referred to as intensive.

The populations poverty and development is relevant as the intensity of the natural hazards. Because poorer countries do not have an adequate coping mechanisms. And often they lack of infrastructure and health services.

"**A disaster is made inevitable by the historically produced pattern of vulnerability, evidenced in the location, infrastructure, socio- political structure, production patterns and ideology, that characterize a society. The society's patterns of vulnerability is an essential element of a disaster.**"
O.S. Anthony ,1998

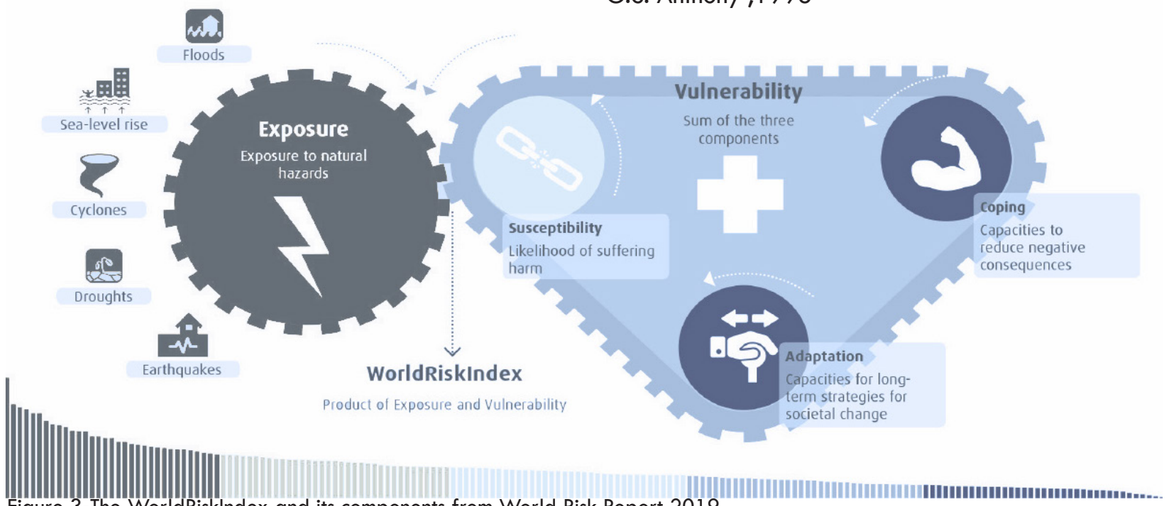


Figure 3-The WorldRiskIndex and its components from World Risk Report 2019

NATURAL DISASTERS

"Approximately 1.3 million people lost their lives and **4.4 billion people were directly affected as a result of climate-related and geophysical natural disasters** that occurred throughout the world between 1998-2017." (NATURAL DISASTER-ECONOMIC LOSSES POVERTY, DISASTERS 1998-2017)

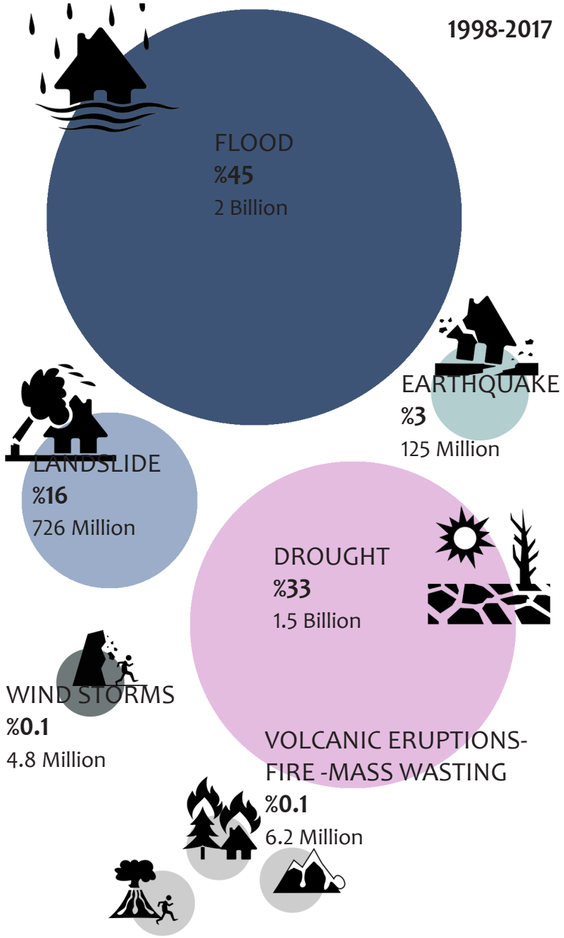


Figure 4-Recreated data ,Number of people affected per disaster type 1998-2017 ,Economic Losses, Poverty & Disasters 1998-2017

Data collected indicates every year the quantity of natural events is in increment. There is also enough evidence to prove some of these events are in rise because of the global warming.

Natural disasters cause appreximately 60.000 fatalities per year around the world.(H.Ritchie ,M.Roser 2014) The death rate is decreasing every year also because of the developing technologies and better disaster management. But we can still consider earthquakes are one of the most deadly disasters, especially for developing countries, without adequate construction techniques, infrastructure they can not protect respond or recovery their society.

CASES AROUND THE WORLD 1900-2019

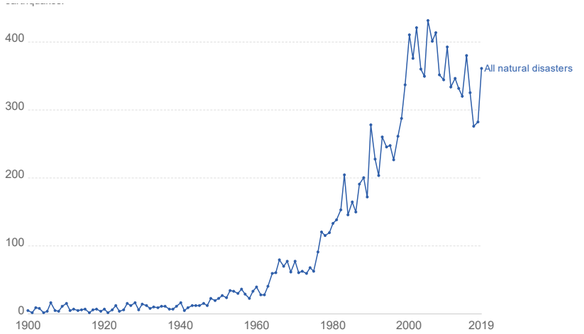


Figure 5-The data of natural disasters in the world between 1900-2019, EMDAT (2020): OFDA/CRED International Disaster Database, Université catholique de Louvain – Brussels – Belgium

RISK MAP OF EARTHQUAKE

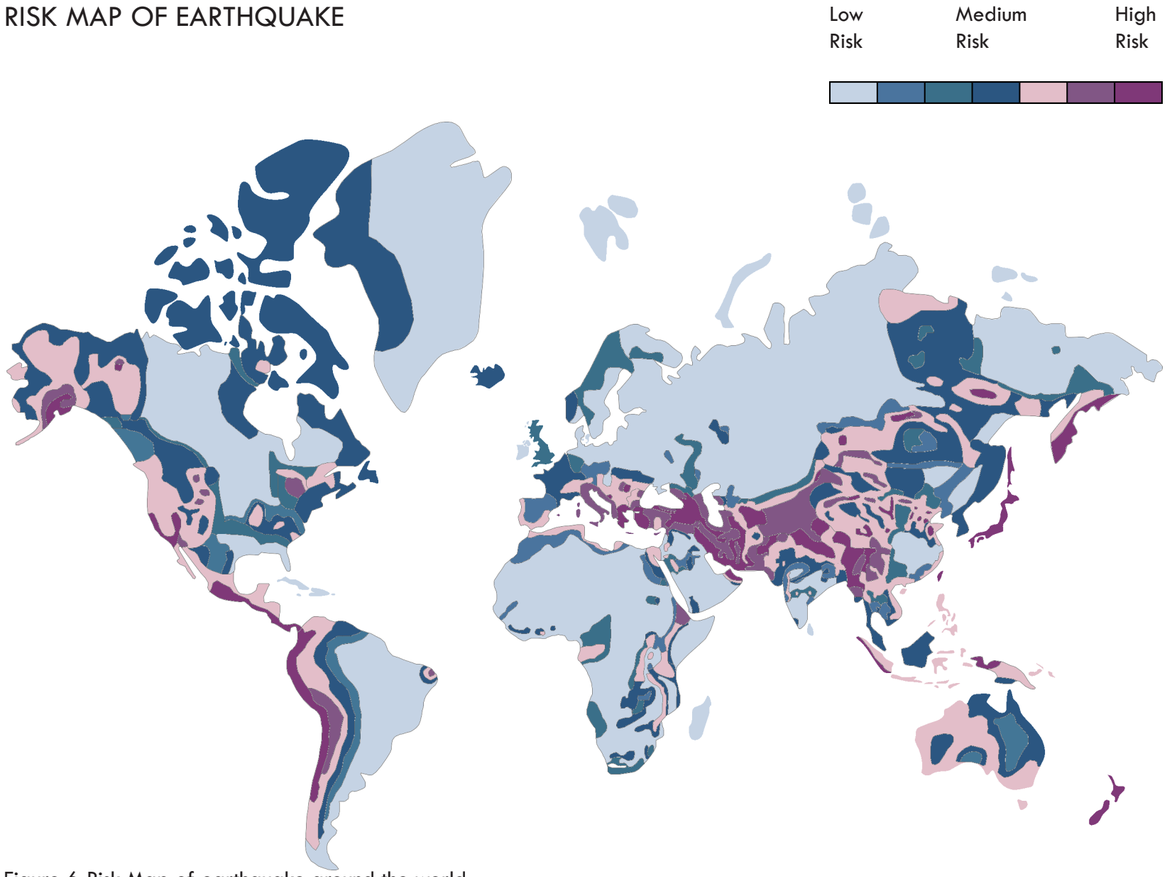


Figure 6-Risk Map of earthquake around the world

Asia and the Pacific are two of the most exposed territories to the disasters. Also because of their increased population more than 75% are affected by the natural disasters on earth, live in these regions. Upcoming climate crisis has an impact on all countries but Pacific Island nations are the ones that they are most at risk. In 2019 the regions that had strikes the most were Oceania, Southeast Asia, Central America & West and Central Africa.

The increased prevalence of severe climate - related natural disasters in due to increased human exposure, greater environmental risk and increased climate related dangers. Hydrometelogical Disasters are mostly linked to population rising and whether fluctuations, shifting temperatures are more responsible for climatological disasters.

RISK MAP OF TROPICAL STORMS

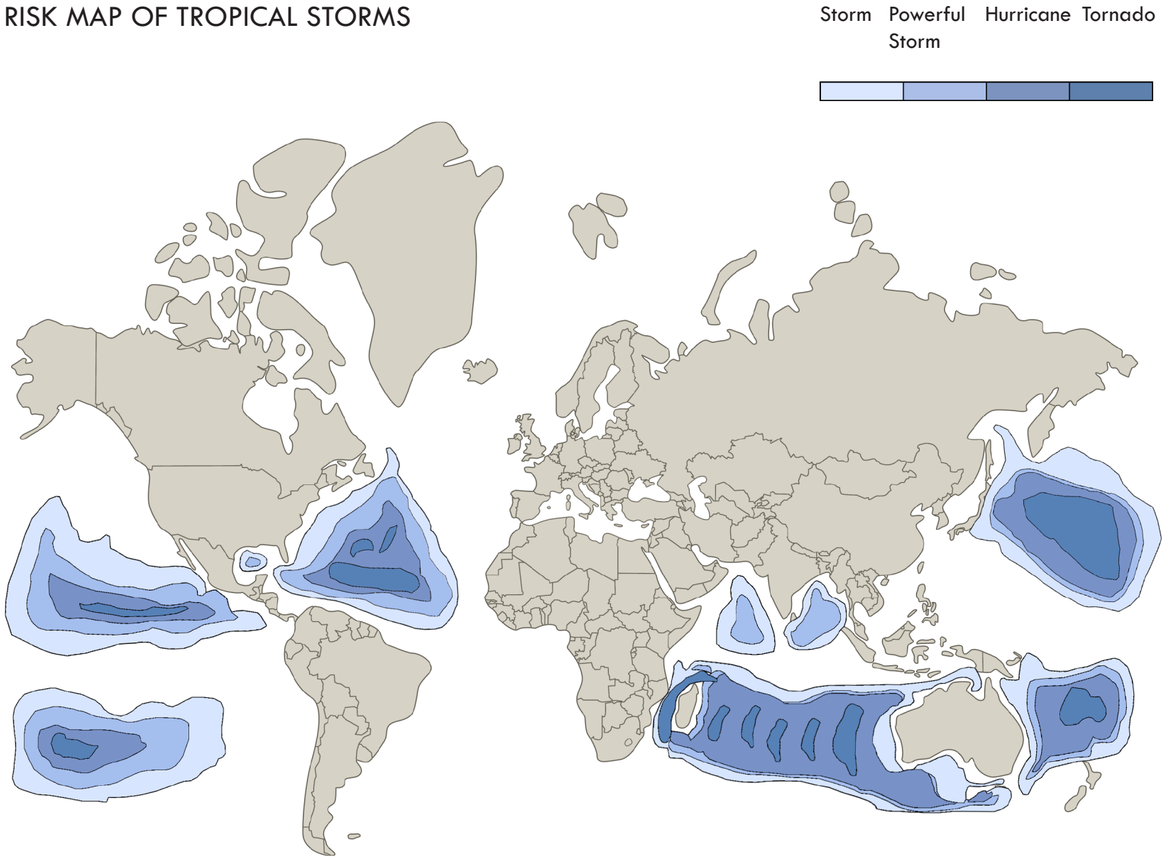


Figure 7-Risk Map of tropical storms around the world

United Nations member states approved an international document named “The Sendai Framework for Disaster Risk Reduction” in order to avoid or minimize the impacts of disasters.

- Increasing the importance of disaster risk
- Improving disaster risk policies
- Investing in catastrophe prepadness
- Improving prepadness in order to respond efficiently in the post disaster phase

1999 GÖLCÜK EARTHQUAKE - TURKEY

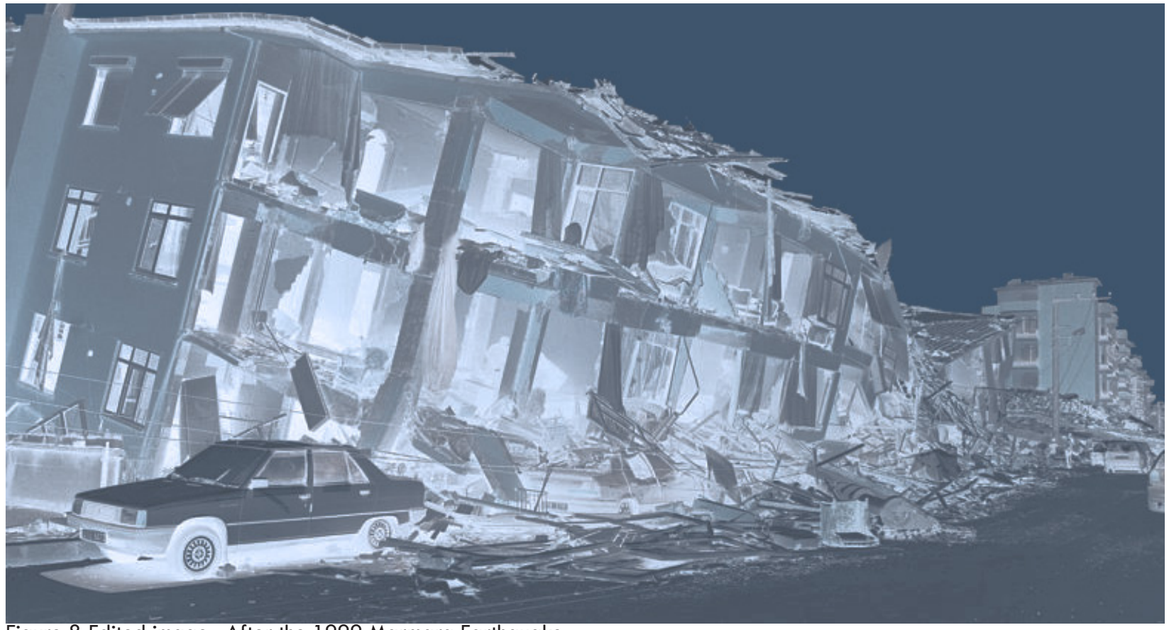


Figure 8-Edited image , After the 1999 Marmara Earthquake

The morning of 17 August 1999 around 3:00 am , the residents of northwestern provinces of Turket woken up by a 7.4 magnitude earthquake that lasted 45 seconds. The cities that had affected by the quake was densely populated, industrial territories.The main shock hypocenter was located 10 km east and 15 km depth of the city of Gölcük. The quake caused 120 km rupture of the north Anatolian fault system and felt across the entire Marmara Region , as well as wide range from Ankara to Izmir provinces.It caused intensive hovac in Gölcük, Düzce , Sakarya, Istanbul and Yalova.

Turkish goverment had announced that the eartquake caused;

- 17,127 loss of life and 3,953 injuries.
- More than 250,000 displaced people.
- 121 tent cities were necessary for emergency sheltering.
- 214,000 residential units and 30,500 businesses were damaged.

Buildings that were collapse or damaged mainly were made of reinforced concrete.

2009 L'AQUILA EARTHQUAKE - ITALY

Figure 9- Edited Image, Devastating Aquila Earthquake 2009

On the 6th april 2009, the magnitude 6.3 earthquake shaken Abruzzo region at 3:30 in the night.The day after and on 9th of April 3 strpng aftershocks happened.The medieval capital city of Aquila was severely damaged. .Alongside the villages of L'Aquila municipality , 15 towns suffered serious impact, and 31 were mildly affected. Onna, Paganica, San Gregorio, Tempéra, and Villa Sant'Angelo were the other historic centers that had severe consequences.

- 308 loss of lifes and more then a1500 injuries.
- 60,000 buildings were collapsed or had significant damage.
- 67,500 lost their homes.
- 171 tents cities were built.
- 40,000 were staying in emergency shelters , others had been rehoused in hotels or hosted by families/friends.

2010 HAITI EARTHQUAKE

Figure 10-Edited Image, Haiti earthquake of 2010,A woman walking down a devastated street in Port-au-Prince by Gregory Bull/AP

JANUARY 12 2010 , the country was shaken intensively by a 7.0 magnitude earthquake that brought destruction to the region's near to Part au Prince. This tragic event revealed the vulnerability of Haiti's infrastructure and unsteady government.

- 3,500,000 people were affected.

- 220,000 people lost their lifes.

- 188,383 damaged houses.

- 105,000 destroyed houses.

- The rubble and debris **19 million cubic meters, "Enough to fill a line of shipping containers from London to Beirut"**

- 600,000 people left their homes.

-1.5 million stayed in camps, others stayed with host families.

- Because of the accommodation issues, such as hygiene, at the end of October there was an epidemic of cholera.

Thanks to the UN program for Human settlements, , 7000 Haitions had been educated and been hired to remove of rubble, repairing damaged properties and recycling.

"Community involvement is essential. Haitians have to be at the centre of reconstruction and training and empowerment are crucial to their successful management of the earthquake recovery," Jessica Faieta.

2011 JAPAN EARTHQUAKE AND TSUNAMI

Figure 11- Edited Image, The 2011 Tohoku earthquake caused devastation in Japan, by Asahi Shimbun via Getty Images

On 11 March 2011, Japan was struck with a magnitude of 9.0 earthquake.This was one of the most powerful earthquake thas has ever happened.It's epicenter was near Oshika Penisula.Immediately afterwards a massive tsunami reached in east cost of Japan and affected almost entire east cost. This tragic event had caused severe damage also on the Daiichi Nuclear Plant . Within the 3 weeks of event , there were explosions and radiation was leaked. The local resident were evacuated thanks to early warning systems. Japan is one of the most disaster prepared countries in the world. Yet the earthquake ,tsunami and explosions had caused very intense losses.

- 15,854 people lost their lifes and 26,992 people were injuired.

- Economic loss was more then USD 210 billion.

- 129,225 buildings were collapsed

- 254,204 buildings were severely damaged.

- 691,766 buildings were partially damaged.

- 340,000 people were displaced.

2012 HURRICANE SANDY - USA , CARIBBEAN

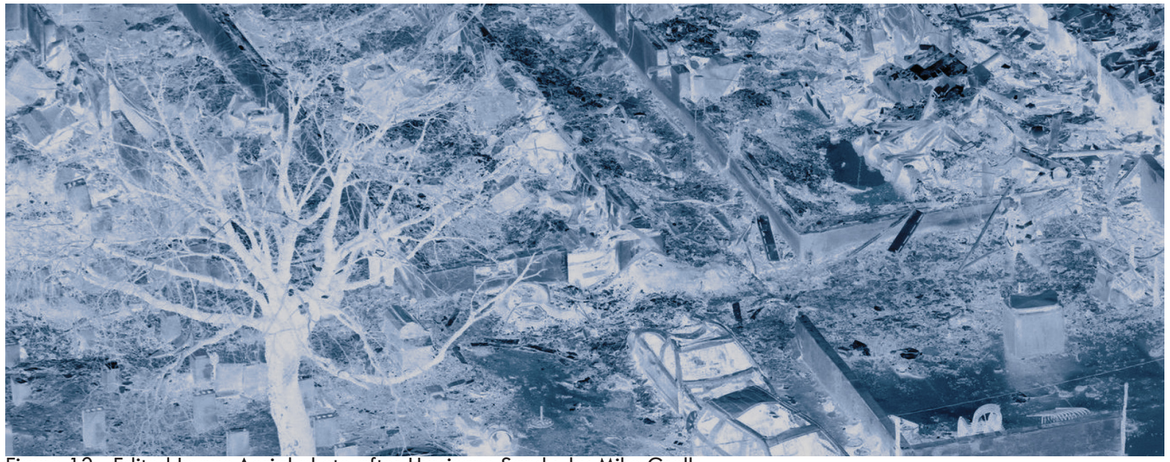


Figure 12 - Edited Image,Aerial photo after Hurricane Sandy by Mike Groll

Hurricane Sandy devastated the Caribbean and East Cast of US in October 2012.

USA
- 125 deaths
- More than 600,000 housing units were destroyed /damaged.
- $62 billion cost in damage in the United States
- Thousands of people lost their homes, and more than 20,000 households were displaced.

HAITI
- 60 deaths
- Had damaged infrastructure roads, schools and hospitals.
- 6,274 houses completely destroyed and 21,427 damaged.
- 350,000 people were still living in camps due to earthquake of 2010, had been affected severely.
- Emergency shelters of 5,298 families destroyed.
- 90,000 ha of cropland damaged.

CUBA
- 11 deaths
- 3 million affected
- 211.000 house damaged
- Issues related to clean water has emerged.
- Schools and health clinics were damaged.
- 100,000 ha of crops affected.

JAMAICA
- 310,621 affected.
- Schools and health clinics were damaged.
- Damage in agriculture , infrastructure and housing.

DOMINICAN REPUBLIC
- 6 deaths
- 175,000 affected.
- 24,559 house damaged.
- Extensive damage in agriculture.
- State of Emergency in Azua
- Issues related to clean water has emerged.

2015 NEPAL EARTHQUAKE

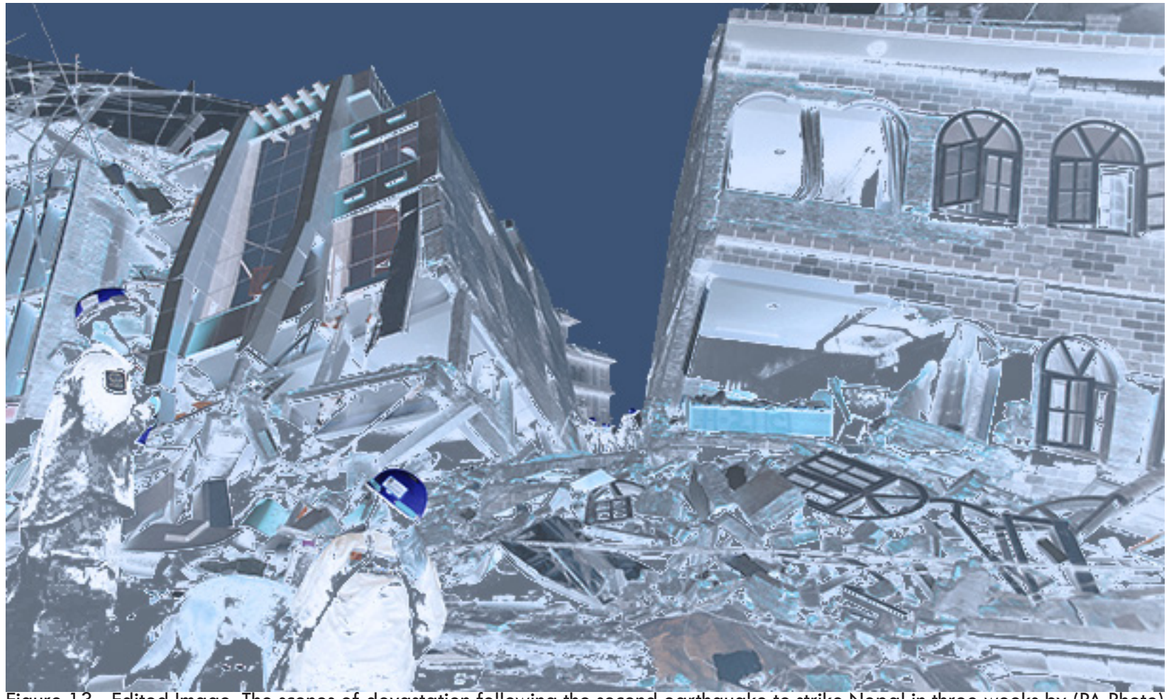


Figure 13 - Edited Image ,The scenes of devastation following the second earthquake to strike Nepal in three weeks by (PA Photo)

On 25th April, 2015 Nepal was shaken by a devastating earthquake measuring in 7,8 richter scale. And was hit again by a aftershack of 7,3 magnitude on 12th May.The affected regions were central and eastern Nepal. In Kathmandu severe affects and collapses were registered.Also the neighbouring countries Tibet and India had some losses The earthquake caused significant landslildes and avalanches on the mountains. The landslides devastated the rural settlements of the city of Katmandu.The resident were terrrified of the idea of returning to their homes ; which led to forming ' tent cities' in the middle of streets making the affected areas highly inaccessible.

- 31 districts of Nepal had severe impacts.

- 8,856 loss of lifes and 22,309 people were injuiried

,- 882,000 buildings were destroyed or damaged.

- 5 Unesco heritage sites had massive damages.

- 8 million people were affected.

- More than 2.6 people were displaced and among them 1.1 million were childrens.

- 409 emergeceny settlements formed.

-The economic loss was about US$ 7 billion.

2016 CENTRAL ITALY EARTHQUAKES

Figure 14 - Edited Image , Amatrice, Italy, one week after a 6.2-magnitude earthquake hit the city by Alessandro Grassani for The New York Times

Figure 15 - Edited Image, Aerial of the tent city by Alessandro Grassani for The New York Times

On 24 August 2016, a magnitude 6.2 earthquake shattered the small towns of Amatrice, Accumoli and Pescara del Trento. Just after 2 months, two aftershocks of magnitude 5.5 and 6.1 happened in Visso, and again on October 30, another earthquake hit Narcia of a magnitude 6.6.

- The large percentage of the Amatriciana was destroyed.
- 299 lives were lost, 390 people were injured.
- **41,000 people left their homes because of the damages.**
- Approximately 2,100 people found shelter in the emergency camps.
- The economical loss was about 6 billion $.
- 300,000 buildings were damaged.
-3,587 emergency shelter.
-5,000 cultural heritage were damaged.

2020 KYUSHU FLOOD , JAPAN

Exactly one year after the catastrophic floods of 2019, Kyushu, Kyush, one of the largest island in Japan, had affected by flooding and landslides in July 2020. The Island of Kyushu had severe rainfall, that caused floods and landslides. The rising water level washed away anything and everything that come in their way. At least 68 people lost their lives. The Ministry of land, had reported more than 200,000 people had been evacuated, 282 landslides occurred and nearly 14,000 houses damaged.

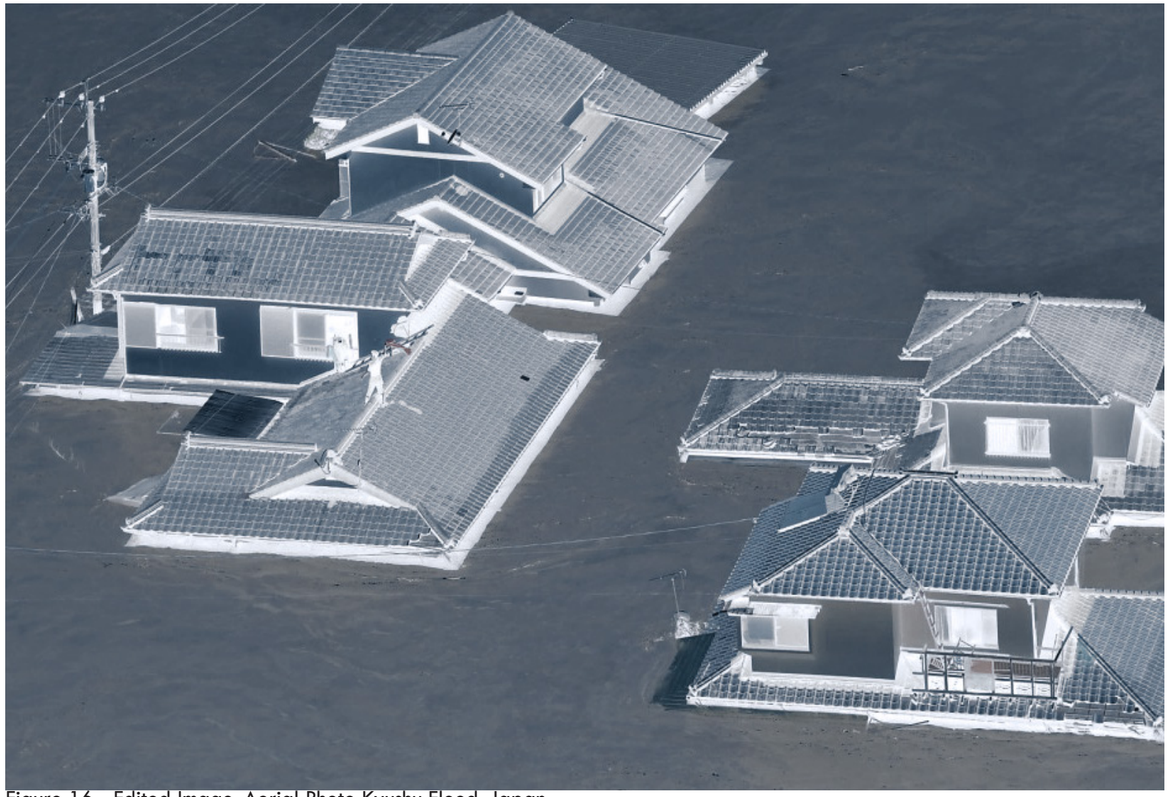


Figure 16 - Edited Image, Aerial Photo Kyushu Flood, Japan

2021 TROPICAL CYCLONE ELOISE , MOZAMBIQUE

Figure 17 - Edited Image , A woman searches for materials to rebuild her home after the passage of Cyclone Idai, in Beira City, central Mozambique by EPA-EFE/Tiago Petinga

Central Mozambique was hit by cyclone Eloise on 23 January 2021 causing extensive floods and destruction over a severe distance of coast.Also Eloise had caused some havoc on southern African nations .Unfortunately, in 2020 and 2019 Mozambique was effected by other 2 natural disasters. Cyclone Idai in 2019 ,one of the worst tropical cyclones,and several months later by the tropical storm Chalance that hit the same areas as in cyclone Eloise.

The vulnerability of the areas were high also before the cyclone hit, also the pandemic Covid 19 had made the situation worsen.There were families that staying still in these shelters and resettlements , 64 resettlement areas were damaged,leaving the survivors again without a shelter. A large-scale humanitarian operation has been announced. The tropical cyclone has highlighted the dangers that tropical cyclones cause, as well as the urgency of WMO's efforts to improve prepadness and create resilience, particularly in vulnerable and exposed territories.

- 441,886 people were affected.

- 56,364 damaged houses.

- 34,566 people had been evacuated.

- 8,755 emergency shelters were severely damaged.

- 34,271 displaced people had to stay in 36 accomadation centers.

RESEARCH AND THEORATICAL BACKGROUND

DISASTER PHASES

Figure 18 - Recreation of diagram of '4 Phases of Disaster Management by Meghan Kelly'

The total measures to be taken account before, post and during a disaster. This management helps to minimize the impact, losses and damage that can happen during a natural disasters. Disaster Risk Management aims;

- Minimizing the loss of lifes.
- Reducing physical impact on properties and rebuilding the areas affected.
- **Reducing the vulnerabilities (physical, social, economical, environment)**
- **Helping to individuals, societies & organizations to strengthen their capacity to mitigate risk and create resilience.**

"Emergency Management is the generic name of an interdisciplinary field dealing with the strategic organization management processes used to protect asses of an organization from hazard risks that can cause disasters or catastrophes, and to ensure the continuance of the organization within their planned lifetime"(Haddow and Bullock, 2003)

Emergency prepadness includes policies, management and plan of action for those in need of assistance, in the disaster event. A well prepared emergency planning facilitates the management of a disaster in the immediate aftermath, working together in such times is crucial. Organizations, volunteers, communities can solve the problems more easily by establishing tasks.

Generally the prepadness phase and response phase is controlled by communities civil protection.

In the event of a natural disaster it is not important that is sudden or slow on set, emergency management has to response to all key topics for to deal with the catastrophic event.

The a well prepared emergency action plan includes early warning systems, cooperation among numerous actors, shelter locations for the displaced people, emergency supplies, services and should be created and managed at all levels of the government.

Due to frequency increase in natural disasters across the world, the governments started to acknowledge the need to be prepared for any scale disaster.

PRE DISASTER

Prior to a tragedy striking, it is important to ensure that all kinds of impacts minimized, to be prepared before anything happens. The pre-disaster phases duration can be minutes or as long as months, depending to the situation. With the help of pre planning; The governments and societies can make decisions,operations and investments more quickly.

Prevention and Mitigation

Prevention and mitigation defined as; steps done to avoid or mitigate the negative effects of a catastrophe in the short and long term. It comprises a wide variety of actions that can be classified as political, legal, administrative or infrastructure related. It's also critical to make guidelines and empowering the the disadvantaged populations; people who are most likely get harmed in the catastrophic situation, to prepare themselves before it occurs.

Preparedness

The characteristic feature of disasters is that most of the times strike suddenly. We may predict a disaster, but we cannot stop it in its tracks. The intention of the preparedness is making the all civic bodies and essential services(administration, hospitals, police, fire department) prepared to be ready to operate, to reduce the impacts

"Figure indicates the effects of a disaster are determined by three preimpact conditions—hazard exposure, physical vulnerability, and social vulnerability."(FEMA)

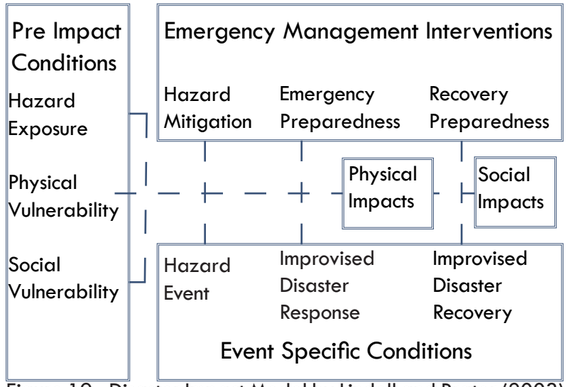


Figure 19 - Disaster Impact Model by Lindell and Prater (2003)

Activities

- Mitigation and Risk analysis
- Hazard Mapping
- Structural and non structural mitigation
- Land use,resource management
- Emergency operation plans
- Warning systems .etc

Figure 20 - The National Fire Academy holds a table-top emergency preparedness exercise with firefighters from across the country simulating a structure fire and other emergency situations in a mock city.
Photo by Jocelyn Augustino/FEMA News Photo

POST DISASTER

The intensity of a natural disaster generally impact the societies, environment.Generally after a intense catastrophe communities, environment needs a long time to recover also depending on development of a country. Especially in the last years, the populations that are living in hazard exposed areas are more prepared but unfortunately there is no way to eliminate all the effects of the disasters. Knowing the risks of a disaster can help to facilitate dealing with post disaster phases.

Depending on the degree of intensity and the degree of vulnerability, the recovery phase of communities and cities can take very long time or just few days. Such as in the example of Haiti Earthquake, even after 10 years after the event, they were still lacking of permanent housing, and some regions were never recovered from the event.

After a disaster strikes the chaos starts, the response teams are the first ones to act. But it is not easy to reach to the hazard zones. Generally the roads are closed by rubble or infrastructure is damaged. It is also very common that public utilities became damaged. The survivors has to face also the problems of accessibility to electricity, water food. For those who need medical assistance, hospitals have to function properly in these tragic events but without electricity the patients have to be transferred to other hospitals and other cities.

The catastrophes leave behind such a destruction but it is not just physical. The survivors see things that they cannot overcome, emotional trauma is just so intense. So often the survivors has to deal with post traumatic stress disorder. As mentioned before each country has different strategies to overcome the impacts of a disaster. And their built environment and economic conditions. Government services are the quality crucial factors to face adequately the problems.

The affected regions if not recovered in short terms, a large number of families become displaced. Most of them leave their city for forever. The highest number of uproots are seen in Haiti, Pakistan, Africa, Syria and Asian countries.

The government has to evaluate the impacts and decide immediately if there is a need for external assistance. They have to determine how much assistance they need or for what. The external assistance can be for response teams, food/water supplies, shelter supplies etc. but the local involvement is necessary because time is very important in these times and they are the ones that know the surroundings best.

DEALING WITH THE CONSEQUENCES OF A DISASTER IS JUST AS TRICKY AS THE DISASTER ITSELF.

Consequences	Measure	Impacts
Deaths	Number of people	Social and physchological effects on remaining community
Injuries	Number and severity	Social and physchological pain and recovery
Physical Damage	Inventory of damaged elements by number and damage level	Cultural losses/damage, property losses/damage, utilities damage
Emergency Operations	Volume of Labor Equipment and Resources	Stress and overwork in relief participants Risk of disease
Disruption to Economy	Number of working days/production lost	Cost of recovery and reconstruction, value of lost production of local economy
Social & Physicological Disruptions	Number of displaced persons ,Disaster trauma	Need of temporary housing,community morale,safety, food
Environmental Impact	Scale and Severity	Consequences of poorer environment,health risks , loss of wildlife

Figure 21- Tangible and Intangible Consequences of Disasters. '10 - Mitigation, Prevention, and Preparedness' , Jane A. Bullock, George D. Haddow, Damon P. Coppola

SOCIAL AND PHYSICOLOGICAL EFFECTS

In the long term, the social and physiological effects are seen more clearly but it is not easy to measure impacts such as; socio demographic, socioeconomic, sociopolitical, etc. because they need to analyzed over time. Monitoring these impacts can help the populations in long term developing new actions for contingency plans, may help to minimize these effects.

The populations that directly lived the catastrophes, may have injuries or death experiences. They can lose their families, friends but also their daily routines, culture. Very often the survivors can overcome these impacts in over time but it is crucial to get help to recover or may have been experienced for long terms.

One other problem is displacement. People suffer from losing their homes, properties. But it is even more challenging to face physiological effects of homelessness. They lose a sense of a place, home.

Normally the house, symbolizes the shelter, safety, peace. But people that lost their homes they do not know what to do next. If they will be able to feel safe again.

RESPONSE PHASE

As soon as a catastrophe occurs; the response phase starts. The response phase may have last few days or few weeks.The first action is the save lives, removal of people from dangerous zones, in a situation as an earthquake it is crucial to act immediately. Because usually people remain trapped in collapsed buildings, and in these cases every second counts. Roads that have been blocked are the primary issues; to save lifes debris removal starts immediately. Those that are in need of medical services need to be taken to the hospitals. The government's bodies are responsible to help to those in need but often voluntary work is needed.

Local resources and prepadness of country makes a huge difference at this point. The relief phase finishes when the community is no longer in danger.

Figure 22 - Disaster Response Operations

RECOVERY PHASE

The affected areas and population is steady in this phase. The damaged built environment, had passed to removal and disposal of debris.People have some basic needs, they are not fully back to their normal life; but they start to feel more safe. For those in need, temporary shelters provided. They are started to adjust to their new normal. Maybe children started to go to school, and people started to go back to their work.

Figure 23 - Construction of the pilot house in Nepal by C.Heathcote

RECONSTRUCTION PHASE

The permanent reconstruction and restoration of the built environment starts. There is no need for tents, temporary shelters anymore. The displaced families will have their permanent housing in few weeks. The economy is restoring. The businesses are reopening, life feels normal again.

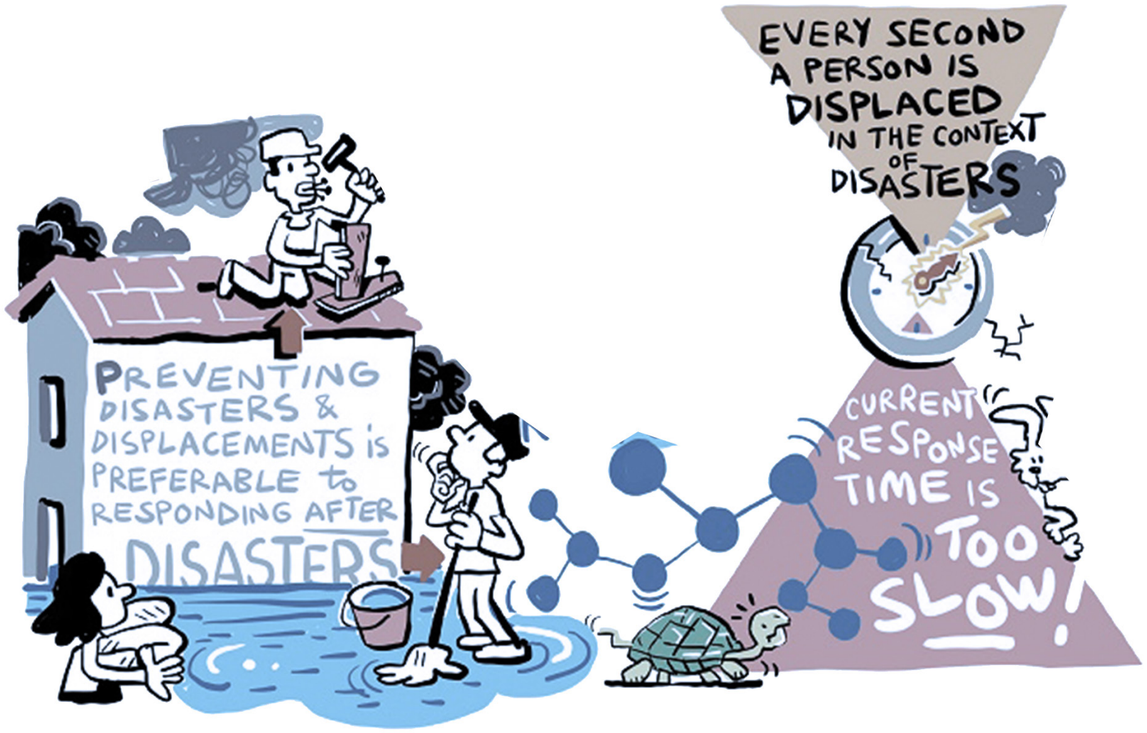


Figure 24 - Illustration byJoshua Knowles

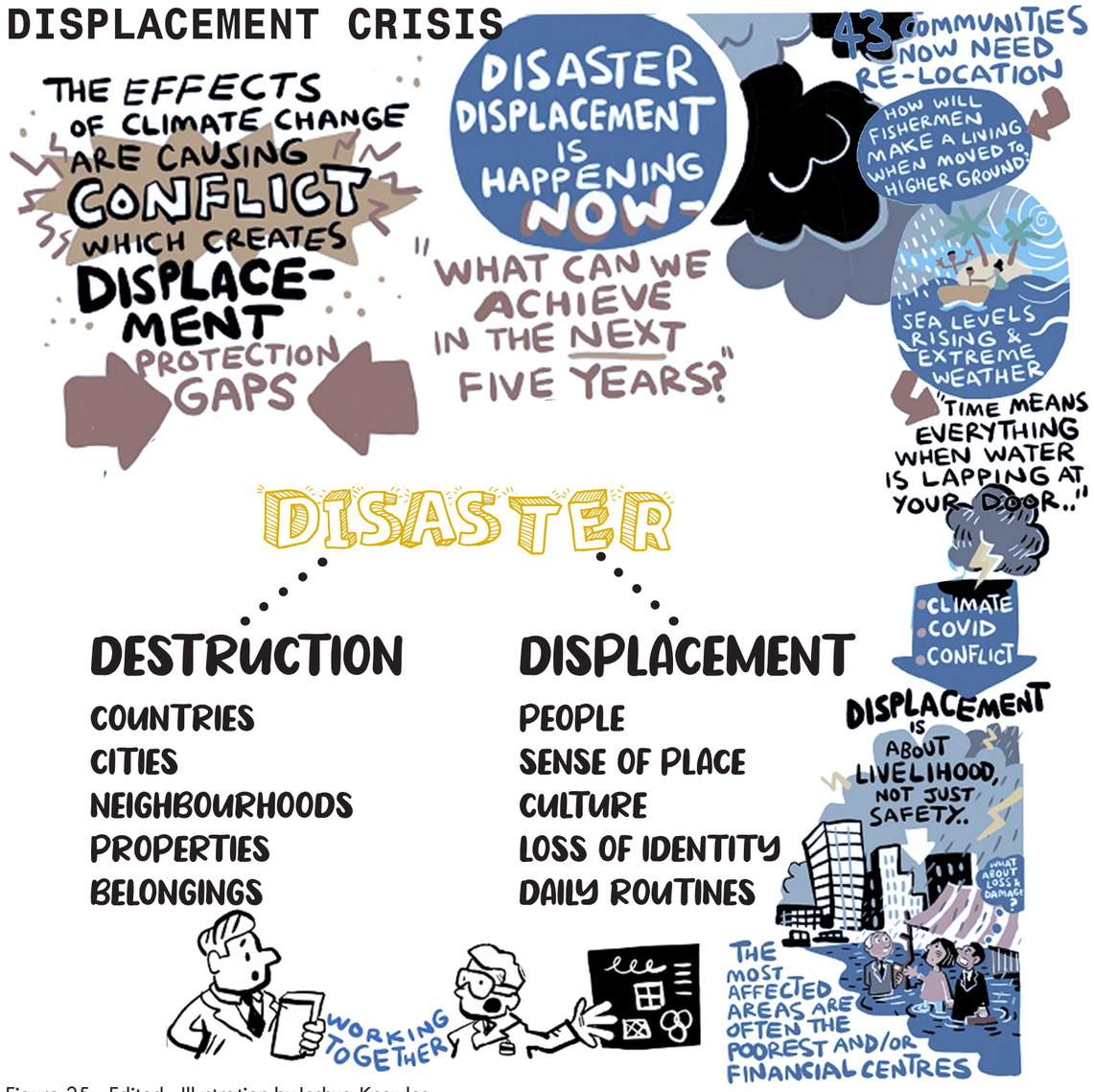


Figure 25 - Edited , Illustration by Joshua Knowles

DISASTER DISPLACEMENT;

Disasters often force the communities to leave their homes, cities. If their homes in natural hazard zone they evacuate in order to save their lifes. But in most cases especially poorer countries forced to leave their home after a destruction occurs. The lack of resilience and a unsteady government makes it harder to handle. Everyday large number of uprooted families can be observed.

"An annual average of 22.5 million people was displaced by weather and climate related hazards." (Michelle Yonetani, Internal Displacement Monitoring Centre (IDMC))

Asia is one of the most exposed countries to natural disaster. They are generally hit by earthquakes and floods. Because of that Asian countries such as, China, Bangladesh, India, Phillippenes have a large number of displaced people. Often the survival of displaced people highly depends on governments and humanitarian organizations.

The basic needs are crucial to survive but we can not forget about the security and protection. The analyzes show that after an emergency occurs, the rate of violence and abuse also increases.

DISPLACEMENTS DATA BY LOCATION IN 2019

The illustrated map shows the displacements occurred in 2019 due to natural disasters around the world.

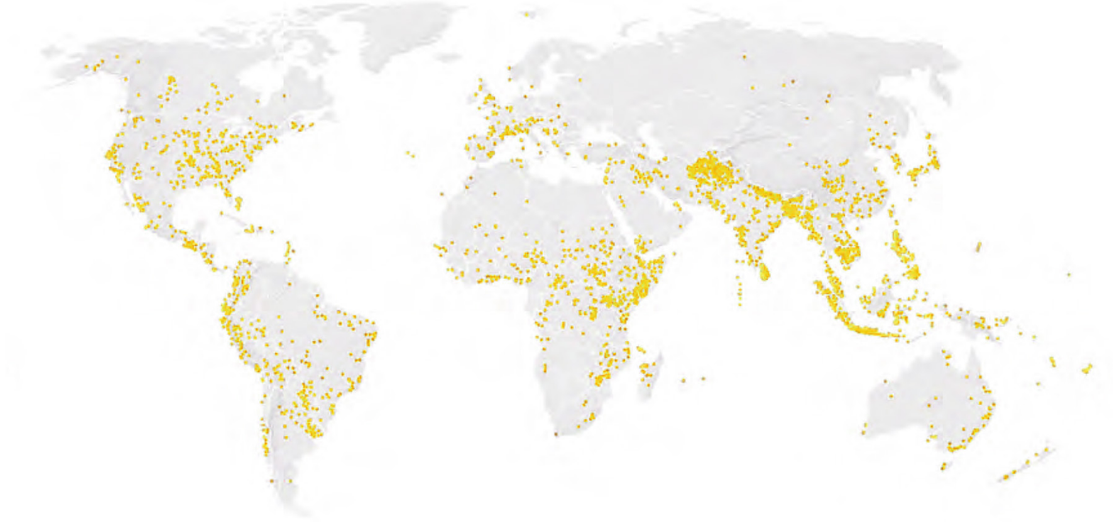


Figure 26 - Disaster displacements in 2019 by location - ' Global Report on internal displacement 2020'

"Around 1,900 disasters triggered 24.9 million new displacements across 140 countries and territories in 2019. This is the highest figure recorded since 2012 and three times the number of displacements caused by conflict and violence.
Around 5.1 million people in 95 countries and territories were living in displacement as a result of disasters at the end of the year. This includes people who fled disasters not only in 2019 but also in previous years. From the 1.2 million people displaced by drought and floods in Afghanistan over the past few years to the 33,000 still living in displacement a decade after the Haiti earthquake, these figures are just the tip of the iceberg." (IDMC, GRID 2020)

In 2019 East Asia and Pacific had high rate of displacement. But early warning systems and evacuation decisions led to decrease the fatality rate. Such in this situations as a result of displacement, these countries had positive result. Temporary shelters are provided to the communities till they have a permanent place to stay. The most common shelter is plastic sheet tents, or prefabricated units. One other shelter option is to stay in public buildings such as schools, gyms. The government has to establish locations where the tent cities will be provided. It has to be take into account that these shelter locations should be available for months because affected communities can extend their stay till they have a permanent housing.

TOTAL DISPLACEMENT DATA DUE TO NATURAL DISASTERS IN 2019

The diagram illustrates the number of displacement occurred in 2019 due to different kind of natural disasters.

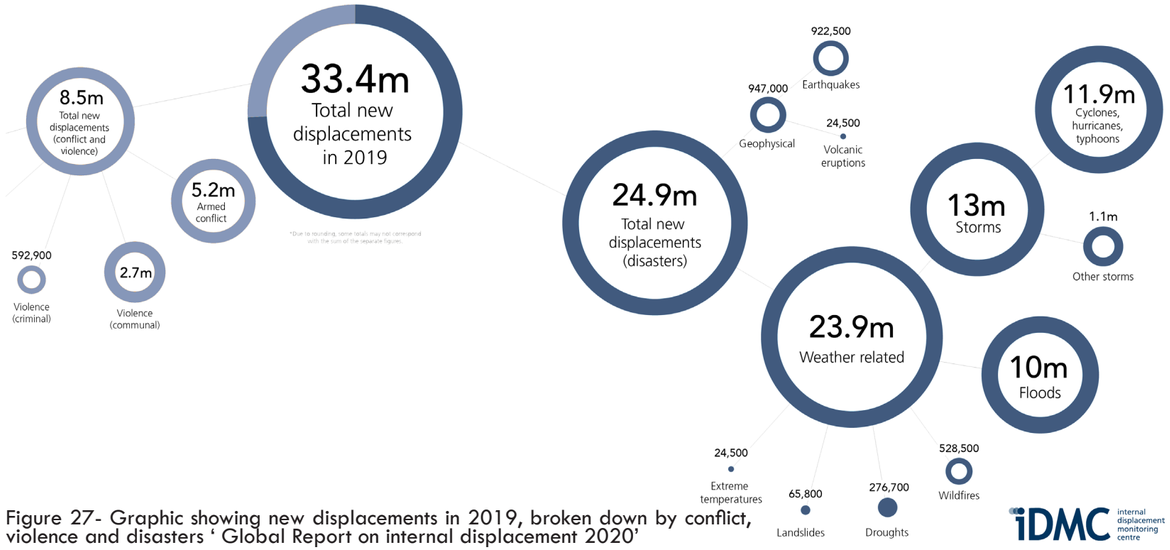


Figure 27- Graphic showing new displacements in 2019, broken down by conflict, violence and disasters ' Global Report on internal displacement 2020'

"Meeting shelter needs pre- and post-disaster remains a major challenge for governments, humanitarian agencies, and, most important of all, survivors. Disaster shelters are considered vital for personal safety, climate protection, security, and resistance to disease and ill health." (IFRC/RCS, 2013).

Figure 28 - Aftermath of Cyclone Idai in Mozambique , Photo by Denis Onyodi: IFRC/DRK/Climate Centre

DISASTER DEBRIS AND WASTE MANAGEMENT

Once the immadiate impacts are over , new challenges arises. In the recovery and rebuilding phase debris management becomes a crucial task. The debris management depends on the type of disaster and theaffected built environment . But generally speaking these events cause a huge amount of waste and debris . These residues needs to be managed and removed carefully.

For instances , Hurricane Katrina left behind more than 99 million cubic yards of debris and it took 3.7 million dollars to manage and remove them. In addition to the high cost of management , it also has a very wide impact on environment and human health.

As mentioned before , to reduce the risks of the event the pre-planning is mandatory, this is also valid for the disaster debris management.In short term the removal is necessary to kick off the reponse and recovery phase but in long term it has to be well managed to minimize the future threats to human health and environment. However , the developing countries have limited financial and technical resources thus , most of the developing countries does not have debris or waste management programmes.

A well planned disaster management includes;
1) Establishing the required equipment and suppliers
2) Identifiying storage and collection sitrs
3) Separation of disaster debris materials
4) Training the civic bodies

In the affected region the first debris removal starts from collapsed buildings that are blocking the roads, to make it accessible to the rescue operations.But in that rush it becomes a challenge to separate and manage the debris in a sustainable way , as a result, most of the residues end up in landfill without segragation or recycling.

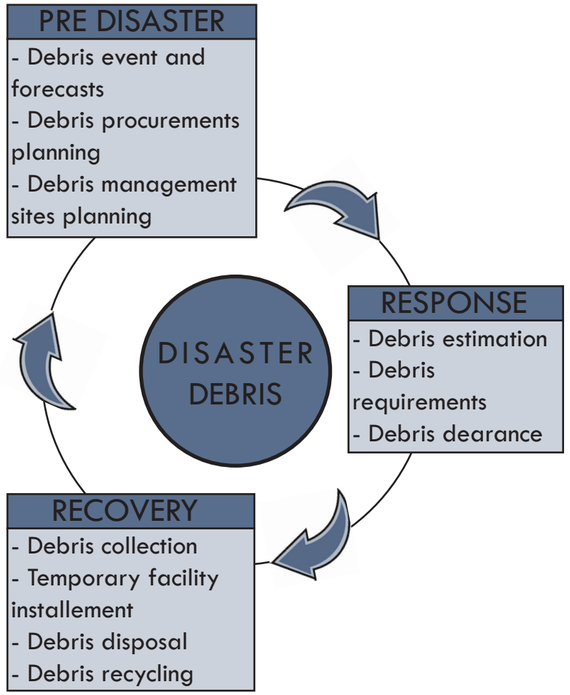


Figure 29 - Flow of debris management operations throughout the disaster timeline , by Pınar Keskinkocak 'A Decision-support Tool for Post-disaster Debris Operations'

MAIN MANAGEMENT ISSUES OF DISASTER WASTE

- FINANCIAL/OPERATIONAL RESOURCES AND COSTS

- UNCONTROLLED STORAGE AND DUMPING

-LACK OF RECYCLING INDUSTRY

-LACK OF SEGRAGATION

-TRANSPORATION ISSUES

Figure 30 - Buildings in Pescara del Tronto were reduced to a pile of rubble by the earthquake as the search for survivors continues. Photo by Giuseppe Bellini/Getty Images

WASTE FROM DISASTER AREA

The collected waste from disaster area , first gets collected and segregated after its transported to storage site. From that point a waste can be reused/recycled or treated for their final disposal.

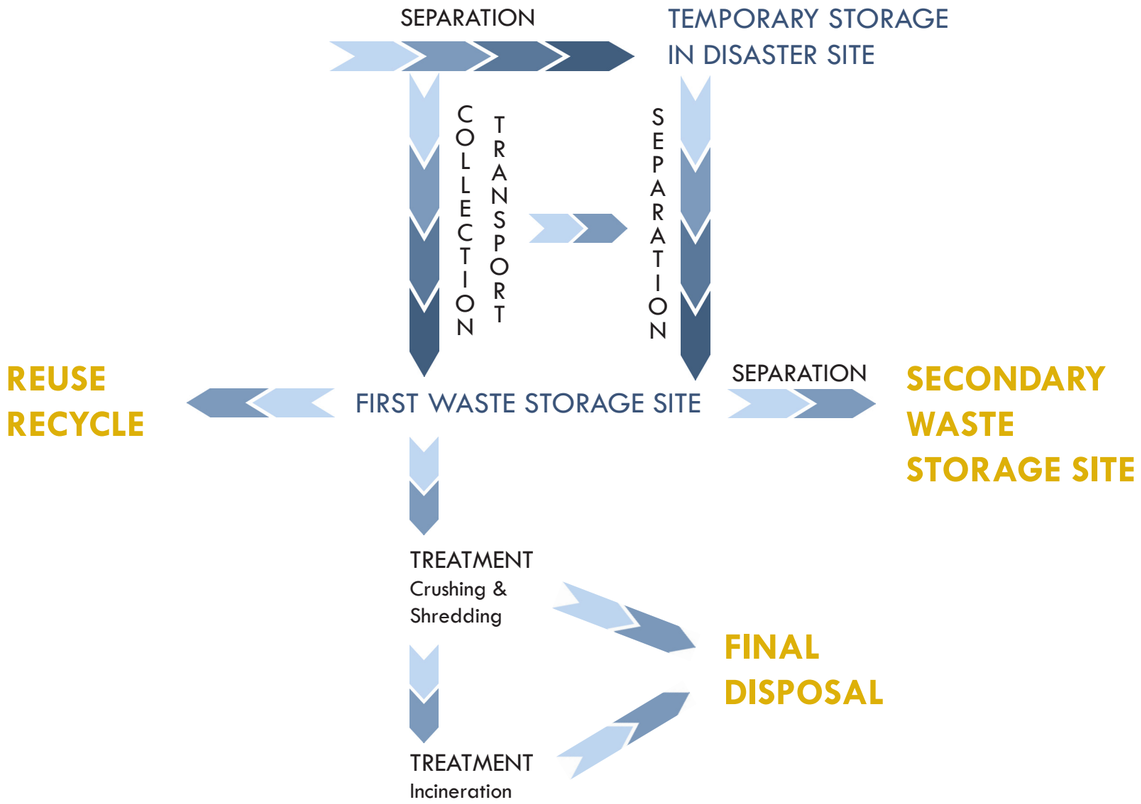


Figure 31- Separation and treatment of earthquake waste , ' Debris Management' , by Shinichi Sakai, Kyoto University and International Recovery Platform, with contributions from Sofia Bettencourt, World Bank

Disaster Waste Management
Main activities (after the disaster strikes)

- Collection and Removal
- Safe Demolition
- Transportation
- Land Fill Management
- Community Engagement

Disaster debris management is a concept of utilizing usable debris for productive use while disposing of the unusable part in an environmental-friendly way. The debris management process consists of the following key features:

1. Recognizing the type of debris.
2. Distinguishing its possible usage.
3. Planning efficient debris collection and processing
4. Phased implementation of debris collection and processing activities

The disaster debris can be separated in two categories:
1.Benign debris
2.Potentially harmful debris

Non-harmful debris further have three categories:
Construction residue – concrete, wood, steel,clay,tiles
Vegetative material – soil, shrubs, trees etc
General wastes – household belongings,furnitures

Harmful debris includes;
electronic items and appliances, spoiled food, and household and industrial waste.

The type of disaster occurred is very important for the management plan of debris , generally speaking in the example of residues after an earthquake, the materials are crushed but reusable. But it shows differencein the flood,tsunami or fire events; the residues after these events can be more hard to deal with it. Because they can be water-logged , contaminated or burnt.

"Emergency clearance, debris removal, 3R (reduce, reuse and recycle) and disposal of debris are the common four step for post-earthquake debris management strategy." (Ranjitkar, Upadhyay)

"Recycling was identified early as a key component in debris management to reduce environmental impact and save landfill space."(Di Como)
Reusing the material recovered from the debris helps in cutting the cost required for the rebuilding structure damaged in the disaster.

RECYCLING BENEFITS

LANDFILL SPACE REDUCTION

RAW MATERIAL DEMAND REDUCTION

ENVIRONMENTAL IMPACT REDUCTION

WASTE MANAGEMENT COST REDUCTION

JOB CREATION

CLASSIFICATION AND TREATMENT OF EARTHQUAKE WASTE

CATEGORY	Waste from household goods	Waste from collapsed houses	Bulky waste	Hazardous waste
OUTLINE	Household goods destroyed by eartquake and tsunami	Collapsed houses and buildings destroyed by the earthquake	Large-sized and unusual waste from factories and infrastructure.	Asbestos, PCBs, etc.
TYPE OF WASTE	- Valuables and mementoes - Home appliances - Other home appliances - Tatami mats, mattesses	- Timber from houses - Concrete, asphalt, waste tiles - Asbestos-containing building materials - Plasterboard	- Tanks, power poles, feedstuffs, fertilizer, and fishing nets that each require a specific disposal method	- Batteries, fluorescent lamps , fire extinguishers, gas cylinders, waste oil, waste liquids, transformer oil, etc.
RECYCLING AND DISPOSAL METHOD	- Each item stored for return to owner - Recycling system - Metal recycled after dismantling and crushing - Tatami mats, mattesses	- Potential use: 1) Particle board, charcoal and reuse of material 2) Use as fuel 3) Energy recovery from incineration - Crushed and used as aggregate for roadbed material and in construction disposed of in landfill, melted	- Crushed and separated and then recycled, incinerated, or disposed of in landfill. Caution is required for hazardous substances such as asbestos	- Controlled management undertaked as necessary for each type of waste

The table above classifies the earthquake waste by different categories. It underlines the different types of waste and how to recycle or dispose them.

Figure 32 - Classification and treatment of earthquake waste , ' Debris Management' , by Shinichi Sakai, Kyoto University and International Recovery Platform, with contributions from Sofia Bettencourt, World Bank

DISASTERS WASTE DATA

YEAR	EVENT	WASTE QUANTITIES
1995	Great Hanshin- Awaji Eartquake, Kobe, Japan	15 Million Tonnes
1999	Marmara Earthquake, Turkey	13 Million Tonnes
2008	Sichuan Wenchuan Earthquake, China	20 Million Tonnes
2009	L'Aquila Earthquake, Italy	1.5-3 Million Tonnes
2010	Haiti Earthquake	23-60 Million Tonnes
2011	Great East Japan Earthquake	31 Million Tonnes
2015	Nepal Earthquake	14 Million Tonnes

Figure 33- Reported waste quantities from previous disasters, ' Building Resilience Through Disaster Waste Management UN Environment's Experiences and Approaches' by Pradhan, Xu

L'AQUILA 2009 EARTHQUAKE - DEBRIS MANAGEMENT

A 6.3 M magnitude earthquake hit abruzzo region on April 6, 2009. L'Aquila was the most close city to the epicenter. L'Aquila has a high proportion of historic multi-storey unreinforced masonry buildings. Approximately 25% of the 72,000 damaged buildings require complete demolition (Dolce, 2010). About **2,650,000 cubic meters of earthquake waste** were carried out.

The municipality aimed the removal of 2000 metric tonnes of residues for 250 days. But the municipalties encountered with the issues due to lack of technical and economical resources. Unfortunately after 1 year, a large part of the historic city center was still full of debris , they were still some issues regarding to approval of the temporary and permanent disposal sites , due to strict environmental regulations. And the residents were frustrated that , Aquila was becoming a ghost town , they even tried to clear the debris on their own.

Year	Debris Amount
2009	33,029
2010	69,720
2011	94,339
2012	436,595
2013	641,490
2014	543,739
2015	564,381
2016	564,380

Complex legal regulations for the management of waste , had cause limitations on removing and disposal of the residues. Italy has some strict regulations also on the use of recycled crushed aggregate , this creates an issue for the demand of the recycled material , and limits the possible usage on reconstruction of the affected area. But despite all the issues, recycling of the residues were successfull with the rate of 80%.

The debris management handled by municipalities is not ideal but we must acknowledge also the specific conditions of the area , in this case the preservation of the historic buildings was one of the most important goals , to achieve a successfull recovery in long term.

HAITI 2010 EARTHQUAKE - DEBRIS MANAGEMENT

The destruction generated 23-60 million tonnes of disaster debris . Haiti is a vulnerable country socially, physically and economically for this reason it was not a surprise that they were not prepared for disasters. They didn't have debris management strategies.4 UN entities helped haiti for the waste management and recovery projects.The public participation was a huge part of the debris management. They trained the survivors and devolped a program cash for work , creating job opportunities.By encouraging new businesses that can recycle and transform the debris waste to the new materials also the economy was revitalized .The recycle waste was used also for the recovery of the capital.

Figure 34 - Workers remove rubble from a destroyed school in Port-Au-Prince Photo by Thony Belizaire/AFP/Getty Images

JAPAN 2011 EARTHQUAKE and TSUNAMI - DEBRIS MANAGEMENT

The triple disaster caused 31 million tonnes of disaster waste , equal to 103 years worth solid waste production. Tsunami waves mix up materials from everything in their path, causing various kinds of debris from hazardous to non hazardous, biodegradable and recyclable to non-recyclable waste to be combined into piles.(2012 UNEP) Debris affected by seasalt, can be damaged as well as chemically and physically, thus makes recovering and recycling much more difficult. Also massive quantities of debris was carried in sea by waves and it had huge impact on the marine life.

But even in these exceptional conditions , Japan's Ministry of the Environment deserves a recognition for their debris management strategies. The guidelines were created for the debris removal, segregation , transportation final disposal and recycling. Maximizing the recycling of disaster waste was also very important issue for the local authorities.By the end of 2014 the waste treatment was completed thanks to the guidelines prepared.
80% percentage of disaster debris was successfully recycled.

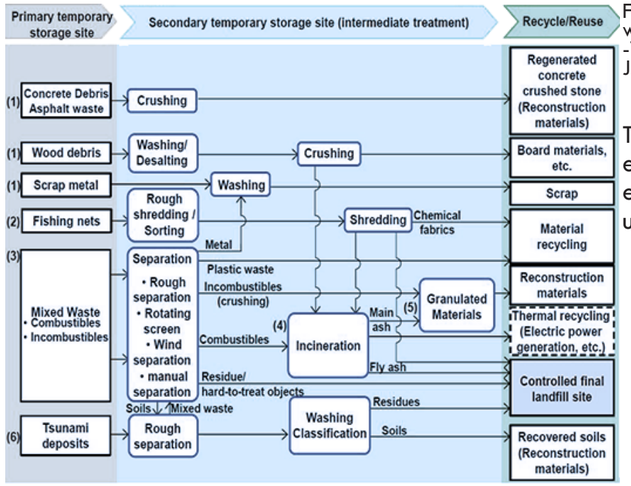


Figure 35- Typical basic treatment flow . 'Treatment of disaster waste generated by the Great East Japan Earthquake -Treatment of disaster waste by member corporations of the Japan Federation of Construction Contractors', Kazuo Ide

This diagram of waste management underlines each materials treatment flow separately. The basic examples of how to recycle or reuse them is given to understand better the waste treatment.

NEPAL 2015 EARTHQUAKE - DEBRIS MANAGEMENT

"The earthquake produced approximetely 18,85 cubic meters of debris, but after the demolition of the damaged buildings it was expected to be 3.9 million tonnes of disaster debris, equal to 11 years of waste generated residents. This large amount of disaster related waste mixed with hazardous wastes was observed exposed to various infections, resulting in adverse impact to human health and environment." (REA, MoEST, 2015)

Nearly after 4 months, the many of the affected areas was still living with the residues of the tragic event. The same approach Italy had for the L'Aquila earthquake was used here, to preserve the monuments and historic buildings before repairing them. The collopsed buildings were mostly unreinforced masonry, without seismic measurements.

Disaster debris was gathered and stored along the roadside/riverside,fields,private lands. Unfortunately the waste collected was dumped without any adequate segregation, causing high impact on accessibility, air pollution that led to respiratory ilnesses.
The Kathmandu metropolitan city (KMC) reused some disaster debris of construction materials such as bricks; to fill potholes and road section.

"UNDP took an incentive for debris management in Nepal after the Gorkha earthquake. A team having 80 Nepali civil engineers worked as UN Volunteers successes to manage debris of 3,000 houses in Sindhupalchwok manually, an estimated 25,000 cubic meter of debris from those private houses was cleared with the coordination with the local community. UNDP replicated this practice in other affected area as well as in public building too." (Poudel, Raju, Yasuhiro Hirai, and Misuzu Asari. 2018)

SHELTER

Shelter and house definition have similar characteristics. But to explain better these definitions in humanitarian context, we have to mention three important impacts; the time, the material and scale.

Definition of shelter;
- A temporary unit for those in need to survive. Generally speaking these units are small and they do not have basic services that houses have. Temporary shelters are used in extraordinary circumstances such as natural disasters, conflicts. But these are the fastest solutions, till they move to more durable, permanent solution. But providing temporary shelters can be one of the most challenging issues in a place that high intensity calamity occurred. The emergency shelters aim is the minimizing the vulnerability and providing a safe place.

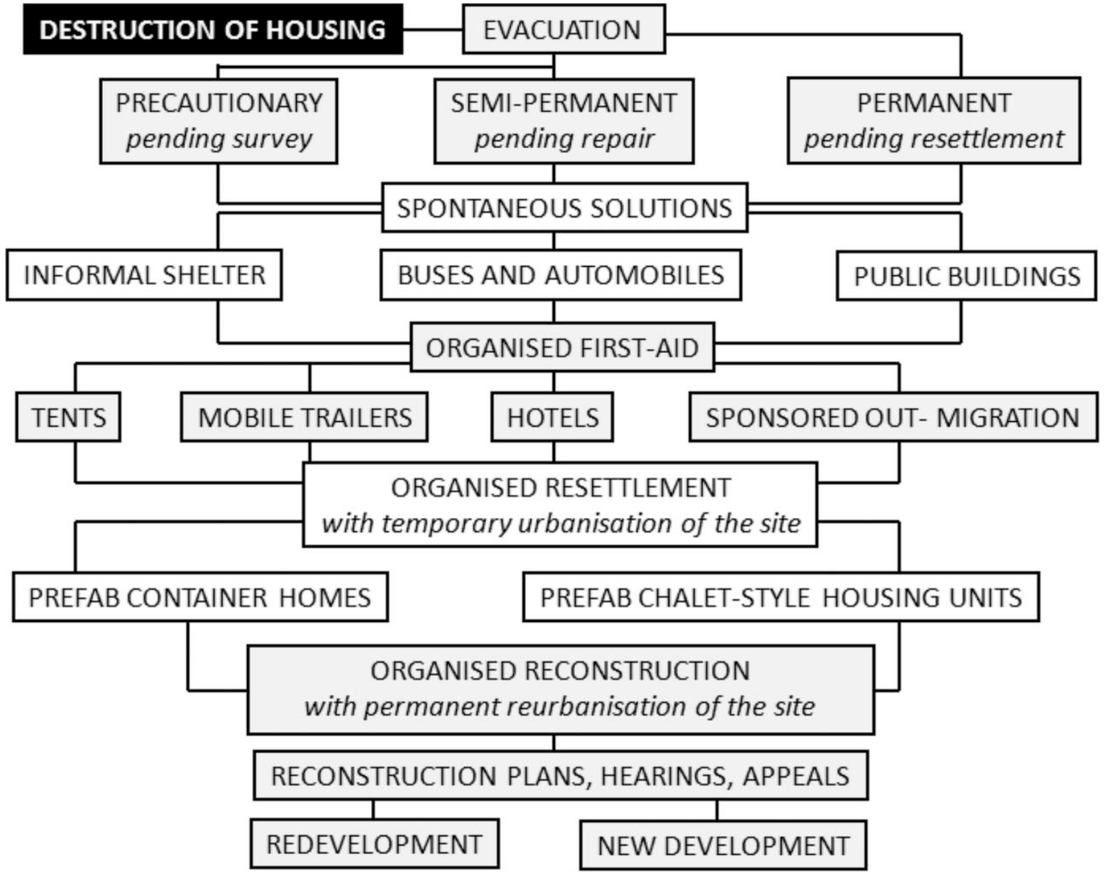
A revised definition of shelter is: "a habitable covered living space, providing a secure, healthy living environment with privacy and dignity to those within it"(ShelterProject.org 2003)

Housing is essentially the step after shelters, their goal is to provide a home for a long term with basic characteristics .

Housing can be more complex in disaster context. Generally the architects and engineers are involved. The aim is to repair and reconstruction but after a new construction needed to provide permanent solution to these are affected. Design and materials have to be designed and selected depending on the location and cultures. It is essential to link design choices to the vernacular architecture while recognizing the needs of people in post disaster housing.
The residents of damaged houses generally stay at shelters, hotels or rental apartments until repairs are done. But others such as habitats of collapsed houses makes a shift from emergency shelter to transitional shelter to permanent housing. These families often end up living in transitional shelters more than 2 years.

In a recent study on post-disaster housing conducted by the Humanitarian Practice Network, housing is defined as "**the process of providing permanent dwellings and the related physical, social and administrative infrastructures**". (Barakat and Roberts 2002).

Figure 36- IOM shelter teams are building robust emergency shelters for Rohingya



When a disaster strikes , the typical steps taken is generally is illustrated in this diagram.It starts with the phase of destruction and ends with new development or reconstruction.

Figure 37- "Full sequence of post-disaster shelter." by David E. Alexander 2010

There are four solutions that can be categorized as Shelter Solutions ;

EMERGENCY SHELTER

The most basic shelter type to spend just few days.Usually it is preferred because it is the fastest solution. It is referred to shelters with some plastic sheets.

TEMPORARY SHELTER

This type of shelters can be used for short time. Also the mass shelters in public spaces are included in this group.But generally it refers to the more durable tarpaulin tents.

TRANSITIONAL SHELTER

Transitional shelters can be upgraded if needed, also can be adaptable through the seasons.These shelters are generally constructed by the communities affected. They can be also relocated.

PERMANENT HOUSING

It can be upgraded version of the transitional shelter or it can developed from the zero as a permanent and durable solution that will last at least for 10 years. The housing should be able to respond all human requirements.

UNHCR says ;

"In the immediate aftermath of a displacement crisis often tents are the lightest, cheapest, fastest thing for to use to shelter people from the elements, save lives and create physical privacy and protection making them the best solution"

General considerations to be obtained by "Shelter and Sustainability , UNHCR, Anja Pirjevec ,2021"

1. Environmental impacts per shelter
Analyzing the negative effects of production, transportation, construction and disposal of construction materials of a specific shelter, by considering:

a) Material consumption
b) CO2 footprint
c) Direct damage of natural habitat
d) Reuse or recycle options

2. Technical performance per shelter
Assessing the performance and behavior of a specific shelter by taking into account:
a) Structural resistance of the shelter context specific assessment
• wind resistance
• flood mitigation
• seismic resistance

3. Shelter habitability
Evaluating the characteristics of a shelter typology in terms of the following criteria:
a) Covered living area
b) Privacy
c) Natural lightning
d) Artificial lightning
e) Appropriateness of materials and construction techniques
f) Complementary facilities

4. Shelter affordability
Cost ofproduction, supply and transportation of construction material and the shelter set up

5. Shelter design characteristics
• Life span
• Set up time
• Natural ventilation
• Fire and flammability
• Thermal comfort

Source : Shelter and Sustainability , UNHCR, Anja Pirjevec ,2021

L'AQUILA EARTHQUAKE- SHELTER

In the immedaite aftermath 35,000 people stayed in tents. 30,000 people moved in hotels.The rest of the survivors had slept in car or at their relatives. Approximately 100,00 people slept outside. The goal was to return to the normal life as quickly as possible. Within 2 months , 50,000 buildings were surveyed. The repairs of the damaged houses started immediately.The government of Italy had built new housing blocks and modular houses. But unfortunately even the urbanization were included in projects , external services was lacking ; shops , public transportation etc.

In 1 year : 185 blocks,4500 flats - 15,000 people

3475 modular houses - 8500 people

TEMPORARY SHELTERS

5.957 tents

Figure 38 - General view of a tent camp for the earthquake refugees in Arquata del Tronto Photo by Giuseppe Bellini/ Getty Images

Shelter set up in a gymnasium of L'Aquila

Figure 39 - Shelter set up in a gymnasium of L'Aquila sport center university Photo by Mario Laporta/AFP/Getty Images

PERMANENT HOUSING

Figure 40 - PROJECT C.A.S.E

185 antiseismic buildings and urbanization project
814 million euro
80 days to build
Laminated wood, concrete, bricks/metal
Energy efficient

MODULAR UNITS - ONNA

Figure 41 - AERIAL PHOTO OF ONNA VILLAGE

100 modular units included urbanization project
5 million euro
90 days to build
30 year of lifespan
Timber framed prefabricated shelters
Based on the family composition.

HAITI EARTHQUAKE- SHELTER

Haiti Earthquake uprooted a large number of families and the achievement of external aids to provide emergency shelter was exceptional. They provided shelter for more than 1.5 million people in 4 months. Unfortunately due to built environment in Haiti the minimum shelter standards couldn't obtained.

EMERGENCY SHELTERS

Figure 42 - A tent city in post-earthquake Haiti. Photo by Fred W. Baker III/Wikimedia Commons

The shelter agencies even if they managed to provide basic shelters, their plan to provide 125.000 T shelters could not be accomplished in time, just 15% of the aimed T shelters were provided.

After 10 years there were still Haitians living in emergency shelters with no accessibility to water, electricity. They did not have a secure place that they could called home.

The number of built permanent housing was not enough the lucky ones had to built their home by their own.

TRANSITIONAL SHELTERS

After 10 Months Of The Earthquake

Figure 43 - A wider view of a tent city set up for earthquake victims in Port-au-Prince Photo by AP Photo/Ramon Espinosa

PERMANENT HOUSING

Figure 44 - Post-earthquake recovery

TEMPORARY SHELTERS

Figure 45 - Overcrowded shelter following the Great East Japan Earthquake Photo by Yomiuri Shimbun

TRANSITIONAL SHELTER/PERMANENT HOUSING

Figure 46 - Permanent public housing for those displaced ,Photo byThe Jiji Press

Government and the municipal government of Tono, Iwate Prefecture, have turned some of their temporary evacuee housing into permanent public housing for those displaced by the March 2011 disasters.

But the survivors were not happy, a 77 years old women “I used to see my son regularly,” she says. “But now he doesn’t come to visit. It’s too exhausting for him to come this far to visit. It’s really hard.”(Elise Hu for NPR)

PERMANENT HOUSING

Figure 47- An aerial view of construction of new permanent housing

The localized housing recovery design of the Kuro no Ie was used for disaster recovery public housing, arranged to promote community interaction.

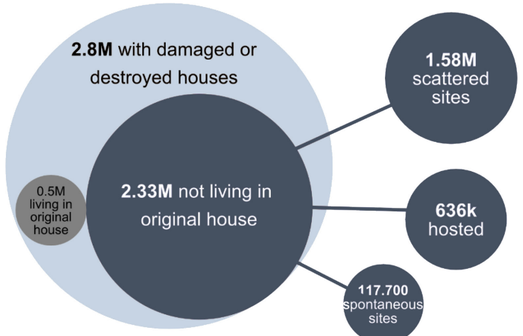


Figure 48- Ihe Nepal Earthquake Impacts

EMERGENCY SHELTERS

Figure 49 - Image of tents used after the Nepal Earthquake

The Earthquake Housing Reconstruction supported the reconstruction of damaged houses project in 32 districts of Nepal. The disaster resilient construction techniques and material were used for rebuilding.

TRANSITIONAL SHELTER

Figure 50 - EHRP beneficiary in front of her newly reconstructed house, holding her Participation Agreement, by SW Nepal. ‘Post-Earthquake Reconstruction in Nepal: Rebuilding Lives, One Home at a Time’ , The World Bank

Project	Location/Year/Disaster	People Displaced	Materials	Shelter Size	Time to build	Anticipated Lifespan	Costruction Team	Number Built	Project Cost
1 	Haiti / 2010 / Earthquake	1.500.000 people	Structure: Steel Slab: Timber Roof: Steel sheet	18 mq	2 days	24 month	Unknown	5.100	3.998 €
2 	Haiti / 2010 / Earthquake	1.500.000 people	Structure: Wood Slab: Wood Roof: Metal sheet	23,7 mq	3-5 days	5-10 years	5-7 people	4.471	5.050 €
3 	Haiti / 2010 / Earthquake	1.500.000 people	Structure: Wood Slab: Concrete Roof: Timber	26,1 mq	Less than 2 weeks	3-5 years	10 people	1.050	2.524 €
4 	Indonesia / 2009 / Earthquake	1.250.000 people	Structure: Bamboo Slab: Bamboo Roof: Terracotta	24 mq	3-4 days	1-5 years	3-4 people	430	307 €
5 	Indonesia / 2009 / Earthquake	1.250.000 people	Structure: Timber Slab: Concrete Roof: Timber	17,3 mq	2 days	6-12 months	5 people	7.000	465 €

DESIGN CHOICES

- not provided
- mostly provided
- provided

	1	2	3	4	5
Resistant to Disaster	●	●	●	●	●
Permanent Housing	●	●	●	●	●
Transitional Sheltering	●	●	●	●	●
User Centered Design	●	●	●	●	●

	1	2	3	4	5
Climate Adopted Design	●	●	●	●	●
Adaptability	●	●	●	●	●
Participatory Development	●	●	●	●	●
Energy Efficiency	●	●	●	●	●

MATERIAL CHOICES

	1	2	3	4	5
Costruction on Site	●	●	●	●	●
Prefabricated	●	●	●	●	●
Easy to Erect and Dismantle	●	●	●	●	●
Local Materials	●	●	●	●	●
Recycling and Upgrading	●	●	●	●	●
Fast Supply	●	●	●	●	●

The table of shelters prepared illustrates the previous shelter solutions adapted in previous disasters by their location, n. of people displaced ,materials , shelter size, time to build , lifespan etc. The selected shelters were analyzed through some important characteristics that a shelter requires.
Datas obtained from https://www.ifrc.org/PageFiles/95186/900300-Transitional%20Shelters-Eight%20designs-EN-LR.pdf

Project	Location/Year/Disaster	People Displaced	Materials	Shelter Size	Time to build	Anticipated Lifespan	Costruction Team	Number Built	Project Cost
1 	Pakistan / 2010 / Floods	1.800.000 people	Structure: Timber Slab: Concrete Roof: Steel sheet	24 mq	1 days	24 month	4 people	10.000	465 €
2 	Pakistan / 2010 / Floods	1.800.000 people	Structure: Brick Slab: Concrete Roof: Steel frame	18,7 mq	Unknown	10 years	Unknown	875	1.210 €
3 	Peru / 2007 / Earthquake	140.000 people	Structure: Timber Slab: Timber Roof: Metal sheet	17,4 mq	1 days	24 month	4 people	2.020	520 €
4 	Peru / 2007 / Earthquake	140.000 people	Structure: Timber Slab: Concrete Roof: Timber	18 mq	2 days	12 month	4 people	3.000	316 €
5 	Afghanistan / 2009 / Conflict	5.000.000 people	Structure: Bamboo Slab: Concrete Roof: Plastic sheet	38,7 mq	3 days	1 years	5 people	380	760 €

DESIGN CHOICES

- not provided
- mostly provided
- provided

	1	2	3	4	5
Resistant to Disaster	●	●	●	●	●
Permanent Housing	●	●	●	●	●
Transitional Sheltering	●	●	●	●	●
User Centered Design	●	●	●	●	●

	1	2	3	4	5
Climate Adopted Design	●	●	●	●	●
Adaptability	●	●	●	●	●
Participatory Development	●	●	●	●	●
Energy Efficiency	●	●	●	●	●

MATERIAL CHOICES

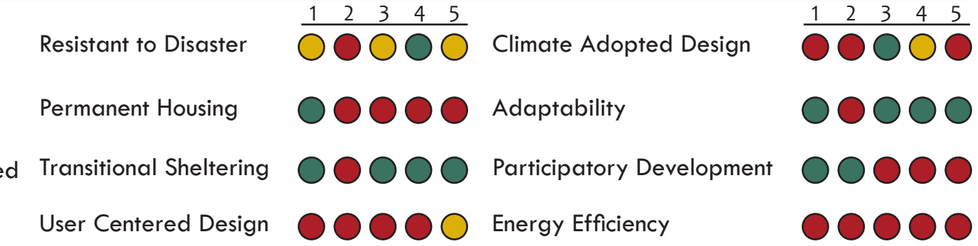
	1	2	3	4	5
Costruction on Site	●	●	●	●	●
Prefabricated	●	●	●	●	●
Easy to Erect and Dismantle	●	●	●	●	●
Local Materials	●	●	●	●	●
Recycling and Upgrading	●	●	●	●	●
Fast Supply	●	●	●	●	●

The table of shelters prepared illustrates the previous shelter solutions adapted in previous disasters by their location, n. of people displaced ,materials , shelter size, time to build , lifespan etc. The selected shelters were analyzed through some important characteristics that a shelter requires.
Datas obatined from https://www.ifrc.org/PageFiles/95186/900300-Transitional%20Shelters-Eight%20designs-EN-LR.pdf

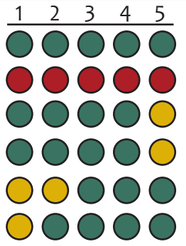
	Project	Location/Year/Disaster	People Displaced	Materials	Shelter Size	Time to build	Anticipated Lifespan	Costruction Team	Number Built	Project Cost
1		Sri Lanka / 2010 / Conflict	450.000 people	Structure: Brick Slab: Concrete Roof: Coconut Wood with Iron sheet	19,6 mq	5 days	10 years	2-3 people	1.000	600 €
2		Burkina Faso / 2009 / Conflict	100.000 people	Structure: Timber Slab: Concrete Roof: Plastic Sheet	17,9 mq	3 days	2 years	4 people	2.840	Unknown
3		Bangladesh / 2007 / Cyclone	200.000 people	Structure: Concrete /Brick/Wood Slab: Concrete Roof: Steel Frame	14,4 mq	5 days	2-5 years	3-4 people	1.250	1.683 €
4		Philippines / 2011 / Typhoon	420.000 people	Structure: Concrete Slab: Plywood Roof: Iron Sheet	17,5 mq	5 days	5 years	5 people	1.823	462 €
5		Philippines / 2011 / Typhoon	420.000 people	Structure: Concrete Slab: Plywood Roof: Iron Sheet	26 mq	12 days	5 years	5-6 people	250	1.850 €

DESIGN CHOICES

- not provided
- mostly provided
- provided



MATERIAL CHOICES



The table of shelters prepared illustrates the previous shelter solutions adapted in previous disasters by their location, n. of people displaced ,materials , shelter size, time to build , lifespan etc. The selected shelters were analyzed through some important characteristics that a shelter requires.
Datas obatined from https://www.ifrc.org/PageFiles/95186/900300-Transitional%20Shelters-Eight%20designs-EN-LR.pdf

TEMPORARY SHELTER SOLUTIONS

Galvanized iron frame
UNHCR plastic tarpaulins
Steel poles, with compacted earth
For 4 occupants
Can be upgraded for minimum privacy
No natural light or artificial light
(UNHCR)

Cost / Life span / Area
$ 536.3 / 1 years / 14 m2= $ 38.3 / year / m2

Structural bamboo elements and tarpaulin
Suitable for 5 occupants
Provides minimum privacy
Meets minimum light. requirements
No access to artificial lightning
(UNHCR)

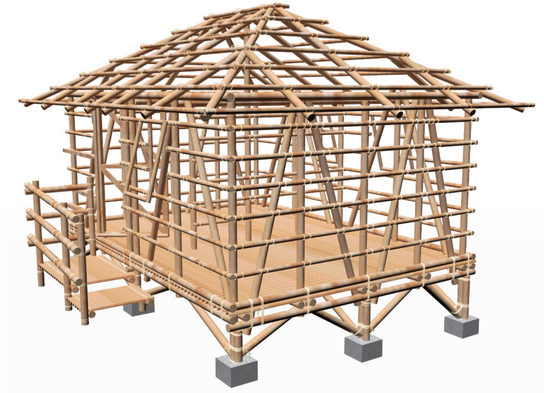
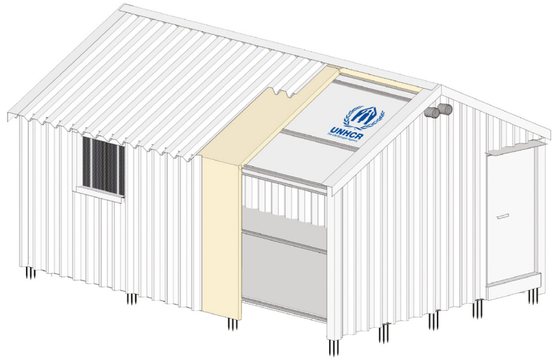
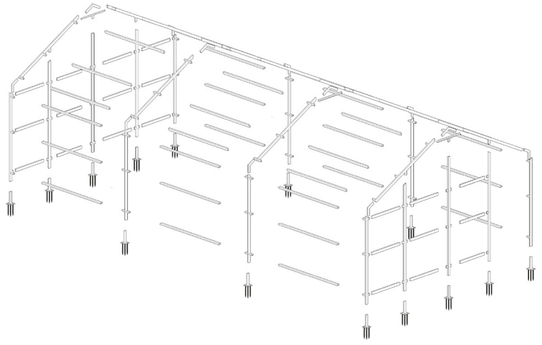


Figure 51 - The Shelter and Sustainability by UNHCR, Geneva, April 2021
Source : The Shelter and Sustainability by UNHCR, Geneva, April 2021

TRANSITIONAL SHELTER

The steel structure, insulation, plastic sheeting and concrete flooring behind the external metal cladding.
Footings are adjustable for the different heights
(UNHCR)





BETTER SHELTER

Structure: Steel pipes connected with cross wires.

The foundation is mounted to the ground with anchors.
Semi-rigid polyolefin panels.
Features a lockable door, four windows, four ventilation inlets and a lamp.

Materials Frame: Galvanized high strength steel
Envelope(wall & roof): Semi-hard & opaque plastic panel

Assembly :Four people in 5 hours can assembly
Lifespan :36 months with basic maintenance
Cost: €1150 per unit.
Covered living space: 17.5 m2
May be upgraded with local material.
Adaptable size and layout
(UNHCR)

Figure 52 - The Shelter and Sustainability by UNHCR, Geneva, April 2021
Source : The Shelter and Sustainability by UNHCR, Geneva, April 2021

DURABLE SHELTER SOLUTIONS

Load bearing walls-non reinforced masonry
Mud plastered sun dried mud-brick
Corrugated iron sheet roof
Compacted earth floor
For 5 occupants
Meets minimum light requirements
Artificial lightning in communal areas
Adapted to local practices
Household facilities in the plot
(UNHCR)

Load bearing walls-non reinforced masonry
Cement plastered burned brick

For 10 occupants
Provides minimum privacy
Exceeds minimum light requirements
Shelter equipped with artificial lightning
Local
Shelter equipped with facilities
(UNHCR)

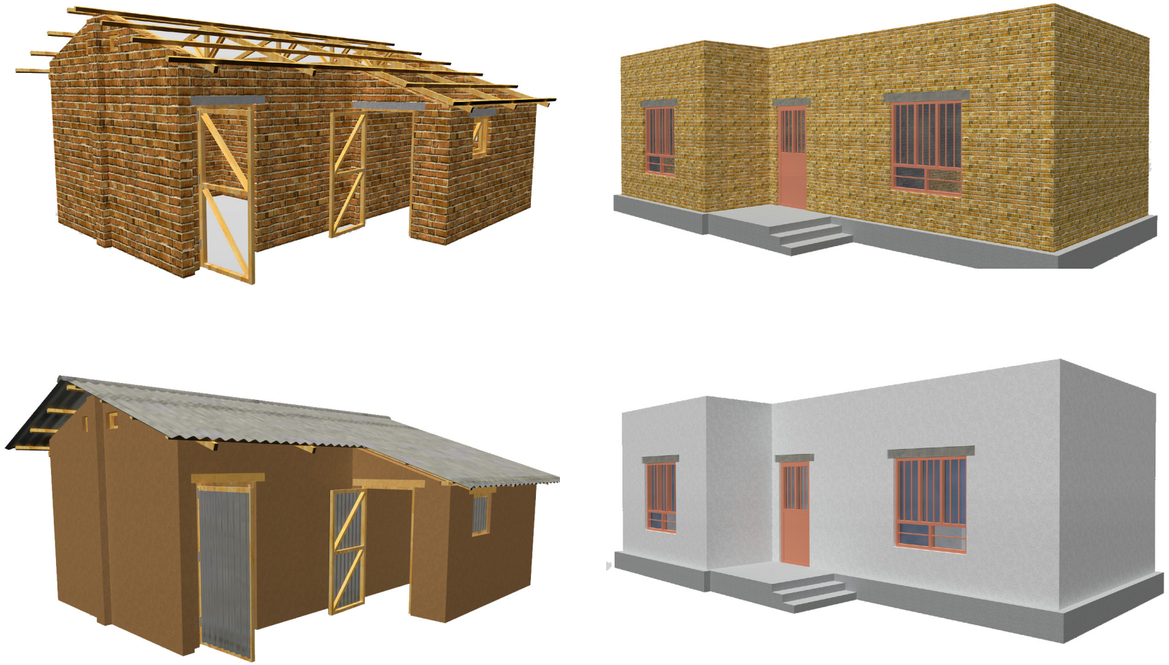


Figure 53 - The Shelter and Sustainability by UNHCR, Geneva, April 2021
Source : The Shelter and Sustainability by UNHCR, Geneva, April 2021

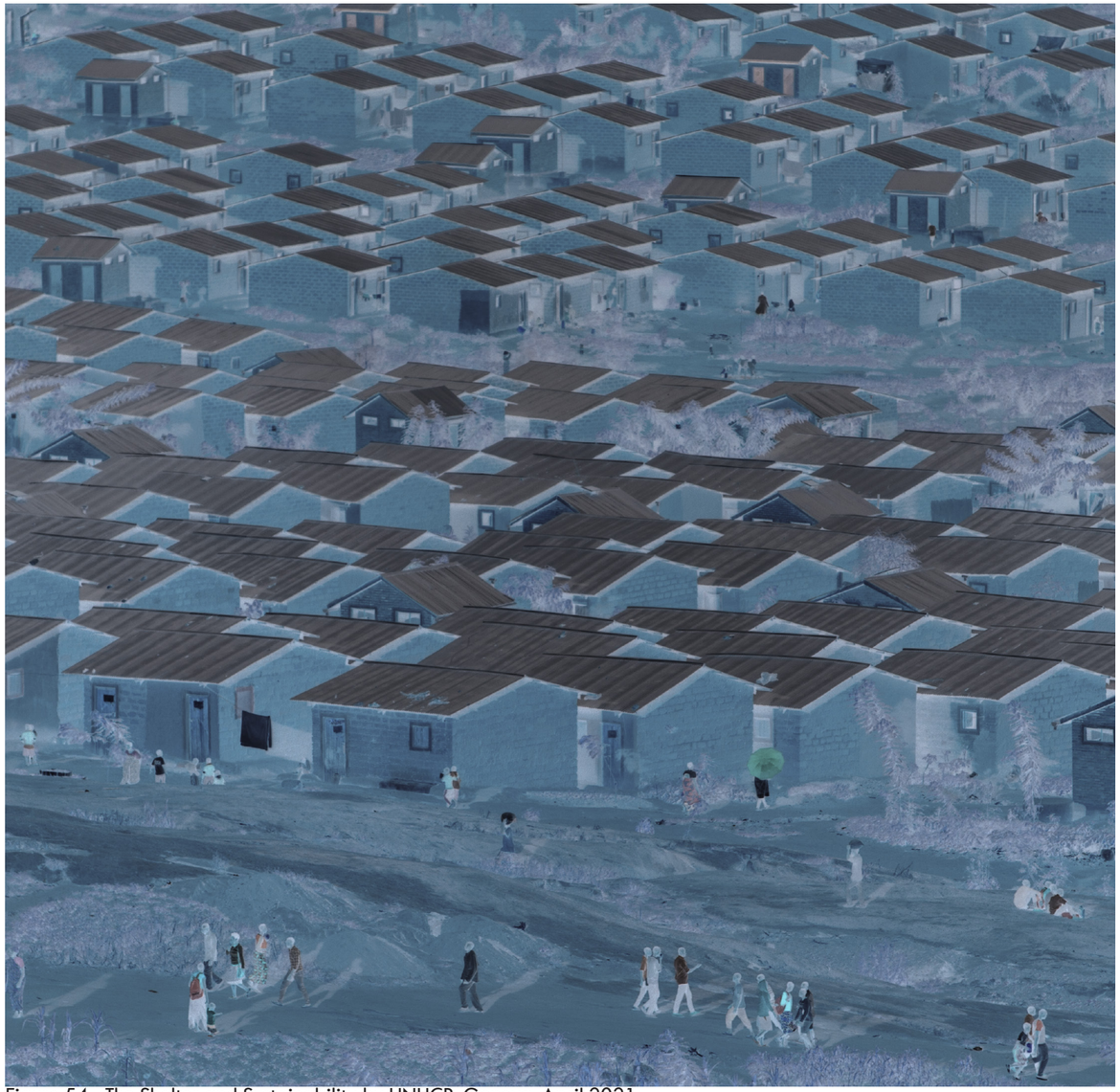


Figure 54 - The Shelter and Sustainability by UNHCR, Geneva, April 2021

Jintai Village Reconstruction Project

Rural Urban Framework / Sichuan, China / 2012

This village is located in Sinchuan, the area was struck by a massive earthquake in 2008. 5 million people were displaced. Most of the damaged buildings were completely collapsed.

Figure 55 - The large public square is lively during all weather conditions Photo by The Rural Urban Framework

Figure 56 - The roofscape blending with the landscape beyond Photo by The Rural Urban Framework

This project consist 22 houses and one community center. The design includes different types of houses for different family typology. The use of local materials, bio gas technologies, green roofs show the sustainable choices made for project.

Figure 57 - Jintai Village Reconstruction / Rural Urban Framework , photo by The Rural Urban Framework

Blooming Bamboo House

H&P Architects / Co Nhue, Tu Liem, Vietnam / 2013

Vietnam is exposed very often to natural disasters. This project aims a shelter that can stand to strong winds and earthquakes. The bamboo was chosen also because of its high tensile strength. It can be built easily and it is low cost. Bamboo beams were tied together, creating a frame. It can accommodate a family of 6 people.

Figure 58 - Perspective and detail of the fold down deck Photo by Doan Thanh Ha

Figure 59 - Interior perspective of the adaptable structure Photo by Doan Thanh Ha

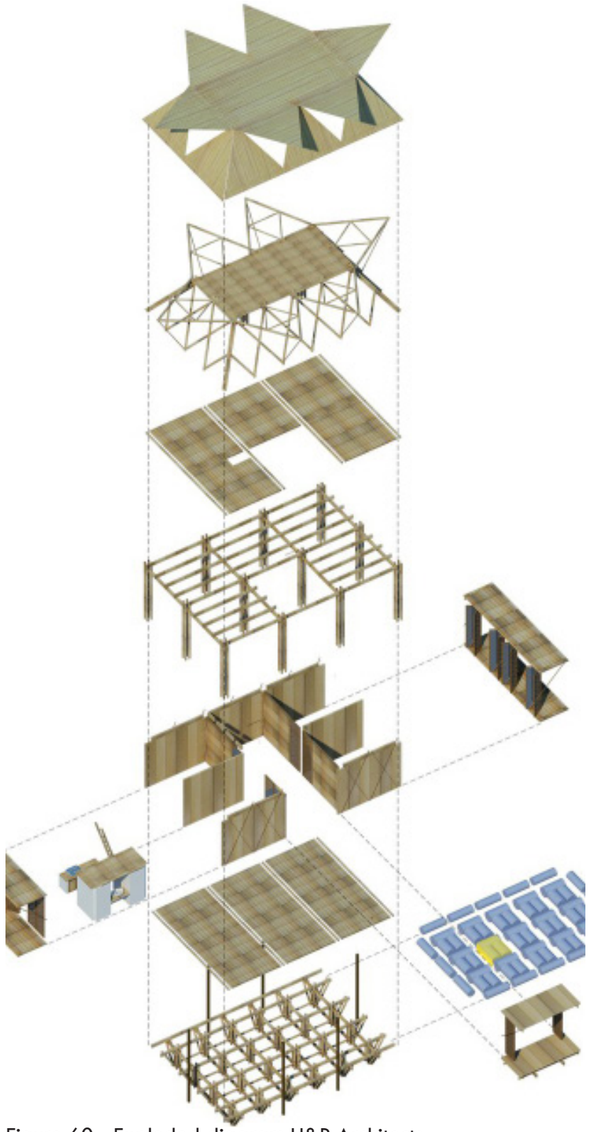


Figure 60 - Exploded diagram H&P Architects

INNOVATIVE SHELTER SOLUTIONS

EXO HOUSING UNIT

This shelter solution brings together the emergency design and technology. The company spent more than 1 year to develop a prototype.This units are brought to the site stacked inside to each other.The pods have 4 beds.But the problem is that this project is not flexible , and it is not very cheap. One Exo cost around 12.000$, an UN tent costs around 500 $. It is not possible to get all of these units if a very intense disaster strikes.(Inhabitat , Allison Leahy,2011)

Figure 61 - EXO Modular Units

THE TENTATIVE , DESIGNNOBIS

This project takes just 1 hour to assembly and there is no need for special tools. The each component is demontable and fits in a flat pack. Made by fiberglass shells and weather resistant textile.
Also in this shelter design there is a problem of manufacturing each component. This unit costs around 2.500$ (Fast Company, Diana Budds,2015)

Figure 62 - The Tentative Shelter

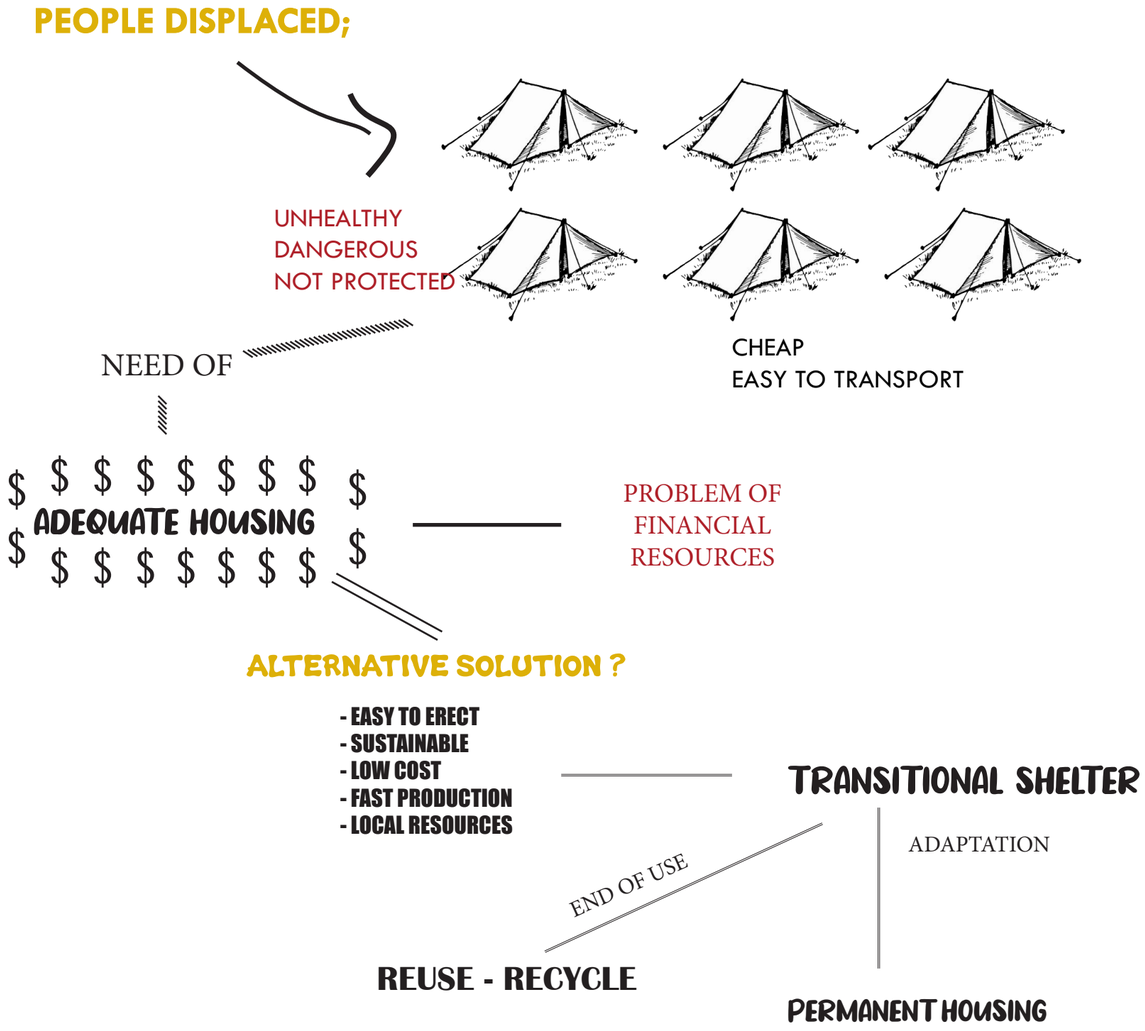


Figure 63 - The people in need of shelter scheme

THE CITY OF ISTANBUL

1999 MARMARA EARTHQUAKES

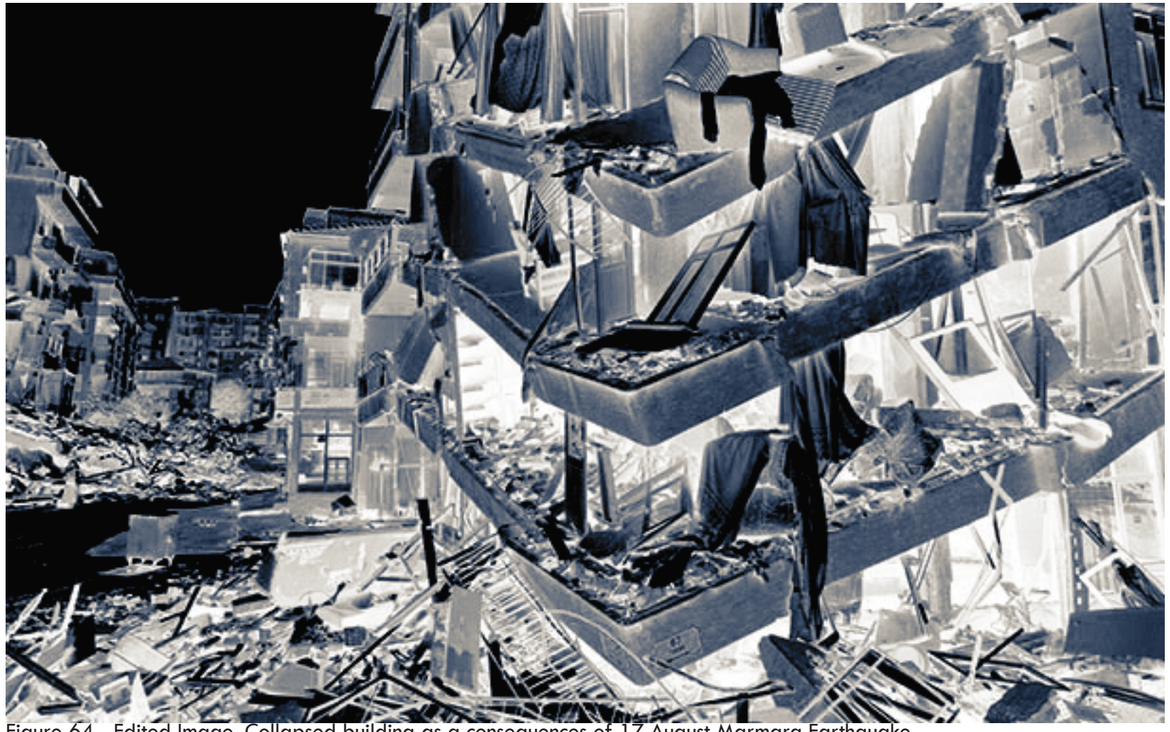


Figure 64 - Edited Image ,Collapsed building as a consequences of 17 August Marmara Earthquake

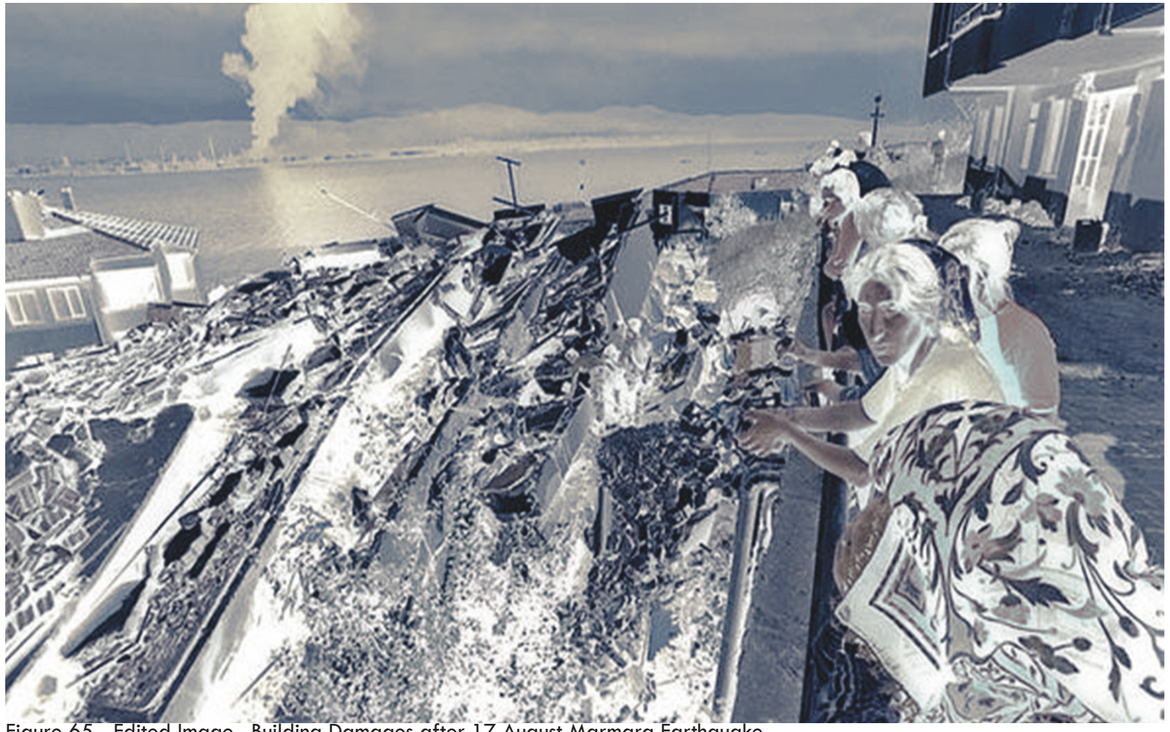


Figure 65 - Edited Image , Building Damages after 17 August Marmara Earthquake

The case study chosen is in Turkey in 1999 ,even that the tragic events happened 22 years ago it is still very important to understand the consequences occurred. Paradoxically in a transition of more than 20 years, the losses to be experienced in an earthquake higher than 7 magnitude will be almost the same. The rapid increase in population and low quality of the construction techniques are also responsible for the vulnerability of the city of Istanbul and therefore Istanbul is a perfect case study for further analysis.

Turkey due to its location and geological characteristics often has to face with natural disasters. The most frequent disaster happening in Turkey are earthquakes. Because it is located in the high risk earthquake zone. The quality of the built environment and rising population members, increases the fatality and destruction rate.

In August and November of 1999, the most devastating earthquakes in modern Turkish history, the Marmara and Düzce earthquakes, hit Turkey's Marmara region. Official numbers say over 17000 people lost their lives, while the unofficial estimates claim nearly double (Ganapati 2008; Jacoby & Özerdem 2008).

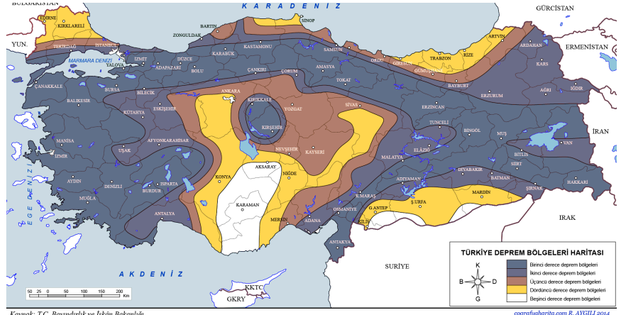


Figure 66 - The Map of earthquake zones in Turkey,1996,AFAD

MARMARA EARTHQUAKE

365.000
NUMBER OF DAMAGED BUILDINGS

112.735
HEAVY DAMAGED BUILDING

124.131
PARTIALLY DAMAGED BUILDINGS

128.042
LOW DAMAGED BUILDINGS

Figure 67 -Map of the Marmara Sea earthquakes analyzed in the study and main faults in the area. Credit: Faults retrieved from the GEM Foundation's Global Active Faults project by Miguel Neves

After the 1999 earthquakes Turkey has established a 3 step recovery strategy ;

1) Temporary Shelter
2) Temporary Housing
3) Permanent Housing

In the early response of the event tents with plastic sheeting had been used , also because of its cost and quick installation but they are not the most desirable option for the people in need. Some of the survivors had been placed in public buildings and others had stayed with their families and friends. But the first week, the documents are showing that people were living in their cars , on the roofs and also in the streets. For the upcoming winter plastic sheet tents were not enough , for this reason they were upgraded to winterised tents to keep the inhabitants warm and secure.

135,000 PEOPLE stayed in 101 tent camps

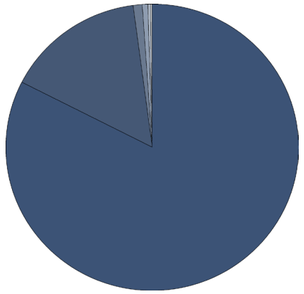
"In october 1999, the government of Turkey announced to provide 47,000 prefabricated temporary housing for the people affected. Turkey was able to provide the 42,000 temporary homes to families only in August 2000. But even after the temporary houses that were home to 150.000 people , more than 30,0000 people were staying still in emergency shelters."(Cassidy 2006)


Figure 68 - Image of people sleeping on the roof


Figure 69 - Image of injuried people in street

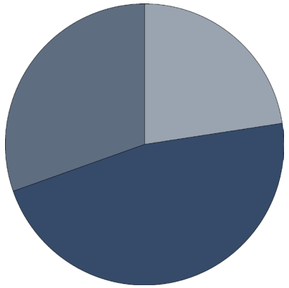

Figure 70 - Image of a tent city after Marmara earthquake

BUILDING DISTRIBUTIONS IN ISTANBUL ACCORDING TO CONSTRUCTION TYPES



- Steel - 0,20%
- Prefabricated - 0,30%
- Wood - 0,60%
- Tunnel Frame - 1%
- Masonry - 15,4%
- Reinforced Concrete - 82,5%

BUILDING DISTRIBUTIONS IN ISTANBUL BY YEAR OF CONSTRUCTION



- Before 1980 - 22,6%
- Between1980 and 2000 - 47%
- After 2000 - 30,4%

Figure 71 - Datas collected from Kandilli Rasathanesi ve deprem araştırma enstitüsü

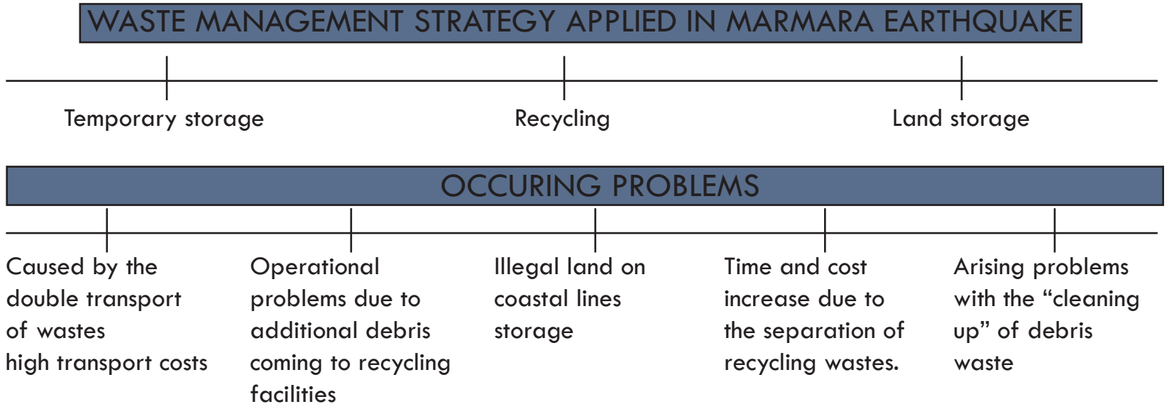


Figure 72 - Waste Management Strategies and Problems Occurred ,'Waste Management in Sustainable Disaster Management' by Ülker Aslı Güler, Natural Hazards Application and Research Center ,Journal of Natural Hazards and Environment

MANAGEMENT : Local Government Ministry (MPWS)overseeing Government and NGO involvement

PEOPLE AFFECTED : 300,000 homeless

TOTAL UNITS REQUIRED : 40, 621

COST PER UNIT: $US5000

LOCATION : Mainly Government owned land, some private leased land

Figure 73 - The Prefabric houses of Kızılay organization from https://www.cnnturk.com/ekonomi/turkiye/kizilay-prefabrik-evleri-kendisi-uretecek14-yil-4942801-haberi/

TIME TAKEN FOR PROVISION OF TEMPORARY HOUSING : 8 months

TIME OF OCCUPANCY WITHIN TEMPORARY HOUSING: Intended for 3 years, but extended to 6 years

MATERIALS : Local factory-made prefabricated panels and components some wood construction

THE TRANSITIONAL SHELTERS WERE ABANDONED IN THE SITE
IT TOOK 14 YEARS TO REMOVE THE SHELTERS.

Figure 74 - Image of prefabric shelters in Sakarya, Turkey from https://www.haberler.com/depremzedeler-icin-yapilan-prefabrikler-14-yil-4942801-haberi/

TENT

↓

PREFABRICATED UNITS

↓

REINFORCED CONCRETE PERMANENT BLOCKS

1999 EARTHQUAKES- SUM UP

Buildings were not resistant to earthquakes. No one was expecting such devastating consequences. It underlined the poor construction quality and techniques.

Communication failure for 48 hours. The telephone lines were not working.
Radio was the only communication method.

Lack of coordination,cooperation and communication. The rescuers came to some districts after 2 days.

At that time each city should had 50 to 150 rescue members , but it was way more less.

Lack of training of the response teams had worsen the situation, when they arrived to the disaster areas they did not know what to do. Lack of proper equipment was also an issue.

Search and rescue teams were not organised , they created dangerous situations especially for removing people under the rubble.

Turkey did not have national mitigation strategy.Legal insufficiency for management made the country more vulnerable.

The Marmara earthquake showed success of the concept of volunteering in Turkey. Many volunteers and organisations were active in every phase of the disaster and they tried to accomplish everything that local authorities couldn't do.Volunteers help for the rescue and search , providing aids and essential needs.

Traffic was one of the main issues. Volunteers, aid organisations couldn't arrive to areas on time. The families that couldn't reach to their families and friends were trying to go to disaster zones to have an information on the survivors.
The aids reach to the disaster site after 5 days ,for this reason the research and rescue teams were made by the volunteers.

There was a need for organizational structures. The most tents were provided from Turkish Red Crescent but still it were not enough.The distribution of food , water , clothes were also depending on Turkish Red Crescent and volunteers.

The damage analysis had started around the second week. Inadequate damage assesment caused people to return their home and some of these were collapsed with an second earthquake in november.

Tents were not adequate, they were lacking of infrastructure and basic services.

Insufficiency of green areas and open areas, forced to place tent cities away from the city.

Survivors were experiencing post trauma , they did not want to go back to live in concrete buildings, they preferred to stay in temporary shelters.

TURKEY

The Geographical Context

Figure 75 - Satellite Images, Turkey
Google Earth Pro

Turkey is located between Europe and Asia.It surrounded by Aegean sea in west, Mediterranean sea in south and Black sea in the north. Through centuries it was always an important node for history, trade,diverse cultures, beliefs. Turkey has a population of 83.2 million people (2020) and has three major urban centers ; Istanbul , Ankara (capital), Izmir. Turkey due to its location and geological characteristics often has to face with natural disasters. The most frequent disaster happening in Turkey are earthquakes. The quality of the built environment and rising population members, increases the fatality and destruction rate.

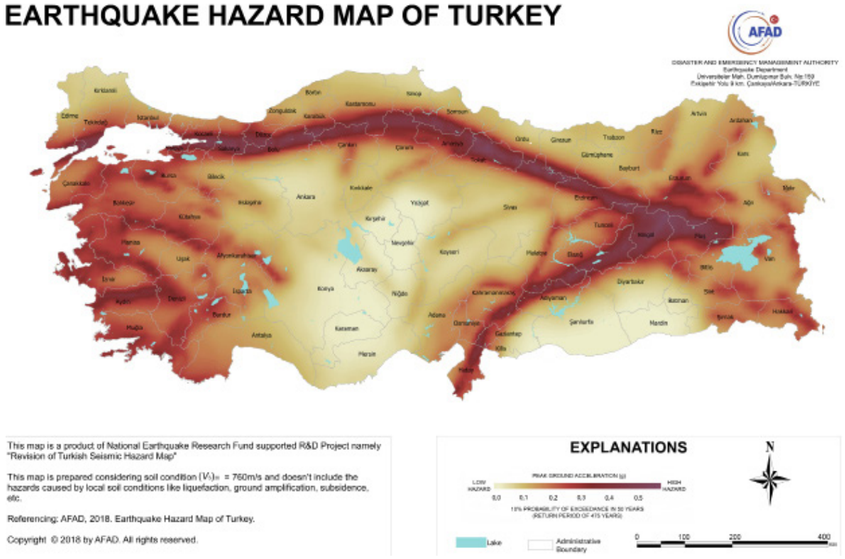


Figure 76 - Earthquake Hazard Map of Turkey, AFAD, 2018

This map is the latest updated version of the earthquake hazard map of Turkey.

However, this map prepared by considering just the soil condition in the country.

For further analysis it is important to produce a map , considering all the vulnerable characteristics of Turkey.

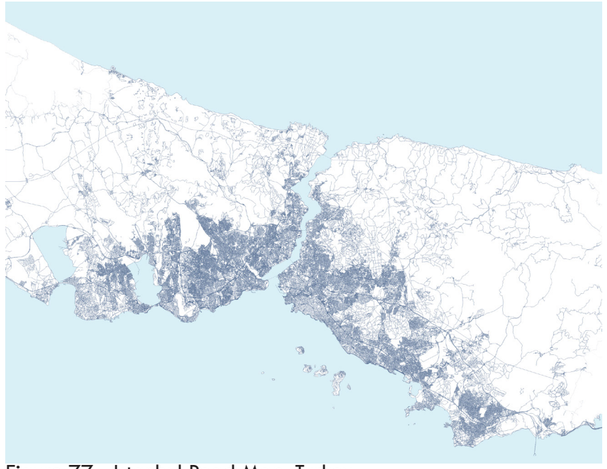


Figure 77 - Istanbul Road Map, Turkey

'The country is among the world's most seismically active zones as it is situated on several active fault lines, with the most potentially devastating being the Northern Anatolia Fault (NAF), the meeting point of the Anatolian and Eurasian tectonic plates.' (Istanbul districts face imminent earthquake danger ,Daily Sabah)
Consequences of the exposure rate to the hazard and dense population makes Istanbul very vulnerable. And the built environment quality worsens the situation.

Figure 78- Satellite Images, Turkey
Google Earth Pro

NAF is an active fault over 2000 years. Most of the Marmara region and industrial cities are situated on the NAF.

Through the years Istanbul faced several intense earthquakes and was damaged severely.

THE DISASTER MANAGEMENT IN TURKEY

"Through the years Turkey has faced several intense natural disasters that caused many loss of life, economical losses and destruction of properties. Earthquakes from past to present are the most common natural events encountered in Turkey. Therefore the disaster management policies dated back to Ottoman Empire. On 14 september 1509, Istanbul was hit by an earthquake , that caused more than 13.000 fatalities and thousands of property losses. The ottoman empire had issued an edict to give 20 coins to each house hold to repair or rebuild their properties." (Kemaloglu,2015)

In history of Disaster Management in Turkey, it is possible to distinguish disaster management phases into four periods;

1) Before 1944
2) Between 1944 and 1958
3) Between 1958 and 1999
4) After 1999

BEFORE 1944

1509 ISTANBUL EARTHQUAKE

Regulations;
- Donation of 20 gold coins.
- Construction of timber buildings.
- Ban of construction on filled lands.

Turkish Red Crescent Society was founded in 1868

1939 ERZINCAN EARTHQUAKE

- Law on "Relief to be Provided to people affected by the earthquake in Erzincan"
  a) Elimination of taxes.
  b) Lands and building materials without any cost.

The Construction and Devolopment Authority was founded.

1944 - 1958

1944 GEREDE EARTHQUAKE

- Law "Measures to be taken Prior or to Post Earthquakes.
- 1945 Seismic Regions Map and Regulation on Buildings in Seismic Zone.

1944 KARLIOVA EARTHQUAKE

Earthquake Burceau was founded in 1953

- Law "Rules for the planning and construction of residential areas" ; The risk of natural disasters was corparated in the planning and supervision.

1958 - 1999

- 1958 "The Civil Defense Law"
- 1959 Law "Measures to be taken in Response to Disasters" law in the international level. Aims to minimize, the loss of life and property, establishing organizational structures during and after.

The General Directarate of Disaster Works was founded in 1965.

1966 VARTO EARTHQUAKE

- 1968 "Emergency Relief Organization and Planning Guidelines for Disasters"

1970 GEDIZ EARTHQUAKE

1971 BINGOL EARTHQUAKE

- 1972 LAW NO. 1571

1975 LICE EARTHQUAKE

- 1977 LAW NO. 2090
- 1981 LAW NO. 2479
- 1983 LAW STATE OF EMERGENCY

1983 ERZURUM EARTHQUAKE

- 1985 LAW NO. 3194 " Construction/ Development"
- 1988 LAW NO. 12777 " Regulation on Emergency Response and Planning Principles for Disasters

1992 ERZINCAN EARTHQUAKE

- 1995 LAW NO. 4123

1995 DINAR EARTHQUAKE

- 1997 Law "Crisis Management Center of the Prime Minester" defines organizational structure as well as guidelines and responsabilities.

1998 ADANA - CEYHAN EARTHQUAKE

'Regulation on Buildings to be Built in Disaster Prone Areas '

AFTER 1999

1999 MARMARA EARTHQUAKE

1999 DUZCE EARTHQUAKE

- Law "Measures to be taken against Natural Disasters and Compensation for losses resulting from disasters.

Turkish General Directorate of Emergency Management and The Natural Disaster Insurance Agency was founded.

- LAW NO. 574, 575, 576, 580, 584, 586, 587
- 2000 LAW NO. 454, 593, 595, 596, 597, 598, 599
- 2001 LAW NO. 4708 " Law on Building Inspection
- LAW NO. 24600 " Decree on Working Procedures and Principles of Natural Disasters Insurance
- 2006 LAW NO. 23098 Decree on Design Principles for Buildings in Disaster Regions

2009 Disaster and Emergency Management Presidency was founded.

- LAW NO. 5902 ' Disaster and Emergency Management , The organization and the responsabilities of the Presidency
- 2011 LAW NO. 5902 " Disaster Risk Reduction Platform" was established.
- 2012 LAW NO. 6306 " Disaster Risk Reduction Strategies, Urban Renewal of disaster risk areas
- 2013 Disaster and Emergency Response Services Regulation
- 2014 Turkey Disaster Response Plan (TAMP)
- 2016 Provincial Disaster Response Plans
- 2019 Revision of the TAMP

Source : AFAD
Özden, A. T. (2013: 33), Architecture and Disaster

SUM UP

BEFORE 1944;

Mainly disaster response activities , including reconstruction very limited improvement policies and strategies; fragmentary planning and post-disaster approaches.

1944-1958 ;

Mainly post-disaster policies (response and recovery-oriented approaches) very limited and initial level pre-disaster studies:
Establishment and settlement of the traditional disaster management model.
Tendency to attribute disasters to Divine power and destiny.

1958 - 1999 ;

Mainly post-disaster policies (response and recovery oriented approaches) developing but insufficient and unintegrated pre-disaster studies: the traditional disaster management model evolving towards the understanding of connecting disasters to natural events, the beginning of the concept of the Protective State.

AFTER 1999 ;

Transformation in post-disaster policies (more effective and sustainable intervention, recovery and reconstruction approaches)
Disaster Transformation in pre-disaster policies (avoidance and preparedness approaches gain importance)
Pre-disaster and post-disaster strategy and efforts to consolidate policies:
The beginning of a transformation towards disaster risk management understanding,
The development of the understanding that disasters are both natural and human-induced, from the understanding of the remedial state to the understanding of the protective state.

Source : Özden, A. T. (2013: 33), Architecture and Disaster: A Holistic and Risk-Based Building Inspection Professional Training Model for Practicing Architects in Turkey.

Turkey Building Earthquake Regulation;

Have been revised in 1947, 1953, 1961, 1968, 1975, 1998 ,2007 and 2018.
In these prepared regulations, the minimum conditions required for the earthquake resistant design and construction of buildings are given, taking into account the earthquake zone and ground characteristics of the building.
From 1963 to 2018 Turkey has issued 10 development plan. However the disaster policies were mentioned very inadequately in these plans.

After 1999 earthquakes , 38 laws and 6 regulations were issued. Bur most of them was about the post disaster and reconstruction phases.

The laws included after 1999 earthquake;
- Coordination decisions for the new settlements
- Insurance system that is a must for everyone.
- Creation of new provinces, countries and metropolitan municipalities, affected by the earthquake for 10 months.
- Assessing damage
- Construction of prefabricated and permanent housing.
- Search and rescue teams with local authorities involved

1999 Earthquakes that caused great loss of life and property but it has also been a milestone in terms of disaster management in Turkey. For the first time in Turkey a strategy change occurred. Legal arrangements were made for prepadness, response, recovery.

“This devastating disaster clearly demonstrated the need to reform disaster management and compelled the country to establish a single government institution to single-handedly coordinate and exercise legal authority in cases of disaster and emergencies. In line with this approach, the Turkish Parliament passed Law No.5902 in 2009 to form the Disaster and Emergency Management Authority (AFAD) under the Prime Ministry” AFAD.

This diagram represents the change of emergency approach by the Turkish Government. In the previous disasters he authorities understood that the preparedness and risk asssesment is essential . The remedial state is unorganized, deals with the problems when they occur but the protective state , protects their citizens from the beginning of the emergency.

The protective state has already funds for these situations , their community is prepared , the rescue teams and organisations had already made their plans in order to minimize the impacts. The Turkish government has some studies and analysis for the pre disaster phase but yet it is not sufficient.

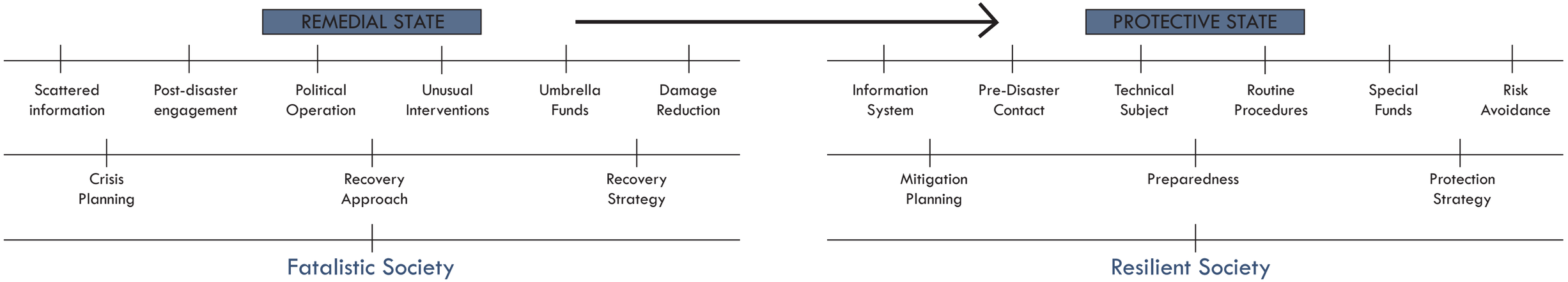


Figure 79 - Source : Balamir, M. (2002: 40), 'Painful Steps of Progress from Crisis Planning to Contingency Planning: Proposed and Realized Changes for Disaster Preparedness in Turkey', The Journal of Contingencies and Crisis Management

AFAD

Disaster and Emergency Management Authority, it is an institution aims that to be prepared, to minimize disasters impact and to be more efficient and organized through all of the phases. After the AFAD was founded Turkey had started to transform from a remedial state to a protective state.

Turkey has 81 provinces and AFAD has operation centers on all of those provinces.

"AFAD developed its first strategic plan for the 2013–2017 period. The Strategic Plan(TAMP) 2013–2017, which served as a roadmap in shaping the future of the institution." (AFAD STRATEGIC PLAN 2019-2023)

"Enhancing public resilience will minimize the effects of disasters and the resulting damage, as well as the length of time it takes a community to recover after a disaster. AFAD established its mission based on this perspective. In the new period, however, it was decided to update its mission taking into consideration the duties and responsibilities imposed on AFAD by Presidential Decree No. 4. At the focus group meetings and at the senior management meeting, it was decided to change the mission. Accordingly, the mission of the institution for the period 2019–2023 was defined as to "Engage in the efforts required for the effective management of processes relating to disasters and emergencies, to ensure coordination among the relevant institutions and agencies, and to formulate policies in this field." (AFAD STRATEGIC PLAN 2019-2023)

Turkey is a country that is a vulnerable for all the types of disasters, for the years Afad has worked on disaster such as floods, fires , landslide etc.
AFAD is still improving but there are some missing strategies , and coordination issues. The authorities needs to work more on the building laws and for the prepadness.

Strategic Plan has four main topics ; Risk Management, Disaster Prepadness , Disaster Management , Intervention. Each of this topics has their own gools to deal with the disasters. As we mentioned before Turkey changed its approach to become a disaster prepared country. For this reason it starts with the risk management in order to minimize the impacts even before a disaster occurs. The community should be educated to ensure to be prepared. After the disaster occurs the coordination and financial sources should be managed delicately.
For minimizing loss of lifes response and rescue teams should be on the site immediate after. The recovery phase needs to be controlled very well in order to be fast but successfull. The cities and the inhabitants should be able to go back their usual life as soon as possible.

THE DISASTER MANAGEMENT STRATEGY AND RESPONSE PLAN OF TURKEY

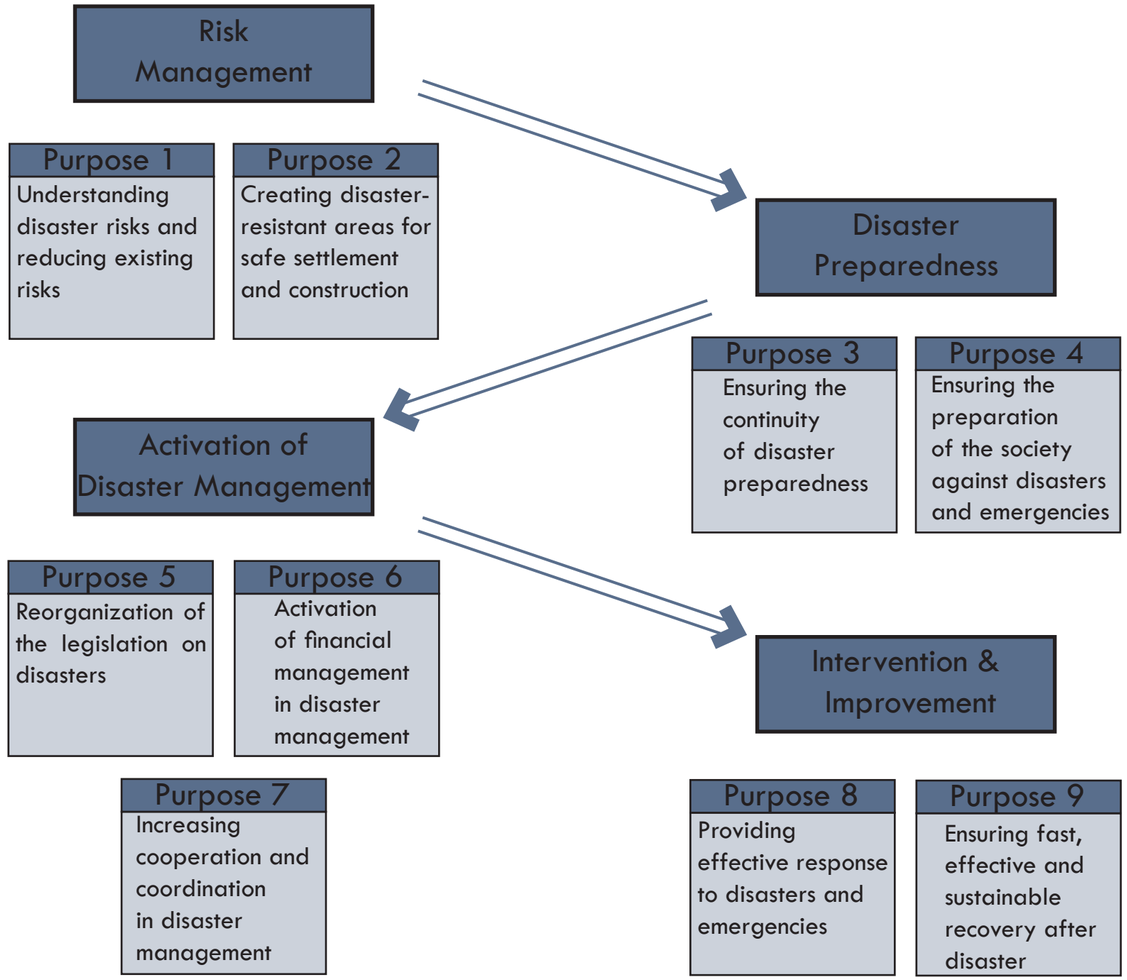


Figure 80 - Source : Balamir, M. (2002: 40), 'Painful Steps of Progress from Crisis Planning to Contingency Planning: Proposed and Realized Changes for Disaster Preparedness in Turkey', The Journal of Contingencies and Crisis Management

2020 IZMIR EARTHQUAKE

On October 30, 2020, at 14.51 an earthquake with a magnitude of 6.9 occurred in the Aegean Sea. The epicenter was in Seferihisar, off the coast of Izmir. 24 buildings in Izmir were destroyed, 449 buildings were heavily damaged, 511 buildings were moderately damaged.

AFAD was one of the first institutions that arrived to the disaster area. Immediate rescue works in the zone were carried out by the local people, right after the earthquake. AFAD, which was in the field from the first moment of the earthquake until the debris was removed, provided active coordination in the search and rescue efforts in the region and managed the process in the best way.

In order to meet the urgent need for shelter, AFAD provided 960 tents, 6 general purpose tents, 4500 blankets, 3672 beds, 3000 pillows and 3000 sheet sets; 2,049 tents, 51 general purpose tents, 6,888 beds, 16,050 blankets and 2,657 kitchen sets were shipped by the Turkish Red Crescent. In addition, 113 personnel, 144 volunteers, 5 catering vehicles, 5 mobile kitchens and 83,480 supplies (catering and beverages) were sent to the region by the Turkish Red Crescent.

In the crisis management process, it was found that the social media's features of announcing/informing, developing interactions, revealing reactions, symbolizing and bringing individuals together came to the fore.

However , the damage was not big as the Marmara Earthquake , this is one of the reasons that response teams succeeded. Disaster management/intervention type plans prepared under the coordination of AFAD was insufficient and could not be applied beyond the success in search and rescue activities.

Analysis done on urban risks in the current zoning legislation described, but requirements are not fulfilled by the relevant public institutions.

For safe cities, it is necessary to accelerate urban transformations to provide safe housing. As a matter of fact, some of the buildings that were destroyed and severely damaged in the Izmir earthquake were built a few years ago clearly shows how important security centered housing and urban transformations are.

Source: IZMIR AFAD (2020)
https://izmir.afad.gov.tr/izmir-seferihisar-depremi---duyuru-23-31102020---1415

PRESENT EMERGENCY COORDINATION ISSUES

There is a lack of education before the disaster.

Disruptions in communication after the disaster occurs.

Survivors are insecure due to the unknown emergency assemble areas.

Gathering and shelter areas created insufficient in terms of infrastructure and security.

Emergency roads are not predetermined.

Assembly and accommodation areas not defined and lack of clarity is an issue.

The number of staff still not at desired level.

In places where tent cities will be established the services relevant municipalities not sufficiently utilized ; such as electricity, water etc.

The unrelevant people going to the disaster zones causes problems.

Multi-headed and irregular management is very common in disaster areas and tent cities.

Search and rescue and other aid teams, due to the lack of Covid-19 measures are vulnerable.

POSSIBLE EARTHQUAKE SCENARIO - ISTANBUL

The residents of Istanbul are in constant fear for the eartquake. The expected Istanbul earthquake is always in our agenda and on our news. Because of the bad quality in construction techniques most of the people are in danger. And still we don't have adequate preparedness for the disaster. Istanbul since the mid 1900 has grown rapidly and this caused unregulated development and uncontrolled urban sprawl. The city needed immediate housing solutions and this led to construction of unsafe buildings. Even if you now that your home has high antiseismic characteristics , you are not safe , for example your doctors office might be in danger or your office or the coffee shop you visit every morning. Turkey yet has not have any early warming systems and should definitely work on it.

Figure 81 -Gecekondu slum in Ankara, Turkey

Analysis shows that the seismic activities are on the rise in the North Anatolian Fault.
"Earthquake researchers predict there is a 95% chance that an earthquake of magnitude 7.0 or stronger will strike the city within the next 70 years." (Tessa Fox,Reuters, 2020)

The habitants know that their homes could easily be destroyed by an earthquake. But unfortunately they can not afford to move in to a secure building.

IS ISTANBUL READY FOR THE NEXT EARTHQUAKE?

Figure 82-83-84-85 Newspaper Headlines in Regional Newspapers

POSSIBLE DAMAGED BUILDING DISTRICTS FOR
MW = 7.5 SCENARIO EARTHQUAKE IN ISTANBUL

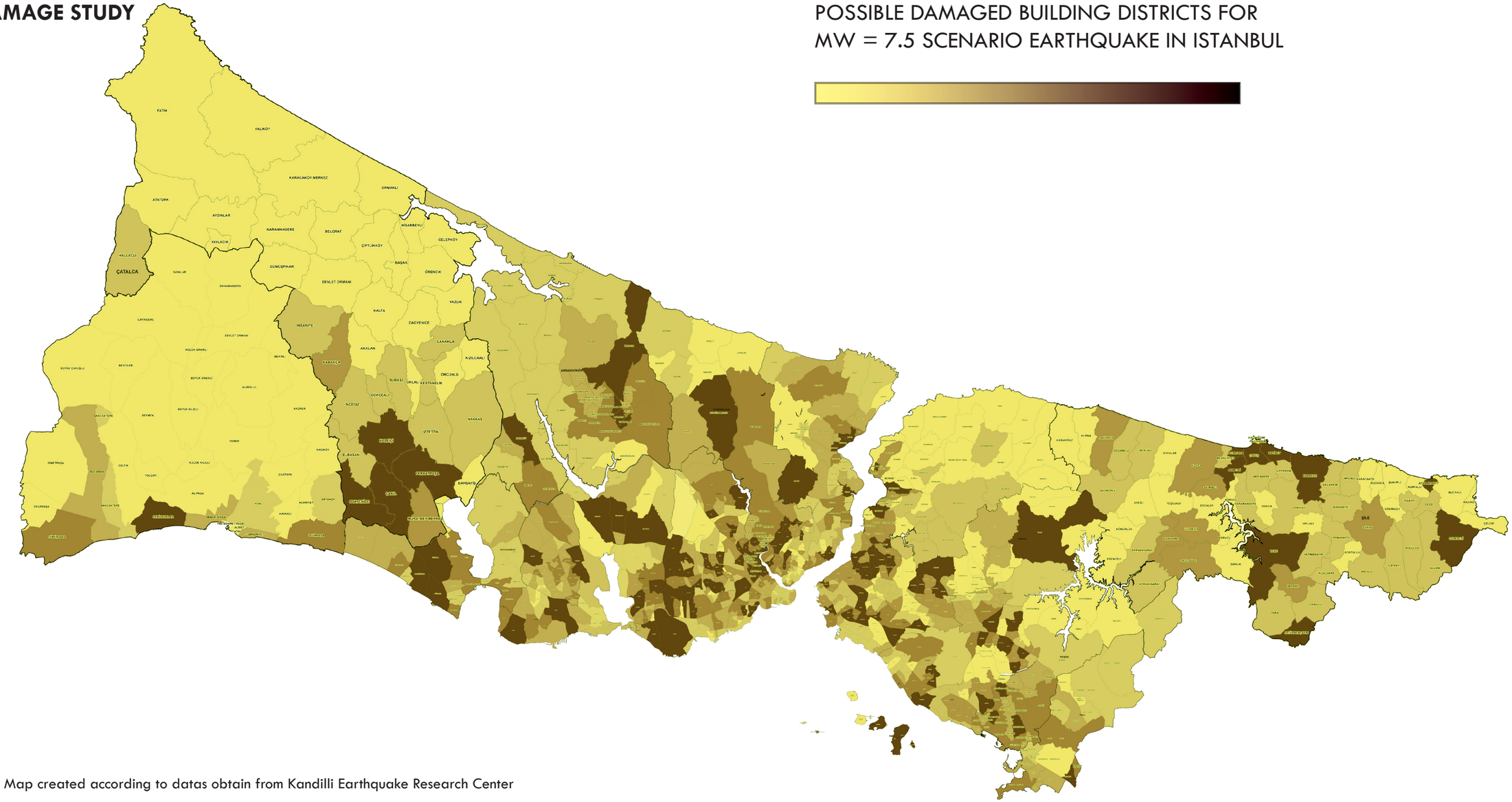


Figure 86 - Map created according to datas obtain from Kandilli Earthquake Research Center

THE DAMAGE STUDY

POSSIBLE HEAVY DAMAGED BUILDING DISTRICTS FOR MW = 7.5 SCENARIO EARTHQUAKE IN ISTANBUL

LOW HIGH

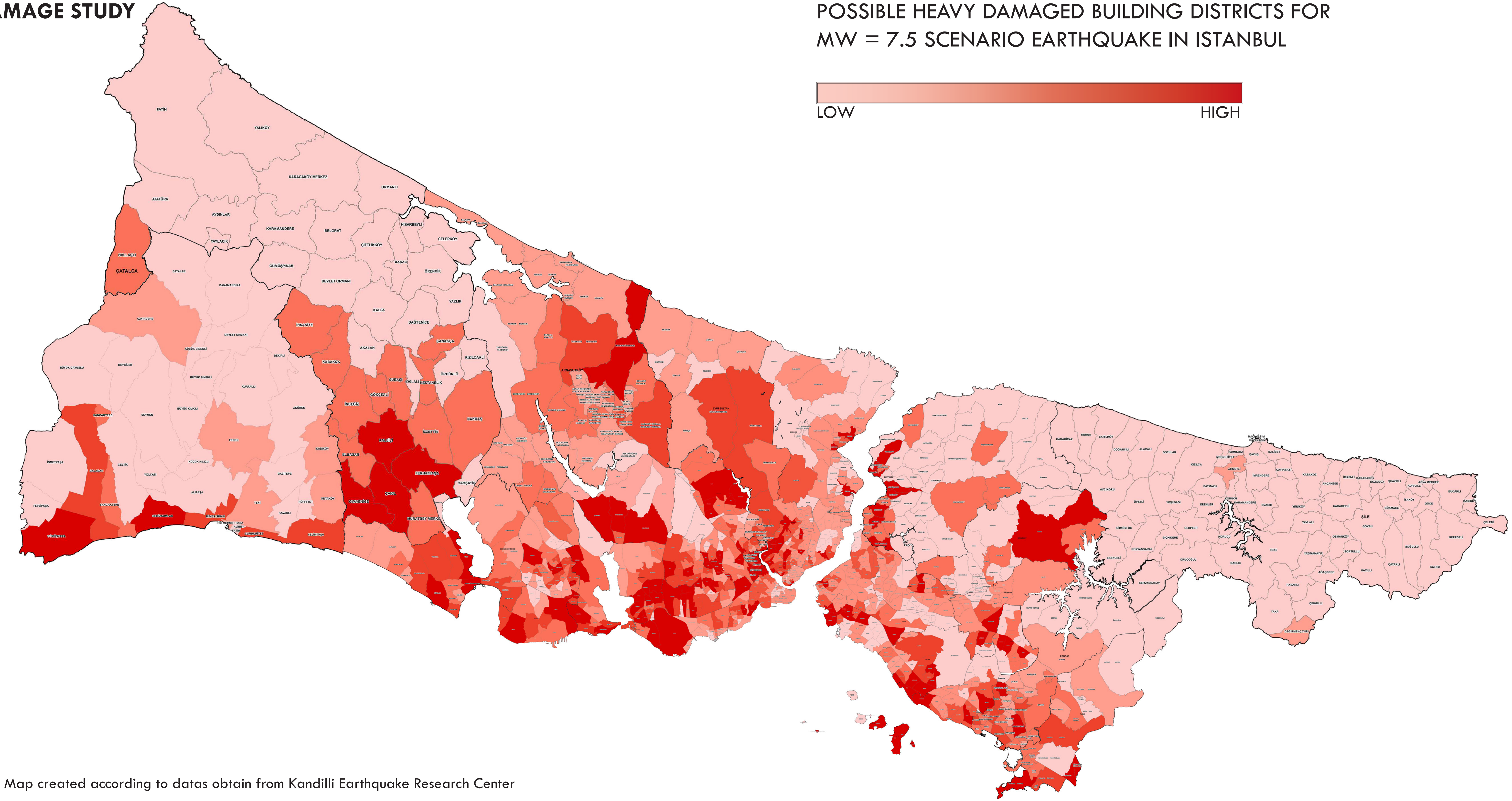


Figure 87 - Map created according to datas obtain from Kandilli Earthquake Research Center

POSSIBLE SHELTER NEEDED AREAS FOR
MW = 7.5 SCENARIO EARTHQUAKE IN ISTANBUL

LOW HIGH

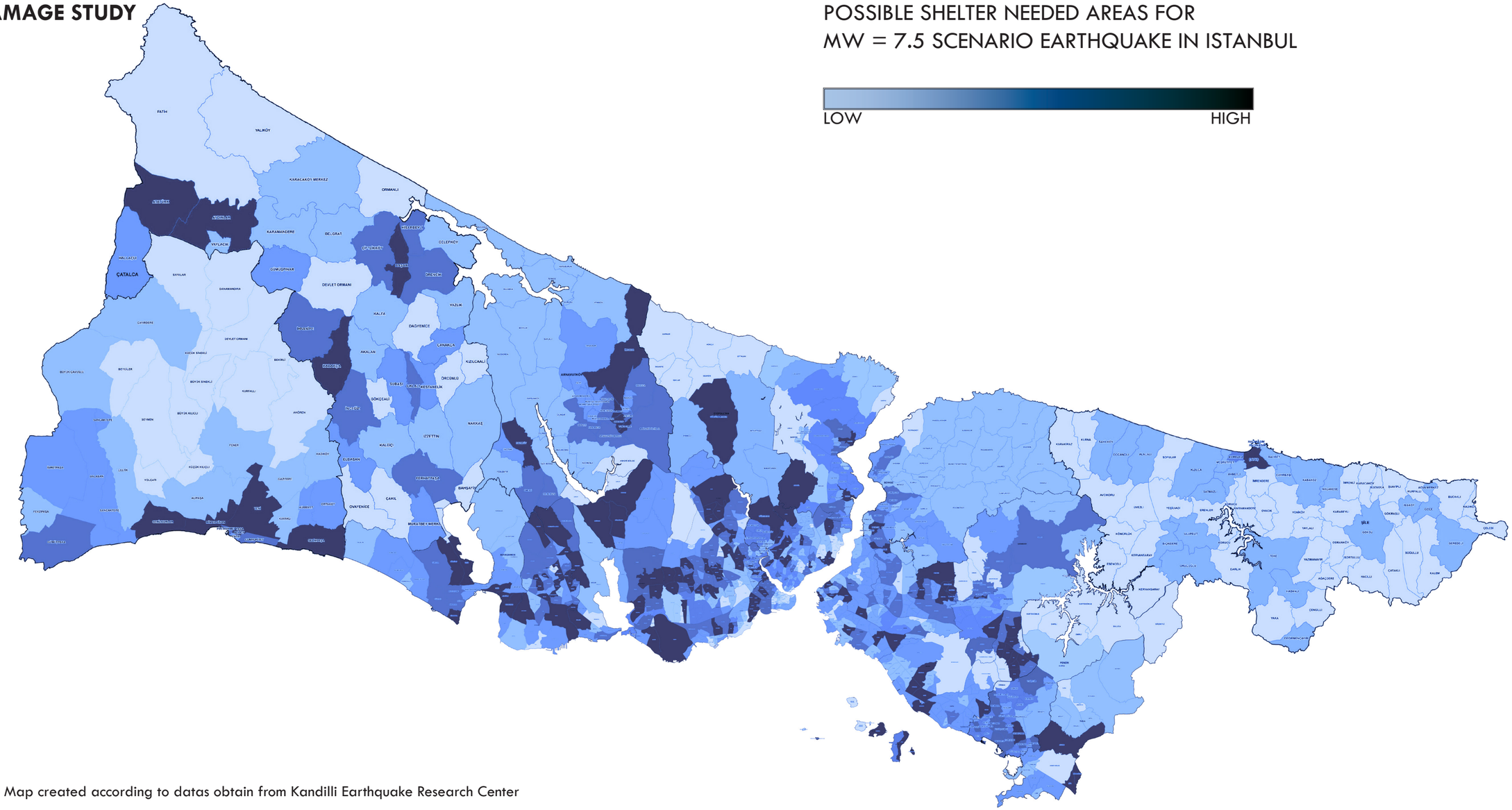


Figure 88 - Map created according to datas obtain from Kandilli Earthquake Research Center

THE LOCATION STUDY - ISTANBUL

The megacity Istanbul is located in the northwest of Turkey.After 1970's , with the beginning of industrialiazation, it become a the center of industry , culture , trade with many job oppurtunities. Thus from other cities people began to migrate to Istanbul. Nowadays it is the most populated city in Turkey.

The city is situated in two continents; Asia and Europe.
"Istanbul's climate is usually warm and dry in summer and cold and wet in winter. Istanbul contains many hills and valleys topographically. Thus, Istanbul's temperature and precipitation are changed from one side to the other." (Toros,Abbasnia,Sagdıç, Tayanç,2017)

"There is more rainfall in the winter than in the summer in Istanbul. The average temperature in Istanbul is 14.9 °C . The annual rainfall is 728 mm. The driest month is August, with 24 mm of rainfall. With an average of 107 mm the most precipitation falls in December.
The warmest month of the year is August, with an average temperature of 24.6 °C. January has the lowest average temperature of the year. It is 6.0 °C. The difference in precipitation between the driest month and the wettest month is 83 mm. During the year, the average temperatures vary by 18.6 °C. On average there are 99.59 hours of sunshine per month."(Climate-data.org)

	January	February	March	April	May	June	July	August	Septem-ber	October	November	December
Avg. Temperature °C (°F)	6 °C (42.9) °F	6.5 °C (43.8) °F	8.5 °C (47.3) °F	12 °C (53.6) °F	16.9 °C (62.5) °F	21.7 °C (71) °F	24.3 °C (75.8) °F	24.6 °C (76.3) °F	21.1 °C (69.9) °F	16.4 °C (61.5) °F	12.2 °C (54) °F	8.1 °C (46.6) °F
Min. Temperature °C (°F)	3.8 °C (38.8) °F	4.1 °C (39.4) °F	5.5 °C (42) °F	8.5 °C (47.4) °F	13.4 °C (56.1) °F	18.2 °C (64.7) °F	20.9 °C (69.6) °F	21.7 °C (71) °F	18.3 °C (64.9) °F	14 °C (57.3) °F	9.9 °C (49.9) °F	6 °C (42.8) °F
Max. Temperature °C (°F)	8.2 °C (46.8) °F	9 °C (48.2) °F	11.4 °C (52.5) °F	15.4 °C (59.7) °F	20.3 °C (68.6) °F	25 °C (77) °F	27.7 °C (81.9) °F	28 °C (82.4) °F	24.1 °C (75.3) °F	18.8 °C (65.9) °F	14.6 °C (58.2) °F	10.2 °C (50.3) °F
Precipitation / Rainfall mm (in)	88 (3.5)	75 (3)	75 (3)	50 (2)	38 (1.5)	35 (1.4)	26 (1)	24 (0.9)	52 (2)	80 (3.1)	78 (3.1)	107 (4.2)
Humidity(%)	79%	77%	75%	75%	73%	70%	69%	69%	70%	75%	77%	78%
Rainy days (d)	10	9	8	6	5	4	3	3	5	7	8	10
avg. Sun hours (hours)	5.0	5.8	7.4	9.4	10.8	11.8	11.7	10.6	9.1	6.9	6.0	5.0

Figure 89 - WEATHER BY MONTH // WEATHER AVERAGES ISTANBUL

Figure 90- WEATHER BY MONTH // WEATHER AVERAGES ISTANBUL

THE LOCATION STUDY - ISTANBUL ATATURK AIRPORT

From the satellite image it easy to observe that there is no vacant places in the urban center.
In a scenario of 7.5 magnitude earthquake , the shelter accomadation points will be crucial , as seen before, the centrality and the accessibility of emergency shelters is a important issue. There are some green areas and forests in the suburbs of Istanbul but it is more convenient to use an abandoned area, or vast parking areas also Istanbul is lacking very much green areas for this reason the destruction of green areas should be our last option to position our emergency shelters.

The only alternative area to accomadate our emergency shelters is former Istanbul Atatürk Airport.

Figure 91 - Satellite Images, Istanbul /Turkey
Google Earth Pro

Istanbul Atatürk Airport is located in the center of Istanbul. Since 2019 the airport is closed to the flights. Thus the area has several buildings, plane roads and the main airport. This area is a perfect area to reuse the abondoned territory for an efficient use.
Urban planning of the area becomes crucial at this point. Istanbul needs more green areas and more open spaces because of the urban sprawl.

Why not to use it also for emergency situations?

The area is larger than 8.000.000 m2. As we know from the previous shelter cases, the centrality was always an issue. In the scenario of 7.5 magnitude earthquake in Marmara Region. The districts near to the area are more vulnerable, and probably these districts will have severe impacts. To accomadate the survivors there is no better area, also because of the water infrastructure. Our goal is a transitional urban project that in the emergency phase can be used immediately.

STRENGTHS	WEAKENESSES
- In a central location - Easy accessibility - Having large and developed hospitals nearby - Having social facilities nearby - Access by seaway is possible	- Wide roads , but lack of green areas - The inadequacy of the infrastructure - The area is very vast but is not enough to accomada-te all displacement people.

OPPORTUNITES	THREATS
- A wide and flat area, thus reducing the cost and difficulty of the project - Maximise the site's sustainability potential. -Land is suitable to spread the project.	- Becoming a residential zone - A region with high seismic values

Unfortunately, even the area is very vast it is not enough to accomadate all the survivors who lost their homes in Istanbul.Our analysis amd researches showed us that more than 330.000 emergency shelter units will be needed.The main buidings of the airport can be used also for sheltering. But still it is not enough in this case some of the survivors should been trasferred to other cities near by to accomadate. Public buildings such as schools , gyms should have to be used to face the displacement crisis.

THE LOCATION STUDY - ISTANBUL ATATURK AIRPORT

Figure 92 - Map of districts of Istanbul , Turkey

The districts near to the Istanbul Aırport is chosen and analysed.
The districts chosen are ;

- AVCILAR - BAGCILAR - BAKIRKOY - GUNGOREN - KUCUKCEKMECE - ZEYTINBURNU

THE POSSIBLE TOTAL NUMBER OF SEVERE DAMAGED BUILDINGS : 8644
THE POSSIBLE TOTAL NUMBER OF VERY SEVERE DAMAGED BUILDINGS : 3903
THE POSSIBLE TOTAL NUMBER : **12.547**

THE AVERAGE NUMBER OF UNITS : **6**
THE POSSIBLE SHELTER UNITS NEEDED : **75.282**
THE POSSIBLE TOTAL NUMBER OF PEOPLE : 301.128

THE AVERAGE SQM OF AN EMERGENCY SHELTER : 30 sqm
THE SQM WILL BE NEEDED FOR EMERGENCY SHELTERS (ROADS NOT INCLUDED) : **2.258.460 sqm**

THE POSSIBLE REUSE OF ATATURK AIRPORT

The government is thinking possible reuses of the Atatürk Airport but still there are no decision made . But probably it will be reused as an urban park.

Figure 93 - Render of possible urban park , ISTANBUL ATATURK AIRPORT

Our aim is to leave an area vast to have an space for emergency situations that it can be used for events, concerts, recreational areas.

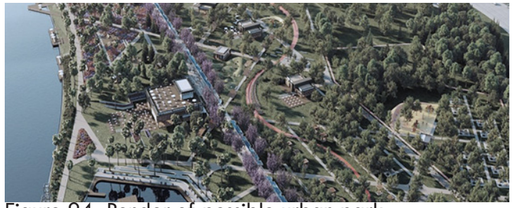


Figure 94- Render of possible urban park , ISTANBUL ATATURK AIRPORT

THE GOVERNMENT PROPOSAL

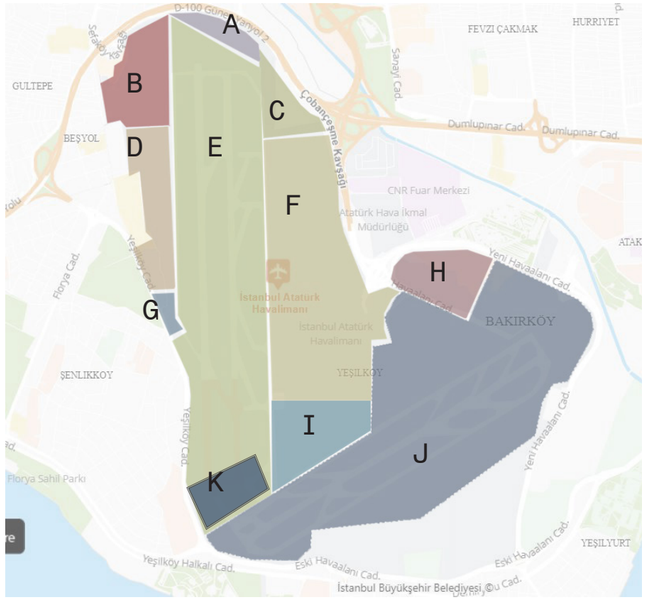


Figure 95 - Possible repurpose of area, ISTANBUL ATATURK AIRPORT

A - EMERGENCY ASSEMBLY AREA
B- YOUTH CENTER
C- WELNESS CENTER
D- MUSEUMS/GALLERIES
E- RECREATION AREA
F- MUSEUMS/GALLERIES
G- MOSQUE
H- RESCUE AREA
I- SPORTS AREA
J- AVIATION SCHOOL
K- CURRENT COVID HOSPITAL

For the possible earthquake it is more convenient to use areas near to the hospital . The areas H,I,J can be used.

APP. TOTAL SQM OF THE H,I,J :2.900.000 sqm

A NEW CONCEPT OF DEVELOPMENT

LESSONS LEARNED

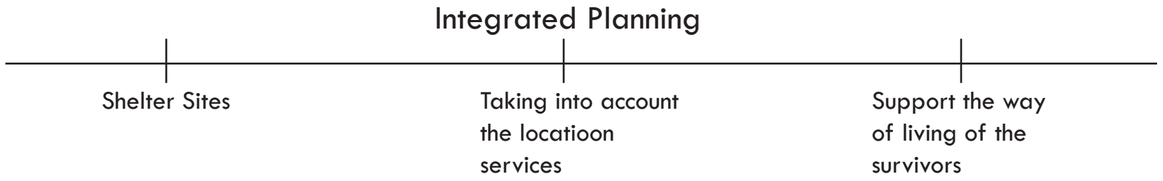
LESSON 1
Pre-Disaster strategy is not a necessery but it is a must.

LESSON 2
Working with local authorities and aid services is the key factor.

LESSON 3
Think locally.

LESSON 4
The number of affected families must be estimated.

LESSON 5
Stay in the contact with the community in order to improve the living conditions.

LESSON 6


LESSON 7
Think from all the aspects; emergency education , empowerment , living conditions.

LESSON 8
It should respond both to immediate and long term issues.

LESSON 9
The design process is must be considered more than the final design.

LESSON 10
Human has to be in the center of the project.

LESSON 11
Adapting shelter design for protection , access to water and sanitation.

LESSON 12
When there is no need for aids or shelters , the feedback is important to be prepared better for the next disasters.

DISASTER PREPARED ISTANBUL

As mentioned before in the disaster management phases , the disaster management has very wide categories.

But for minimizing the impacts it has to start with the preparedness. The preparedness has to be taken into account for all the vulnerable countries and cities. Each city has to analyse their risk and vulnerability.

In this case also for Istanbul preparedness is crucial , without a proper plan , the organisations can not operate properly.

The proper analysis , will affect severely how the government and essential services will respond and if there is a need of the help of external organisations. The way to quick response starts from the preparedness.

The inhabitants of the Istanbul needs to have proper education in order minimize the affects.
The risk assessment of the buildings has to be carried out and the buildings that are vulnerable to earthquake has to be demolished or has to made earthquake resistant.

THE MANAGEMENT STARTS WITH THE PREPADNESS

PRE DISASTER

- The preparation of disaster management plan for the city of istanbul

- Mitigation and risk analysis of the city of istanbul

- The establishment of assembly areas

- The preparation of emergency operation plans and waste management

- Disaster budget for response , recovery and reconstruction

- Local resources has to be identified

- The app. Number of people will be affected for the 7.5 mw earthquake

- The vulnerability analysis of buildings and neighbourhoods

- Preparation of the civic bodies and essential services to be ready to operate and coordinate

- Educating the communities to face a disaster

- A possible shelter options has to be identfied, some of these shelters has to be stored in warehouses.

- A possible camp sites has to be selected.

POST DISASTER

- The operation and coordination of civic bodies and rescue teams

- The assessement of ;
  - -the damage on public utilities
  - -the affected neighbourhoods
  - -the number of affected people
  - -the number of people need of medical service
  - -the number of people need of emergency shelters

- The operation of clearing the rubble from the streets

- The essential services such as hospitals have enough space or some people need to be transferred in other cities?

- The basic needs has to be available for affected community (water ,food , medicine etc.)

- The operations of aid organisations and external organisations

- Disaster relief camp site organisation

- The transportation for the affected families to the disaster relief camp

- The management of the camp site

COMMUNITY PREPAREDNESS

There are so many important key steps to be taken in the earthquake case in Istanbul.Nearly all of these steps need to be organised by governments and authorities.
But the inhabitants of Istanbul , are aware of the probability of an intense earthquake in Istanbul. Each family has to be educated and prepared for the catastrophic event.

Each family should checked their buildings in order to be sure for its structural quality , but unfortunately some families even if they know that their building is vulnerable , they can not afford to move in another place.
In these cases, the preparedness starts at home , it is important to have an emergency suitcase. This suitcase should contain clothes , important documents and some cash.

But being prepared it is not just preparing a suitcase , it is important to know what to do during an earthquake, the families should be calm and should wait till the earthquake stops.

The families need to know before where is the nearest assembly area. As soon as the earthquake stops they should go to a safe space. They should decide a meeting point with their relatives.

Becoming a volunteer is an important issue.Some trainings has to be done prior to a disaster , in order to help efficiently to the people and organisations.

WHAT HAPPENS NEXT ?

As soon as the earthquake stops it is the moment to go to outside. Aftershocks are very common, it is crucial to evacuate people as soon as possible. It is very dangerous to go back to buildings unless the local authorities tell you it is safe to go inside. In the meantime it is important to go open spaces or emergency areas.

Emergency assembly areas are safe areas where the public can gather away from the dangerous area in order to prevent panic and ensure healthy information exchange during the time that will pass until the temporary shelter centers are ready after disasters and emergencies. Determinining your meeting points with family members is very useful especially when there is lack of communication.

Disaster prepared houses should have an emergency bag that contains food, water, first aid materials and samples of your important documents, being prepared in a high risk zone is a must.

Figure 96 - Emergency Assemble area after the earthquake struck in Turkey

The families affected usually don't return their homes for 2 days. They stay in tents, car or in their relatives. But unfortunately some of the survivors are not lucky to go back their home even then because there is nothing left to go back. The organisations that are responsible for emergency management will provide to effected families emergency shelters or temporary shelters in the selected areas . Generally these organisations are very busy to provide food,water,clothes and shelter , for this reason if no one is injured , it is asked to reach to shelter zones by themselves, therefore the centrality of these areas are the main issue.

In the emergency shelter areas it is provided ; medical services, food, communication services , safewater accessibilty, sanitation units.

The emergency shelters provide, the minimum indoor area for each personmust 3.5–4.5 m2 offor tents or containers.

Figure 97 - Temporary shelters were situated in open space.

When the research and rescue searches are finished ,generally after 3 days responders will start to remove debris and belongings of people. People often they don't have any time to take their valuables when evacuating their homes , in this case , if it is necessary to go back it should be investigate if there is any structural damages , observing cracks on walls or pillars means that the building is unsafe. It is better to wait the building gets inspected.

The rescue teams will help to get your belongings if it is not detected any structural damages on the builidng. In the most cases , the belongings from collapsed buildings , or from the buildings that will be destroyed because of the unsafety conditions of building , gets collected and stored in the Red Crescent tent set up in the region. The survivors can collect their belongings thanks to operational teams in the disaster zones.

The devastating impact of losing a place that called home is unimaginable but finding their belongings,photos ,memories are very important for the survivors.

Figure 98 - Organisations collecting the possessions of survivors in an emergency tent

Figure 99 - Photos found in a rubble

The fastest solution for emergency shelters, are not very durable. For this reason if a shelter still needed after 2 days , the transitional units should be provided. This means also to move the people from open parking spaces, green areas, squares to more permanent areas. Unfortunately, this is a huge issue for the survivors that trying to feel safe again. They are transferred to the areas that they don't have any information of the services.
It is crucial to accomadate people in to an area that can be used at least for 10 months.

According to observations and investigations, spatial performance criteria in previous shelters were not fulfilled due to varying conditions (Şener 2003). The families that lived in these temporary settelemts have made various changes in the shelters. This modifications had been made because there was no feedback from the previous disaster shelters and again the human was not in the center of the design.
- The modifications were related to privacy and storage.
- For the outside area , they added some patio and some green spaces.

EXAMPLES OF INDOOR AND OUTDOOR MODIFICATIONS MADE AFTER THE 1999 EARTHQUAKES.

Figure 100 -101 -102 -103 - Photos of Temporary settlements after the 1999 earthquake by Sinan M. ŞENER, M. Cem ALTUN

DISASTER RELIEF CAMPS

In the immediate aftermath of a disaster, one of the main problems are the shelters. The issues related to shelters are not just providing or constructing them.The affected communities need also water,food,clothes,basic supplies. Therefore the organisations often choose to form disaster relief camps.Because it is a more efficient solution to help people. In the dispersed settelements, there is no adequate organisation.

DISPERSED SHELTERS

PROS
+ Self reliance
+ Smaller investment needed
+ Time efficient
+ Community helping each other

CONS
- Dispersed, fractured settelements
- Limited resources
- Unknown number of affected people
- Water, hygiene , sanitation issues
- Security issues

RELIEF CAMP

PROS
+ The area is selected by authorities
+ Humanitarian organisations providing the basic needs of people
+ Water, hygiene , sanitation provided
+ Every step is organised

CONS
- Need of assistance
- People demanding more
- Depends on the authorities
- Probability of outbreak of a disease is higher
- Higher Budget

ASSISTANCE

PROTECTION

INTERNATIONAL LAW AND STANDARDS

PARTICIPITATION

When the disaster strikes , there is a need of shelter for those with damaged homes , the survivors meet with the organisations at emergency points and later on , the authorities transfer the survivors to the site. As soon as they arrive the admittance starts.

Figure 104 - Diagram of what to do after an disaster occurs

DISASTER RELIEF CAMP LOCATION AND SERVICES

The location of the camp is very important and it has to respond some criterias;

- Appropriate geographical characteristics

- A vast , empty area

- Has to have sufficient area for more services and shelters (if needed)

- Has to be distanced from damaged buildings

- Min. width of roads should be 10 meters

- Fire escape routes should be established

- Can not be located far away from the center

- Accessible for affected community and logistics

- Stable soil

- Min. slope of the soil has to be 1% for the drainage

- Easy access to local energy sources and water supplies

- The main services should be in the middle of the camp layout

- Site has to be secured

20.000 people camp should include;

- REGISTRATION POINT
- SHELTERS
- SECURITY/POLICE
- MANAGEMENT OFFICE
- BATHROOMS / SHOWERS
- STORAGE/WAREHOUSE
- GENERATORS
- MARKET
- DISTRIBUTION CENTERS; FOOD,WATER
- DAYCARE- PLAY AREA
- CLINIC
- LAUNDRY
- COMMUNAL KITCHEN
- CANTEEN
- WORSHIP AREA

Minimum Standards to be Obtained;

SHELTER ;
- 3.5 sqm per each person
- 1 tent for each family
- Air ventilation and protection from sunlight
- Must be adapted to winter conditions if needed

FOOD ;
- 2100 kcal must be provided for each person
- Food must be coherent with the local culture and religion
- Expiry dates of the packages must be controlled.
- If the families must cook by themselves , each week it should be distributed rice,flour,salt, oil etc.
- Camp authorities are responsible for the management and distribution of food.
- Storage and freezer must be provided for food.
- The food facilities should be clean and hygienic.

- The food cannot be stored on the floor , it should be elevated.

WATER ;
- Water distribution points must be accessible and safe.
- Must be located equally around the camp.
- The camp management is responsible for water supply.
- Total basic water needs are minimum 20 liters for each person per day.
- Camp authorities should control the water quality often.

Source : Guidelines for minimum standards of relief in camp

SANITATION AND HYGIENE ;
- Min. 1 toilet for 20 person
- Separate toilets for male and female and between them it should be a bıundary
- It should be accessible day and night.
- 1 soap must be provided for each family weekly.

SECURITY ;
- There should be polices or guards in order to maintain the safety inside the camp.
- Entry and exits should be controlled and closed at night.
- The guards must patrol and do a night watch.
- Fire points has to be located for each division.

Other Aspects ;

- If the shelterees are more than thousand in a camp , one ambulance should be waiting inside the camp.

- Social events , religious activities help the affected communities to recover more rapidly.

- An health control must be done each week.

- Medical kit and basic medicines should be available in camp.

-Camps should pay attention to vulnerable groups safety.

SHELTER CAMP ANATOMY

MAIN CHARACTERISTICS THAT EACH CAMP SHOULD HAVE ;

Location

The location selected by authorities are generally situated outside of the city. But generally this brings out more issues. The camps can not be near breeding facilities.

N. of People

The number of people in need changes according to intensity of disaster but one camp should not exceed 20000 people. It is recommended to form smaller camps with less people.

Duration

These are temporary settlements , but from the previous events , the duration can last more than 6 months so each camp should be planned for long periods.

Reception

The admittance to camps made through reception area, it is important to keep the track of number of people also for providing basic services.

Shelters

For each person minimum area should have to be 3.5 sqm , the cooking and bathing facilities can be seperate from the shelters. Each shelter has to keep a 2 meter distance from eachother.

Security

The security provided generally by the hosting communities. The fences are required also to make survivors feel more safe.

Source : Anatomy of a refugee camp, CBC News , 2007
https://www.cbc.ca/news2/background/refugeecamp/

Latrines

In optimal conditions each family should have their own bathroom. But generally speaking public latrines are used more often. Each latrine can be used maximum by 20 people. The distance between the shelters can not be more than 50 m.

Services

Some basic services should be located in the camps, such as , markets , schools,meeting places. For 20.000 people one market should be located.

Water Point

There should be several water points , the distance from a shelter should be max. 100 m. Each water point have to provide water for at least 200 people.

Food Distribution

For 20.000 people at least there should be 4 food distribution points.
Usually these points distribute foods for weekly.

Healthcare

A clinic should provide services for those in need. After the disaster strikes also they should be able to make a first medical check for each person.

Lightning

The people living in the shelter camps, should feel safe ,especially in night. For this reason the camps should have street lightings.

MANAGEMENT OF THE CAMP

The general information regarding to camp ;

1) Admission and registration of shelterees to the site registry

2) Orientation for the shelterees about the rules, services and schedules. Information about the site management with the services of medical assistance, food programme and mental health division

3) Programme of identification of necessities to participate the shelterees to significant volunteer works

4) Simplification of creating opportunities to shelterees to gain independence with a durable solution

5) Sustainable solutions for a healthy and secure environment with adequate protection measures

6) Maintaining a hygienic and functional space

7) Transparent communication and dialogue spaces with authorities

8) Data collection and analysis systems to improve conditions and management of site

Figure 105 - Kilis, a refugee camp in Turkey near the Syrian border.Credit by Tobias Hutzler for The New York Times

QUESTIONS TO BE ASKED

1) How many people live in a typical family?

2) How many families are without any or with unsuitable shelter and what is their condition?

3) What are the main activities for affected families to support livelihood and what is the reflection of designed spaces to activities?

4) What are the first shelter actions or resources provided to impacted families and persons?

5) What are the main barriers to train women, youth, and elderly persons in the construction of their own shelters?

6) What are the main characters of site for temporary settlements, topographically and environmentally?

7) What is the accessibility to water for drinking and personal hygiene ? Are water requirements reachable as anticipated?

8) What is the urgent danger of not having enough clothing, blankets, or bedding, and how many people are at risk?

9) What kind of stove for cooking and heating is reachable from the members of families?

10) What are the main tools accessible from persons in order to support construction and maintenance of shelters?

DESIGN ANALYSIS
THE USER STUDY

Turkey's culture has been influenced by both Eastern and Western cultures because of its geographical situation. Family is the foundation of the Turkish culture. "The size and structure of Turkish households vary significantly throughout the country. Most households are nuclear, with the average number of children for a couple being two."(Konda,2018)Generally speaking the turkish families, have at least one relative living with them , they support economically and emotionally their elder relatives. "Traditionally, men are the breadwinners and provide the main source of household income.Women are generally seen as homemakers, managing money, cooking, cleaning and hosting." (Konda,2018). They are religious people , who likes to socialize especially with their relatives . It is very common to have large dinner tables to gather around and drink some tea.
The children prefer to play on the street with each other. In an neighbourhood usually everyone know eachother.

Figure 106- A photo of an Turkish family

Generally, the affected families from the earthquakes are low or middle income families. These families generally live in poor quality blocks or in the squatter settlements called Gecekondu (landed overnight),that began to form as early as the 1940's in the larger cities of Turkey. This term derives from a construction of illegal building with low quality construction that can be built in one nighnt.Since then , it is one of the biggest problems of Turkish government.The gecekondus can be one storey , or can go op to 6-7 floors . Those with higher than 4 floors carry a huge risk to collapse. These buildings as mentioned before can not stand an intense earthquake also because of the low quality materials used. It is important to determine this buildings and evacuate them in order to do a structural renovation or to completely destroy .These building carry a huge risk of loss of lifes in an intense earthquake.

Figure 107- Interior of an Gecekondu

Figure 108- Aerial Photo of a district formed by Gecekondus

USERS

WOMEN

MEN

CHILDREN

INFANTS

ELDERLY PEOPLE

DISABLED PEOPLE

SHELTER REQUIREMENTS

Spaces for everyday activities

Sanitation

Thermal comfort and ventilation

Acoustical and visual privacy

Safety

Clean and Healthy environment

Storage

Accessibility

Adaptation of different functions

Access to electricity

Durable, practical and acceptable to the affected population

Communal cooking facilities or a stove

BASIC GOODS AND SUPPLIES

Food

Drinkable Water

Clothing (suitable for their culture, season and climate)

Bedding or sleeping mats

Hygiene products such as soap , shampoo etc.

Diapers for infants , children and elderly

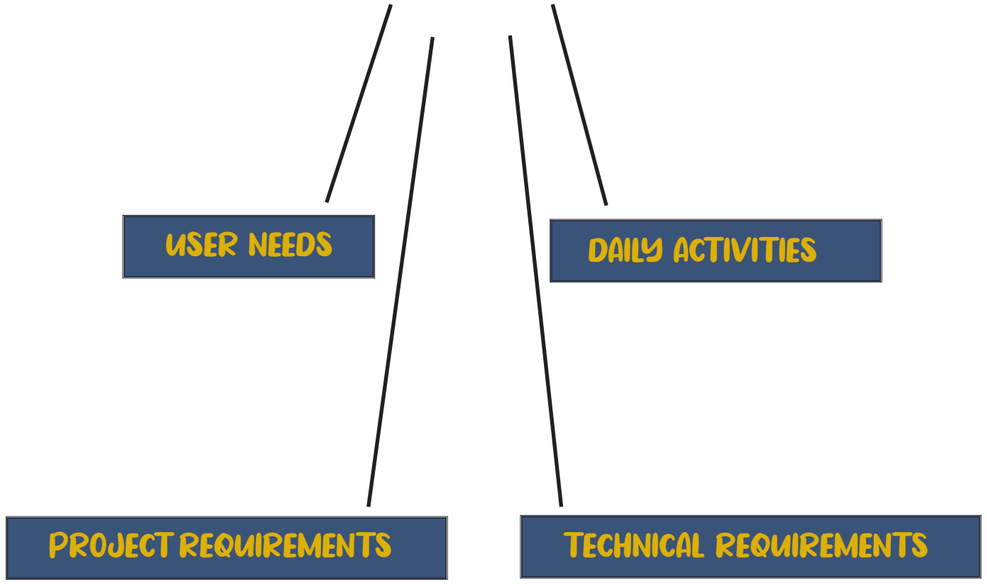
Sanitary materials

Cooking equipments
Plates , knifes , fork etc.

10 to 20 litre water collection units

Basic tools

THE DESIGN CRITERIA



1.USER NEEDS

- **SAFETY**
- **PRIVACY**
- **SECURITY**
- **HYGIENE**
- **SOCIAL RELATIONS**

The design of the post disaster sheltering starts with the basic human necessities. The standard regulations helps to set a base for a design but it is very important that survivors feel safe in their new environment.

The families search for a stable and secure place in the immediate aftermath of a disaster.In the shelter camps the privacy becomes a crucial point because these camps are generally very crowded.
Turkish people are very friendly and social. The design requires spaces for a social interaction.

2.DAILY ACTIVITIES

The daily routines of Turkish people should be considered. Generally the shelters have inadequate indoor spaces. Creating spaces for each activity makes the shelters more livable.
Zoning the activities could help the maximize the spaces in small spaces.

To make people feel at home ; their culture , gender, family type , religion and their daily routines should be included in design.

Organisations , aids often mistaken to not consider daily routines , unfortunately providing just shelters are not enough. The survivors are going through a lot of physical and emotional issues , providing a more stable life, will help them to go to back their normal life more quickly.

3.PROJECT REQUIREMENTS

-ADAPTABILITY **-COST** **-TRANSPORTATION** **- PARTICIPATION**

-ASSEMBLY & DISMANTLE **-LIFESPAN** **-RECYCLE / REUSE**

The emergency shelters should be low cost and fast because it should respond a high number of suvivors as soon as possible. Generally people end up living in these shelters more than 6 months for that it should be durable.The participitation of the local residents helps the maximize the organization for that it should be easy to erect. The materials should be local to minimize the waiting time also the transportation fees and environmental impact. The materials used should be recycable or reusable.

4. TECHNICAL REQUIREMENTS

-EARTHQUAKE RESISTANT

-NATURAL VENTILATION

-WATER RESISTANCE

-THERMAL COMFORT

-SUSTAINABILITY

-FIRE RESISTANCE

Given the local climate , the design should be water resistance ,lightweight and resistant also to protect from earthquake aftershocks.

The roof should have an inclination for water drainage.For the habitants to proivide the minimum comfort levels natural ventilation should be maximized and should be protected from sun.

Figure 109- Interior Photo of a district formed by Gecekondus

THE MATERIAL STUDY

In Istanbul it is available various types of materials , genereally most used building material is reinforced concrete. It is easy to find bricks, steel,aluminium and wood.

For our proposal of transitional shelter , it is very important that the materials are easy to access, low cost , adaptable and easy to erect. But one of the crucial points of the materials is the recycling possibility. In Turkey especially in Istanbul it is very common to use the plywood. For this reason for the plywood seemed the most convenient choice also because its light weight.

Figure 110 - Plywood Board

Plywood is similar to wood in terms of basic qualities. It also has the following advantages as a result of its fabrication technique: Structures benefit from its strength and stiffness. Dense and resistant to shock.

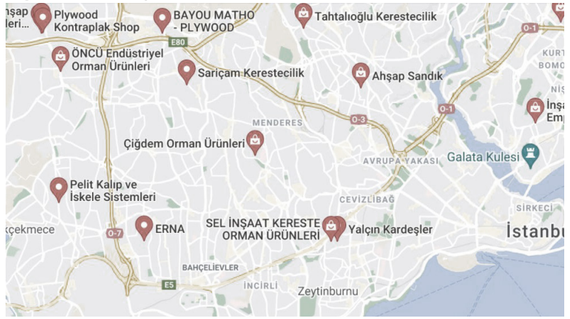


Figure 111- Plywood Manufacturers

On the map it is possible to detect more than few wood /plywood /timber factories near to our site.
This makes much more convenient the chosen area for the emergency shelters. In the immedaite aftermath the transportation is one of the key factors especially for the shelters.
Plywood can be used 40-50 times as long as it is used properly.

In Turkey, plywood has thicknesses ;from 6 mm to 30 mm,
2500mm x 1250mm
3000mm x 1500mm
2440mm x 1220mm
1525mm x 1525mm
sizes of plywood are produced.

Thickness mm : 18 mm
Number of Layers : 13
Weight (kg/m2) : 12.6

18 mm 250 x 125 cm - 25 /50 euro

PLYWOOD

"Plywood is made of several thin layers, or 'plies' that are laminated together. The layer structure leads to more uniform properties than solid wood, since the effects of grain anisotropy are minimized. The properties of plywood vary with the quality of the constituent layers; typical values of sheathing grade are listed below." (MATWEB ,Wood Engineering Handbook, Second edition; Forest Products Laboratory; Prentice Hall, Englewood Cliffs, NJ (1990)

Unit weight: 660 kg/m3

Weight per square metre: 6.1–20.4 kg/m2
(with a thickness of 9–30 mm)

Humidity: 9%

Figure 112- Plywood Layers

Carbon footprint (A1–3) of Plywood (Standard Birch) – 9% moisture content.
CO2e g/kg: 718
CO2 fossil g/kg : 650(VTT TECHNOLOGY 115)

ISO STANDARD 14040- 14020

THE DECLARATION COVERS THE PRODUCT STAGE A1-A3 (CRADLE TO GATE)

Tensile Strength : 27.6 - 34.5 MPa parallel to face; ASTM D3500

Modulus of Rupture : 0.0483 - 0.0689 GPa parallel to face; ASTM D3043

Thermal Conductivity : 0.110 - 0.147 W/m-K

Various Properties :
- High Strenght and Stability
- High Impact Resistance
- Water and Chemical Resistance
- Flexibility or Bendability
- Sound and Thermal Insulation

CNC (COMPUTERIZED NUMERICAL CONTROL)

'It is a computerized manufacturing process in which pre-programmed software and code controls the movement of production equipment. CNC machining controls a range of complex machinery, such as grinders, lathes, and turning mills, all of which are used to cut, shape, and create different parts and prototypes.' (Goodwin University, 2018)

The machine that uses this technology is called CNC router. It is commonly used in various sectors. A CNC router can be used on different kinds of materials such as wood , aluminium , plastic etc. The advantages of a cnc router is very high. It is precise, time efficient and increases the productivity. Unlike the old school machines it is also not dangerous and reduces the waste production.

'The parts' mechanical dimensions are defined using computer-aided design (CAD) software, and then translated into manufacturing directives by computer-aided manufacturing (CAM) software.'(Goodwin University, 2018)
Nowadays , the cnc router is used also in the construction sector.

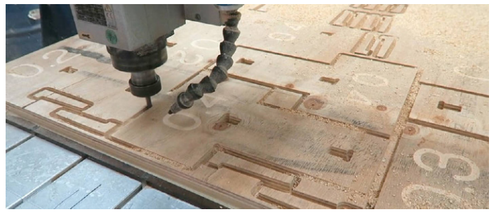


Figure 113 - CNC router cutting parts for a WikiHouse.
© Victoria and Albert Museum, London

'Plywood is a particularly good material for CNC cutting because it is strong, stable and made to a standard, worldwide specification. Its strength and stability mean it can be easily jointed – pieces can be cut from a sheet and notched together, without additional fixtures. Due to the material's standardisation, a design can be reliably cut anywhere in the world, using a single digital file.' (Building a plywood house,Victoria and Albert Museum)

WIKI HOUSE

Wiki House is created by Alastair Palvin and Nick Ierodiaconou. Their aim was to come up with an project that is affordable, easy to manufacture and construct. Wiki house is open source , that contains drawings of building components that everyone can download , and produce the components on standard materials like plywood
The one of the best part of this project is there is no need of tools or training , it is very easy to construct just with 2 people. Wiki House Community has provided several different types of homes that can be adapted to the climate , culture and shared again on the internet , such as sketchup files.

'WikiHouse co-designer Alastair Parvin said, "The open secret is that in reality almost everything we today call architecture is actually design for the 1%....The challenge facing the next generation of architects is how, for the first time, we will make our client not the 1% but the 100%." (designingbuildings , 2020)

Figure 114 - WikiHouse, Beatrice Galilee

FACIT HOMES

Facit Home is founded in United Kingdom. Similar to wikihoıuse , Facit homes uses cnc router and plywood. Each component of the building is designed with every detail on computer. The different aspect of this project is the pieces cutted on cnc router , together they form boxes/cassettes that they are similar to lego pieces. These components are shipped to the construction site and easy to assemble on site. The boxes are stacked together in order to create the structure. Each box is filled with insulation in order to provide thermal comfort after the structure is finished.

Figure 115 - Structural system, the unique Facit Chassis

REFERENCES OF PLYWOOD CONSTRUCTION

Figure 116 - Concept for a prefabricated shelter which is easy to fabricate, ship and assemble

'This is a prefabricated shelter which would be shipped to a disastered area. Its structure is made of plywood boards which are all trapezium of the same width, making them easy to fabricate and pack in a container. The boards are assembled using all-identical connectors. Together they create a profiled roof structure which is high and light in the middle and deep and strong near the columns. It would be covered by a waterproof membrane and the triangular cavities of the structure could accommodate a second internal membrane to insulate the shelter from the sun.' (Jflemay Architecture and Design)

Emergency Center

Figure 117 - Emergency center proposal provides adaptable shelter to sub-saharan communities in need , (Aleksandra Wróbel, Agnieszka Witaszek, Kamil Owczarek)

'Each plywood board slides into another, creating a waffle-like formation that can be put together and taken apart quickly, even by an unqualified person. the system provides a wide range of flexibility, and each wall adapts to the current needs by adding and removing horizontal and vertical boards wherever and whenever needed.'(Aleksandra Wróbel, Agnieszka Witaszek, Kamil Owczarek)
(https://www.designboom.com/architecture/emergency-center-proposal-adaptable-shelter-sub-saharan-communities-need-06-15-2020/)

COMMUNITY INVOLVEMENT

‘Shelter programmes delivered by governmental agencies and humanitarian organisations may be initiated quickly, but they are able to address only a relatively small proportion of the shelter needs of a disaster affected population (Parrack, Flinn, and Passey, 2014).
In the previous events we encountered that the organisations provide their completed dwellings to affected communities but often these dwellings provided are not enough to in order to help all the people effected. In these cases the communities start to build their own shelter with local materials in order to response quickly to their shelter needs.

But in the recent years this approach has started to vanish because in the response phase the community involvement is essential , when a disaster strikes every person can make a difference , the humanitarian organisations are often not sufficient in an intense disaster. Supporting the affected communities to build their own shelters is not just to empower the survivors but it is also time efficient and the costs are much more lower. Instead of bringing a completed dwelling ,organisations can assist the survivors to built their own temporary dwellings.

Although self-construction may be the most viable option for many disaster-affected households, it is also likely to be the most hazardous. When affected communities build back themselves, it is common for construction processes to include the same inadequate building practices as before, and for the repaired or rebuilt homes to leave householders at risk from future disasters (Coburn and Spence, 2002; Green, 2008; Parrack, Flinn, and Passey, 2014).


Figure 118 - Indonesia: Transitional Shelter Construction


Figure 119 - Shelter Cash and Markets Community of Practice

Some countries also gives cash for the construction of shelters , they call it cash for work . It helps to provide an income to the affected community .The community involvement is very helpful but there are some disadvantages too. This approach may be dangerous if it is not controlled. Also the quality of construction may be bad. Vulnerable groups such as elderly people may need assistance. But this approach motivates the people and it speeds up the recovery phase. From the recent analysis from Shelter Projects ,we can say that the cash for work approach may be used more often in the future.

Because of the increasing number of natural disaster that happens every year , new concepts are emerging. For the best outcome , the shelter that will be provided has to be from local materials with local construction techniques or there are some shelter kit options that all the building components are delivered to site and they are easy to erect , there is no need of specific tools . This approach eliminates the risk of poor construction technique or the dangerous situations that can happen when constructing a shelter. With this concept the affected communities in fust few hours and just with few people they will have adequate sheltering.

Unfortunately in an intense disaster , like 7.5 mw earthquake in Istanbul , the organisations will not be sufficient. From the analysis the number of people that will be displaced is so high that we should provide an open - source set to everyone.

Figure 120 - BETTER SHELTER KIT
https://bettershelter.org/wp-content/uploads/2019/04/IMG_6836-1.jpeg

DESIGN PROPOSAL

THE TOGATHER SHELTER KIT

DISASTER STRIKES !!!

The preparedness is a key factor , some of the shelter kits must be ready in a warehouse to send them on site. The building components also will be available on internet. To be able to use all the plywood manufacturers , also the instructions will be available. If a higher number of shelter kits needed, the manufacturers will be able to start to the production of the components as soon as possible.
The shelter kit consists , the building frame , the plywood panels and an plastic sheet in order to be able to survive the first nights. If it is winter an insulation process will be needed , in the first week.

SHELTER KIT

FIRST 3 DAYS

1)SHELTER KITS ARRIVE ON SITE.

2)THE SHELTER STRUCTURE IS EASY TO BE ERECT JUST WITH BASIC TOOLS BY 2 PEOPLE IN 45 minutes.

3) THE STRUCTURE WILL BE COVERED UP WITH THE PLASTIC SHEETING.

TRANSITIONAL SHELTER

THE FIRST FEW WEEKS THE FAMILIES THAT HAVE TO BE STAY LONGER WILL BE DETERMINED , AND THE INSULATIONS AND ELECTRICTY WILL BE INSTALLED , AND LATER ON THE FRAME WILL BE COVERED UP AGAIN WITH WATERPROOF MEMBRANE AND THE PLYWOOD PANELS , FORMING A SORT OF SANDWICH PANEL ON SITE.

REPAIR OR PERMANENT HOUSING OFF SITE

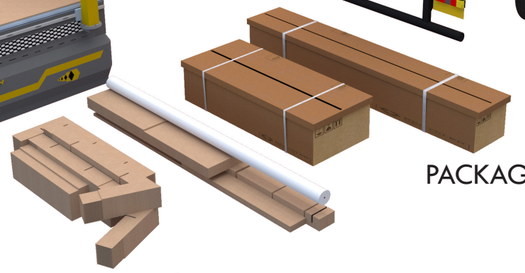
IN SOME CASES THE FAMILIES END UP TO STAY MORE THAN 3 MONTHS.
IN THOSE CASES THE STRUCTURE CAN BE EXPANDED AND CAN BE TRANSFORMED TO SEMI PERMANENT HOUSING.

WHEN THERE IS NO NEED FOR THE EMERGENCY SHELTERS, MATERIALS WILL BE DISMANTLED AND CAN BE REUSED OR RECYCLED.

DWG OF THE COMPONENTS

CNC ROUTER

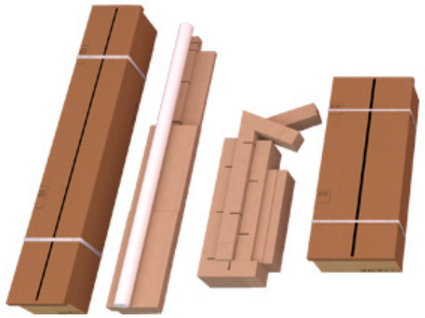
TRANSPORTATION



PACKAGING

The Togather Shelter Kit bases arrive on the site. This shelter can be erected by everyone , even without a proper training. The shelter kits consists an instruction diagrams to facilitate the steps to be taken.

Some of the shelter kits can be stored nearby in the existing airport buildings.
All of the buildings component are shown below;



THE ASSEMBLY STEPS OF THE BASE KIT

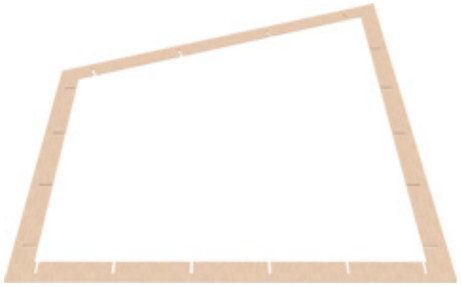
1)

PLACE THE TIMBER FRAMES 3.15 M APART FROM EACH OTHER.

2)

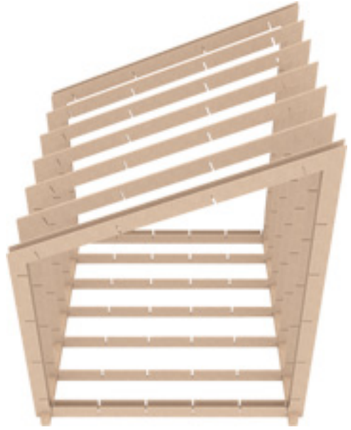
GET FRAME COMPONENTS AND BOLT THEM TOGETHER USING CARRIAGE BOLTS.

3)



USE THE PREDRILLED POINTS TO CONNECT TWO FRAMES TO EACH OTHER.

4)

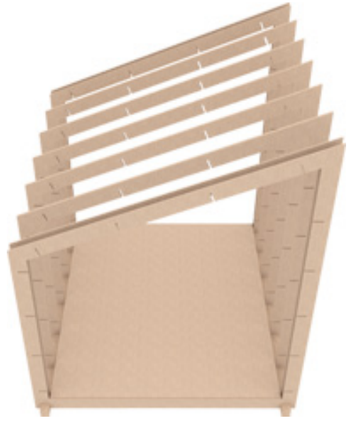


PLACE THE FRAMES ON THE SLEEPERS.

5)

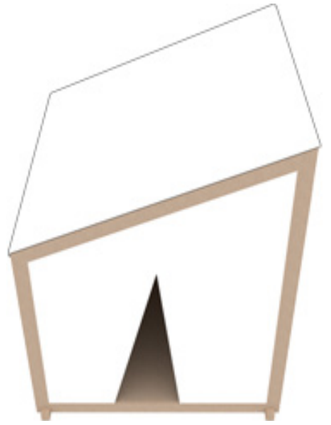
PLACE THE FLOOR COMPONENTS IN THEIR SLOTS.

6)



SCREW THE FLOOR PANELS TO THE RIBS FORMED IN THE PREVIOUS STEP.

7)



COVER THE STRUCTURE WITH TARPAULIN.

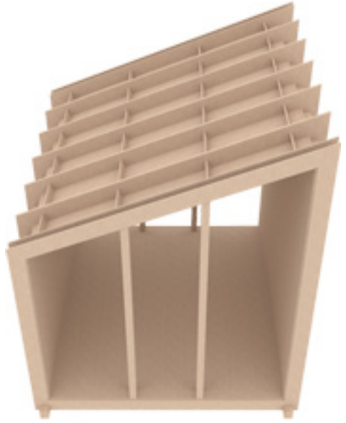
THE BASE SHELTER KIT CONSIST THE COMPONENTS FOR TO BE USED IN THE IMMEDIATE AFTER AN EARTHQUAKE , THE SHELTER CAN BE UPGRADED IN TIME , WITH THE MATERIALS AVAILABLE , THE OTHER STEPS CAN BE ACCOMPLISHED WITHOUT CNC ROUTER WITH BASIC CUTTING TOOLS. FOR FEW DAYS THE SHELTER WILL BE COVERED UP WITH TARPAULIN.

THE ASSEMBLY OF THE UPGRADED VERSION

8)

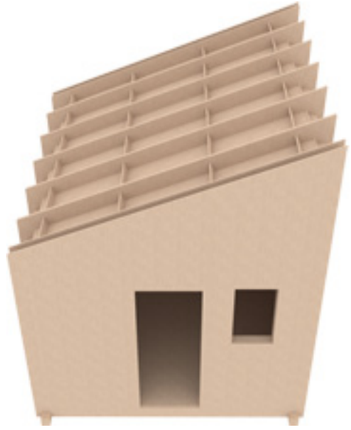
SCREW THE STANDARD PLYWOOD PANELS TO THE FRAMES.

9)



PLACE THE END WALL FRAMES.

10)



PLACE THE PANELS WITH PRE CUTTED VOIDS.

11)

ADD THE DOOR AND WINDOW FRAMES.

12)

ADD 7.5 CM ROCKWOOL INSULATION.

13)

COVER THE INSULATION WITH PLYWOOD PANELS.

14)

PLACE EPDM TO PROTECT THE STRUCTURE FROM RAIN AND UV RAYS.

15)

FINISH THE STRUCTURE TO MAKE IT ENERGY AND WATER SUFFICENT

THE TOGATHER SHELTER EXPANSION

16)

ADD ADDITIONAL FRAMES AND FLOOR STRUCTURE.

17)

PLACE THE PANELS ON THE STRUCTURE.

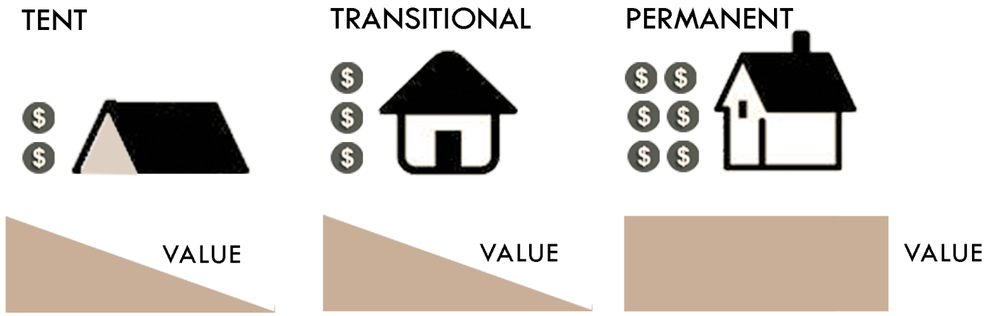
18)

PLACE THE END WALL FRAMES.

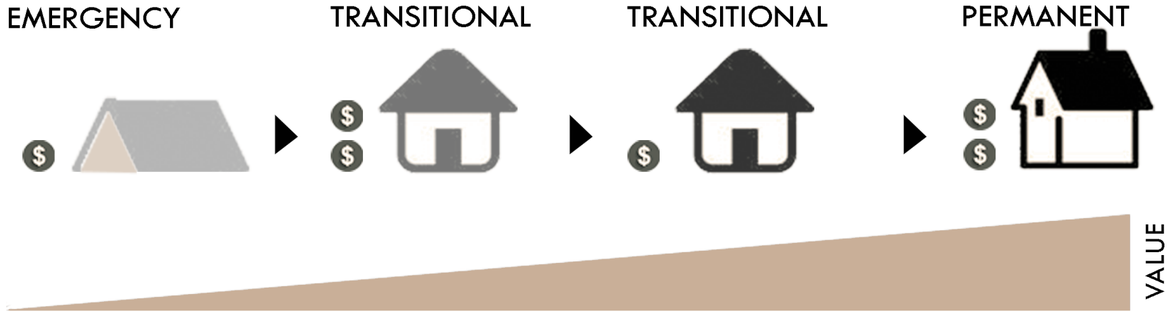
19)

COMPLETE THE ADDITONAL STRUCTURE WITH DOOR.

THREE PHASE APPROACH



TRANSITIONAL APPROACH



THE DIAGRAM UNDERLINES THE IMPORTANCE OF THE SHELTER APPROACH, GENERALLY , TO RESPOND IMMEDIATELY AND AS A CHEAP SOLUTION TENTS ARE SELECTED. ALL TRANSITIONAL APPROACHES MUST BE UPGRADABLE , IF NOT THERE ARE JUST WASTE OF MONEY BECAUSE AT THE END THEY GET ABANDONED. AS WE CAN SEE IN THE TRANSITIONAL APPROACH , IF SELECTED THIS APPROACH ,THE COST OF CONSTRUCTION ARE LOWER AND THE SHELTER NEVER LOOSES ITS VALUE.

STATISTICS

HOW MANY PER SEMI TRAILER?

24 SHELTER KIT

ASSEMBLY TIME ? (THE BASE KIT)

45 MINUTES

HOW MANY PEOPLE WILL BE NEED ?

2 PERSON

THE TOOLS NEEDED?

RUBBER MALLET
SCREW GUN
GALVANIZED BOLTS
SCREWS
WOOD GLUE
HINGES
CARRIAGE BOLTS
DRILL

MATERIAL SOURCE?

LOCAL

UPGRADE POSSIBLE ?

YES, ALL THE PARTS ARE DEMOUNTABLE

LIFESPAN OF THE MATERIALS?,

2 + YEARS

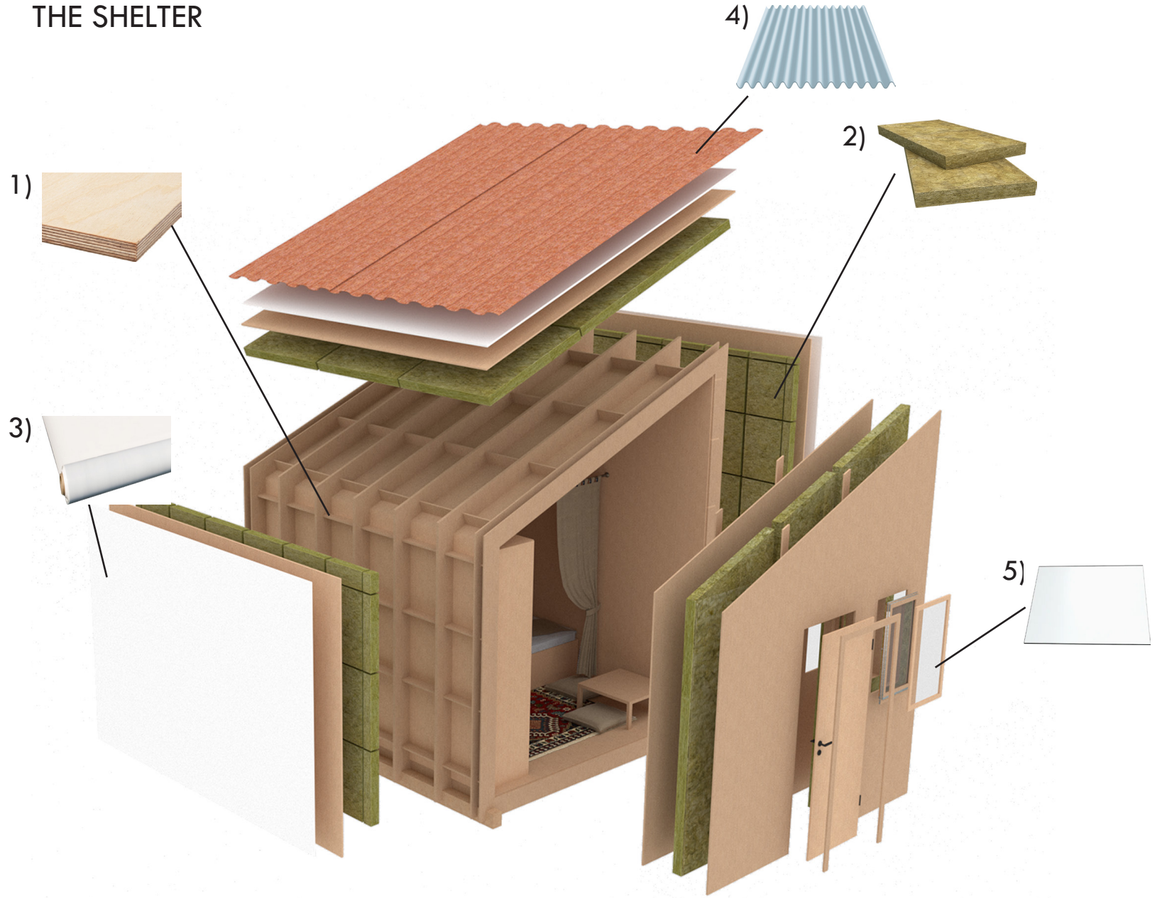
COST OF THE BASE SHELTER KIT ? APPROXIMATELY

300 $

MATERIAL RECYCLABILITY?

ALL THE MATERIALS CAN BE REUSED OR RECYCLED

POSSIBLE UPGRADE VERSION OF THE SHELTER



1) PLYWOOD 250cm x 125cm - 18mm
2) ROCKWOOL - 75mm
3) EPDM MEMBRANE - 2.3mm
4) CORRUGATED ROOF - 0.5mm
5) PLEXIGLASS - 10mm

RECYCLE - REUSE

How to reuse or recycle the materials used in the proposal ?

PRODUCT

PLYWOOD PANEL

AFTER USE SCENARIO

Reusable

Recyclable

Biodegradable

Compostable

Reconditionable

PROCESSING

Adaptation
Use in other buildings

Biomass Production

Compostable

Extraction of raw material for its reintroduction in the production string

PRODUCT

ROCKWOOL

AFTER USE SCENARIO

Reusable

Recyclable

Reconditionable

PROCESSING

Adaptation
Use in other buildings

Extraction of raw material for its reintroduction in the production string

Figure 121 - THE MATERIAL RECYCLE

PRODUCT

EPDM

AFTER USE SCENARIO

Reusable

Recyclable

Biodegradable

Compostable

Reconditionable

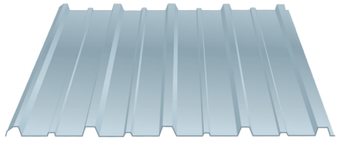
PROCESSING

Adaptation
Use in other buildings

Extraction of raw material for its reintroduction in the production string

Compostable

PRODUCT



CORRUGATED ROOF

AFTER USE SCENARIO

Reusable

Recyclable

Reconditionable

Compostable

PROCESSING

Adaptation
Use in other buildings

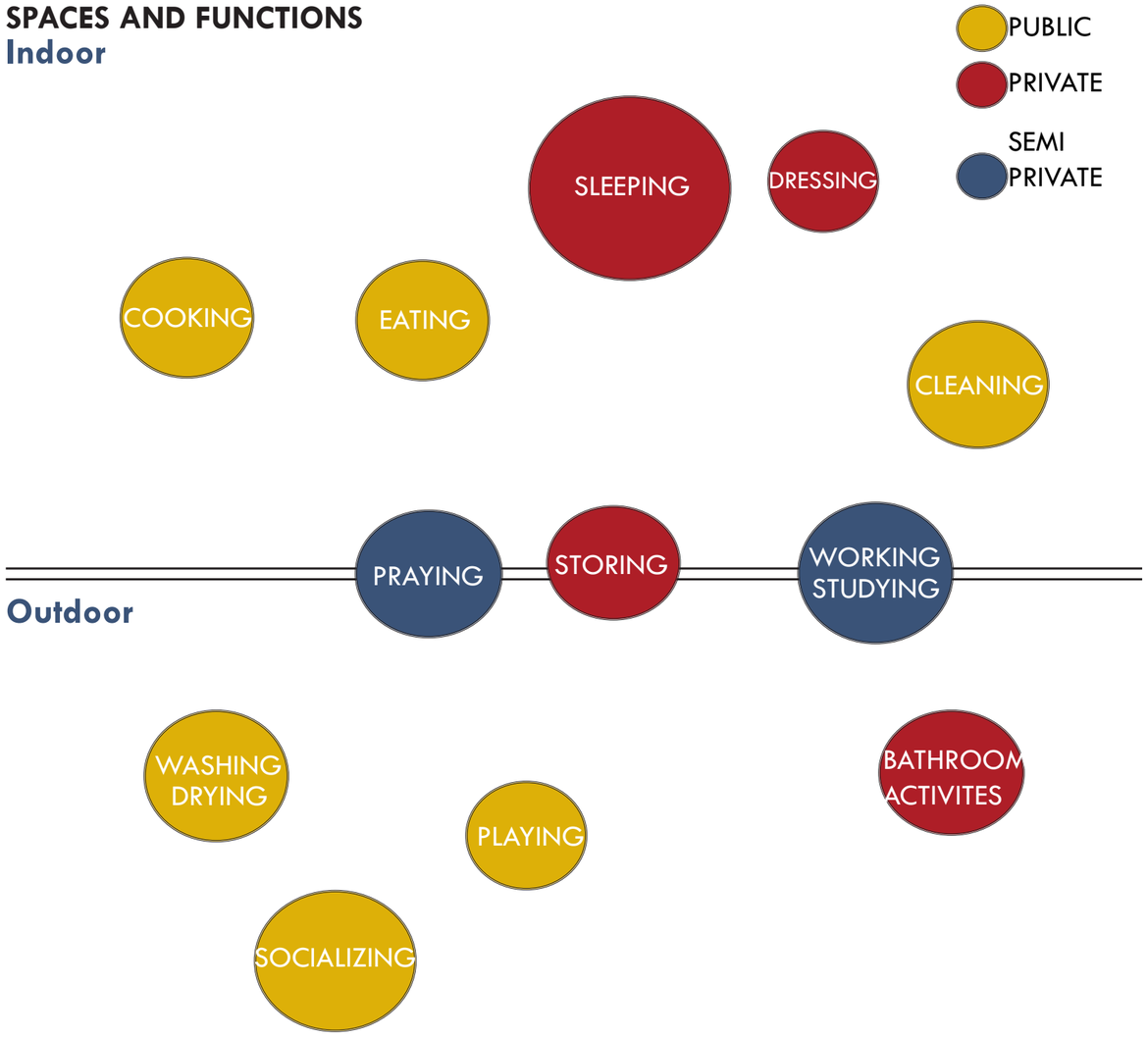
Extraction of raw material for its reintroduction in the production string

Figure 122 - THE MATERIAL RECYCLE


65
66
67

SPACES AND FUNCTIONS

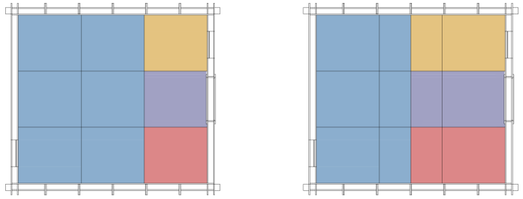
Indoor



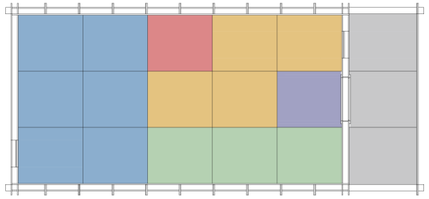
The diagram shows that the smaller the circle , people are spending less time to do these activitites.

Figure 123 - SPACES DIVISION ACCORDING TO FUNCTIONS

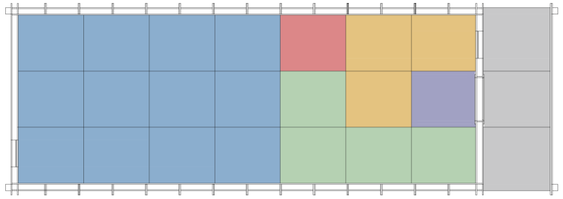
The activities to be carried in the shelter were defined and , distributed according to the shelters areas. The shelter sizes depends on the family sizes. The aim was to distribute the spaces , also for the privacy issues.



The shelters structure can be selected through families , the porch area is optional if wanted it can be covered if an extra area is needed.



This project is expandable , also because the families that are staying in shelter , if they have to stay more they need more space to be more comfortable.

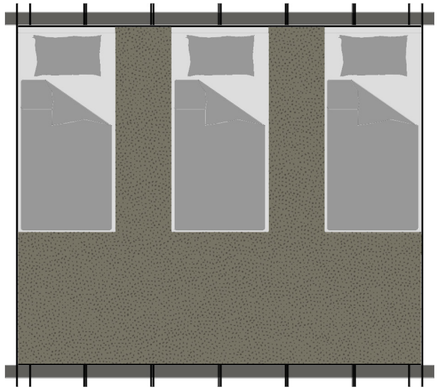


ENTRANCE
SLEEPING AREA
KITCHEN
MAIN ROOM
STORAGE SPACE
PORCH

INCREMENTAL PROCESS OF THE SHELTERS

PLAN PROPOSAL

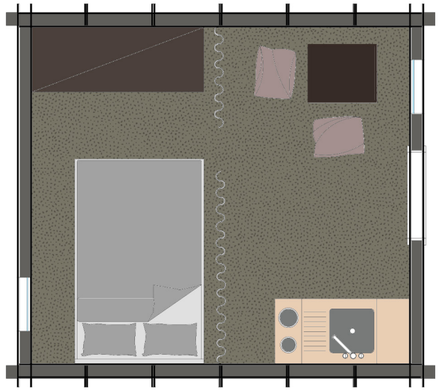
THE FIRST 3 DAYS



THE DISTRIBUTION OF THE SPACES CAN SHOW SOME DIFFERENCE ACCORDING TO HOW MANY DAYS HAS BEEN PASSED AFTER THE DISASTER STRIKED , IN FIRST NIGHTS , THE MATTRESSES ARE DELIVERED.

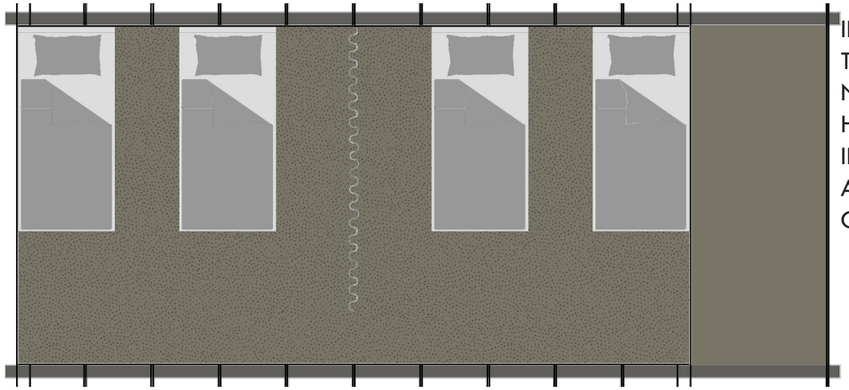
THE DURATION OF THE STAY CAN DEPEND ON THE REPAIR OR TO THE STRUCTURAL DAMAGE ANALYSIS , IF THEY ARE STAYING FOR JUST FEW DAYS , THERE IS NO NEED FOR KITCHEN APPLIANCES ETC.

AFTER 1 WEEK



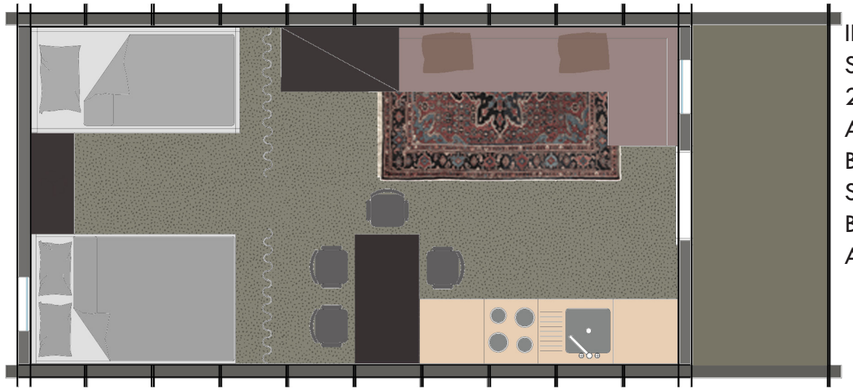
SCALE 1/50

THE FIRST 3 DAYS



IN THE TEMPORARY HOUSING THE LIVING AREA IS NECESSARY AND SHELTER HEIGHT IS ENOUGH TO INSTALL BUNK BED TO ALSO GAIN AREAS IN THE COMMUNAL AREAS.

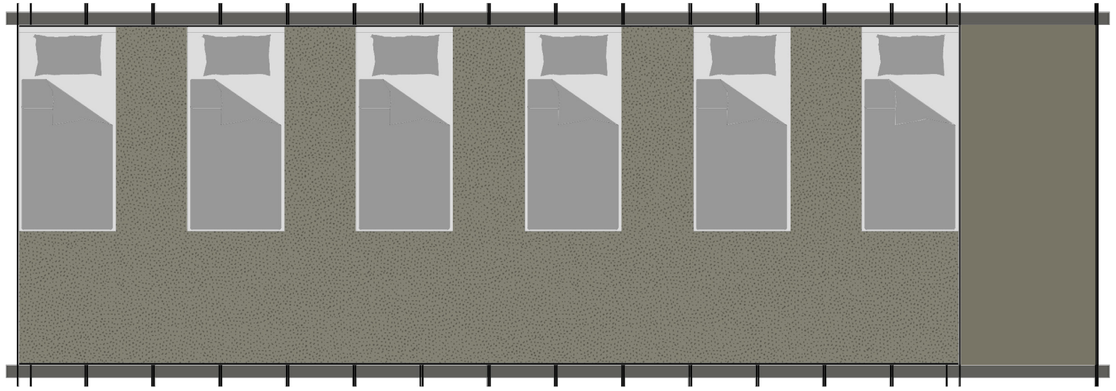
AFTER 1 WEEK



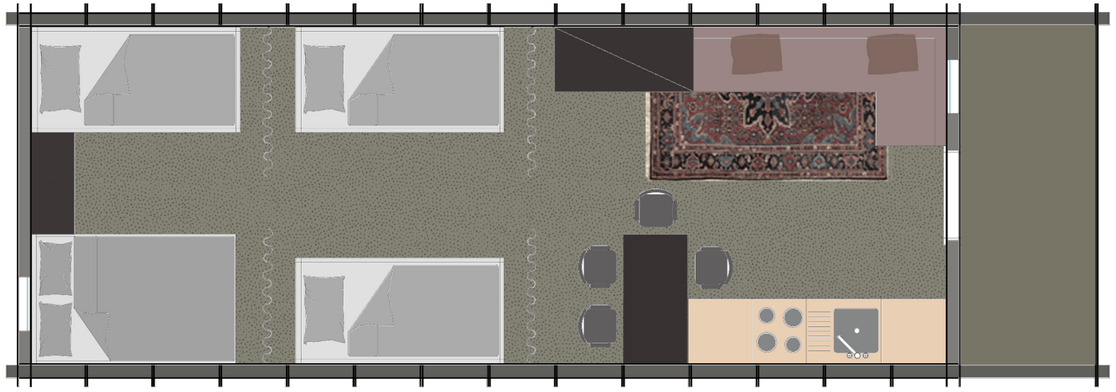
IF THE FAMILIES END UP STAYING MORE THEN 2 WEEKS THE KITCHEN APPLIANCES WILL ALSO BE INSTALLED. THERE IS STORAGE SPACE UNDER BED BUT ALSO THE CLOSE SPACES ARE ESSENTIAL.

SCALE 1/50

THE FIRST 3 DAYS



AFTER 1 WEEK



SCALE 1/50

PRIVATE ACTIVITIES

The activities that are carried in the bedroom are the most private ones thus the bedroom cannot be in the center of the shelter , it is preferred that it is closed with partitions or with the curtains, where people can use personally such as to change clothes, religious needs, to rest. The family's sleeping quarters must not be overly small or waste space.

COOKING, EATING

Cooking, dining, and doing the dishes are among the most common household chores. Generally the Turkish families , love to cook and dine together all the families.
In order to adopt a good cooking stove in a shelter, the local culture of cooking habits and kitchen design must be addressed. The shelter, on the other hand, should be built to accommodate a stove. As a result, the stove may be used or in communal spaces or a private activity. The kitchen table can be situated in the center of the design but it should be located to not create any boundaries.

LATRINES

Ideally the bathroom should be inside the shelters but it creates complex problems in the construction phase and in the dismantle. For this reason public latrines are quickier and easier to install. The restrooms and showers , if they located separately it is better for the hygiene.
A toilet is not strictly necessary in the shelter design because this function is usually provided by community latrines. Regardless, the shelter may provide the option of incorporating an additional toilet unit.

STORAGE

Everyday items typically take up a large portion of the indoor living. The survivors if their home is not heavily damaged, they take their clothes and some equipments with them, in order to not to go back to their home before feeling safe. But some additional storage also needed for the foods, equipments,appliances etc.

LAUNDRY ACTIVITIES

Clothing is one of the few possessions that families are able to bring into the camps. Cleaning them entails tasks like as washing, drying. Usually in small spaces like shelters , the laundry shops are necessary. The shelterees wash their clothes manually and usually outside of the shelter. But due to climate conditions it is not always suitable.

ELECTRICITY

In temporary communities, electricity is a problem , This can be found only in selected camps that have become permanent, and generally only at specialized locations such as smartphone charging stations.But the ex airport area is well lighted and well equipped for the electricity connections. The electricity is essential also for the electrical stove and refrigerator.

Figure 124 - Elevated From Ground

Figure 125 - Porch in the entrance also for storage

Figure 126 - Washing /Drying

Figure 127 - Storage under beds

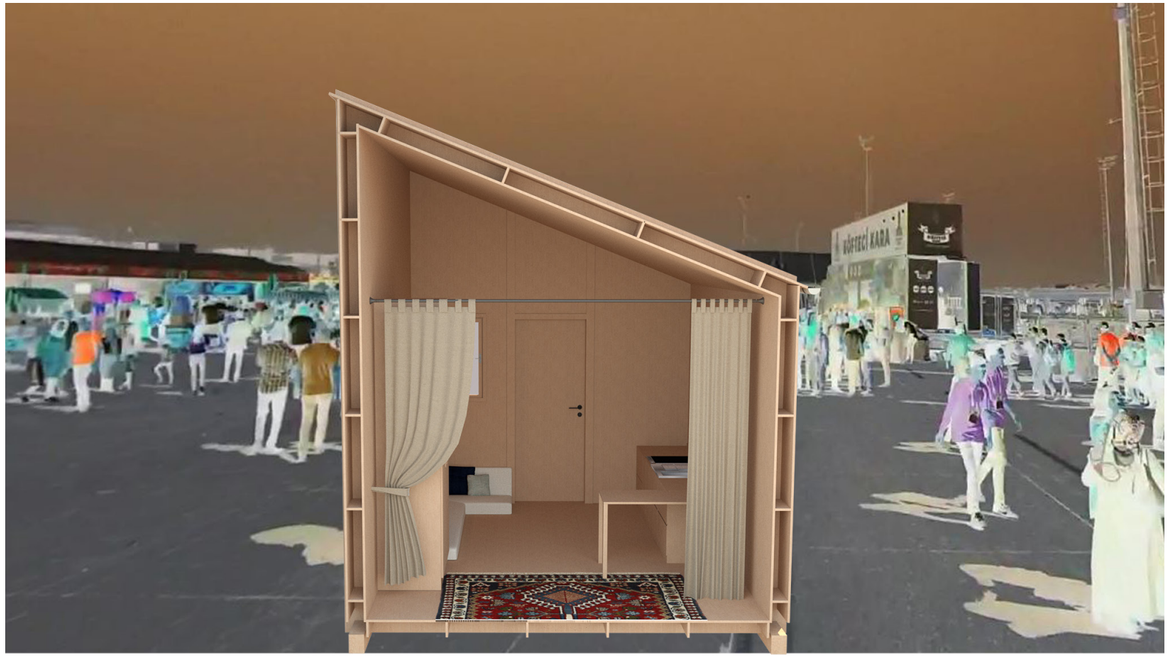
FOR THE BASIC HUMAN COMFORT AND NEEDS SOME DESIGN CHOICES HAS BEEN MADE. THIS CHOICES ARE ADAPTED IN THE SHELTER DESIGN. ALSO THE CULTURAL CHARACTERISTICS HAD PLAYED IMPORTANT ROLE ON THESE DESIGN CHOICES .

Figure 128 - Electrical Stove

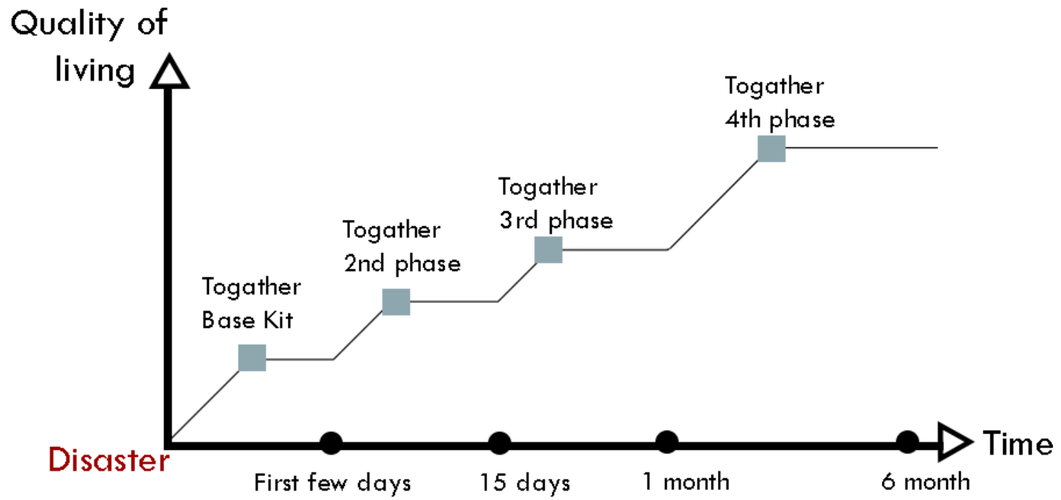
Figure 129 - Socializing ,Drinking Tea / Coffee

Figure 130 - Cushion Sofas

Figure 131 - Division of rooms with curtains



IMPROVEMENT OF THE QUALITY OF LIFE



The diagram illustrates that as the time passes , the shelter gets upgraded and so the quality of the living increases.
Incremental sheltering is not just for the structure ,materials and living areas. We have to think also in the technology aspect.

As the time goes on and the lifes get more stable, Other technological solutions have to be adapted.

It is also important to think about sustainable and efficient design .But the technological solutions must be adaptable to site and it should not be so expensive. There are some innovative solutions but yet they are not so practical.

For those staying more than 3 months , it is necessary to adapt the shelter to respond to the families needs.

The essential upgrades need to be done in water supply , hygiene , electricity and energy solutions.

But first it is essential to do a site analysis, for the existing solutions , that can be used also for the shelter design. It is important also to analyse the existing portable solutions that it is used before in the camp site.

The water and supply and electricity issues were analyzed and adapted to the design , because this problems need to be solved quickly , to make people feel at home , safe and healthy.

The satellite image in the right page , shows the existing lighting , water treatment system and the drainage system.

The analysis made for the existing infrastructure , for the treatment systems there is a water treatment system nearby. The existing drainage system connects to the water system for long term approach the shelters can be connected to existing system.

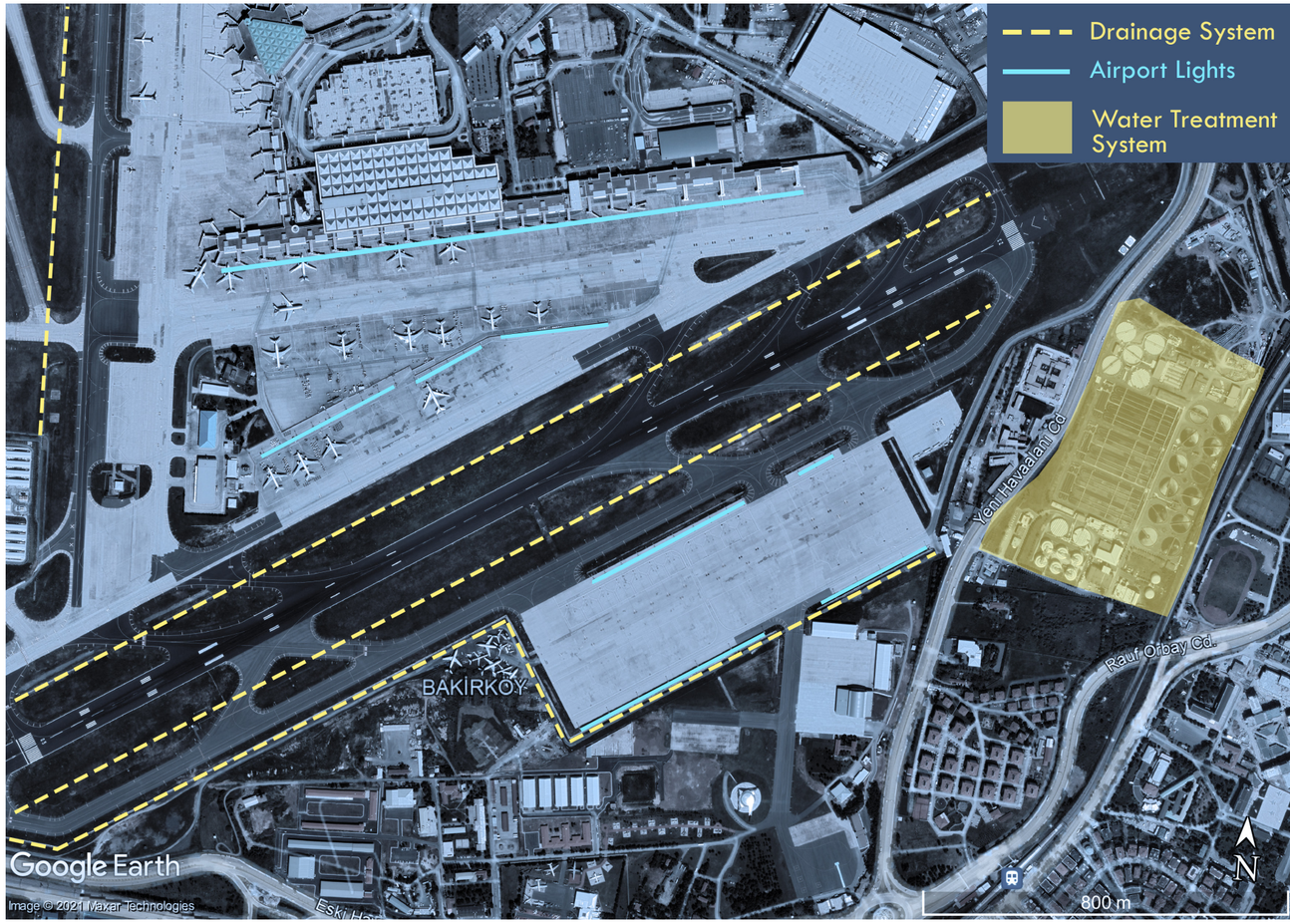


Figure 132 - SATELLITE IMAGE OF ATATURK AIRPORT

THE WATER SUPPLY AND MANAGEMENT

In emergency situations the water is essential to survive. In the disaster context there can be difficulties to access to the safe water and therefore supplying water carries a critical importance. The lack of water affects directly the human health and sanitation. The humans use water for nearly every activity the water is used for drinking ,doing laundry , washing dishes , taking a shower ,cleaning ,cooking etc. The sphere standards determines the minimum survival data that each person has to have accessibility.For the minimum water requirements per day are , minimum 2.5 L for drinking, 3L for cooking and 2 L for basic hygiene needs.

"In Turkey, per capita daily drinking and potable water consumption is 111 liters on average, according to 2014 DPT data. This rate is calculated as 125 lt/day/person for Istanbul, 141 lt/day/person for Ankara and 136 lt/day/person for Konya. In other words, a family of 4 living in Istanbul consumes an average of 500 liters of water per day." (SUMAK POMPA)

TOTAL : 125 LPD(liter per day)

%5 CLEANING ----------6.25L
%10 COOKING ----------12.5L
%20 LAUNDRY/DISHES ----- 25L
%65 WC/SHOWER ---------81.2L
Source : AA,ANADOLU AGENCY

But in the temporary shelters the consumption changes , in the shelter there are no wc or shower , for this reason the water consumption for each shelter reduces.
The minimum consumption for each person is 43.75 L + drinking water 3L.

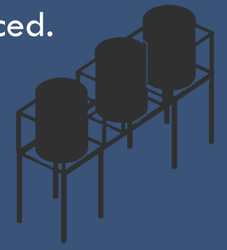
	A - 2 PEOPLE	B - 4 PEOPLE	C - 5 / 7 PEOPLE
1 DAY	90 L	180 L	225 - 315 L
1 WEEK	630 L	1260 L	1575 - 2205 L
	180 $	320 $	390 $

SHORT-TERM SOLUTION

SITE

-Using the existing buildings bathrooms

-Water Storage Tanks will be placed.



-Drinking water distribution points

-Vacuum Truck Tank daily arrives to site to empty the septic tanks for the latrines.

SHELTERS

-Daily water supply tanks

-5 Liter drinking water container per 2 person

-Rain water harvesting gutter added to roof.

LONG-TERM SOLUTION

SITE

-The bathroom units should be connected to the existing sewer system.

-Connecting to the existing main water distribution line all the services.

-Water collection system integrated to the site.

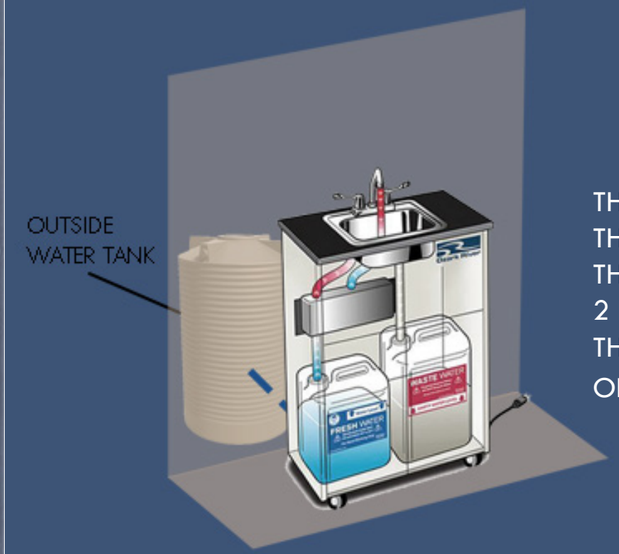
SHELTERS

-After adding the kitchen module , the floor panel should be opened , the pipes for the kitchen sink should be installed and connected to the water tank for supply.Or portable sink can be used.

- The greywater can be connected to the existing water system located in the area.

- Additional storage module to protect the water tanks from weather conditions.

Figure 133 – A child from the Za'atari Refugee Camp in Jordan raised a flag to represent Goal 6, Safe Water and Sanitation.
Photo: UNICEF Jordan/badran



THE ROOF OF UNIT A --- 14 SQM ,
THE AVERAGE RAINFALL IN ISTANBUL--- 728 MM
THE RAIN CAN BE COLLECTED ANNUALY 7.340L ,
2 PEOPLE FAMILY CONSUMES 32.850 L ANNUALY.
THE WATER COLLECTION CAN COVER THE 22%
OF WATER SUPPLY NEEDED.

Figure 117- IMAGE COLLAGE
Portable Sink OZARK RIVER and Rain Water Tank (Bushmans)

PORTABLE SINKS CAN BE CONNECTED TO THE WATER STORAGE TANKS

The portable sinks can be filled with fresh water and by just pluging into electric outlet you will have hot water. There are some products also with battery.There are no contamination risks because the 2 tanks are separated from each other. They are easy to remove and it can be emptied out in any drain.They can be used approximately for 40 to 80 handwashes.

THE ENERGY SOLUTION

The site selected is very well lit and has many generator systems. Generally in the disaster relief camps the electricity gets distributed from street lights and the generators. For the temporary shelters it is the best solution. In an intense event like this , the solar panels are not so reachable and yet they are expensive.

Figure 134 - Generators in Istanbul Ataturk Airport

Existings solutions can be more convenient. Above there is an image of an former expo , that organised in the same airport and the electricity reaches to the modules with the cables on the ground.

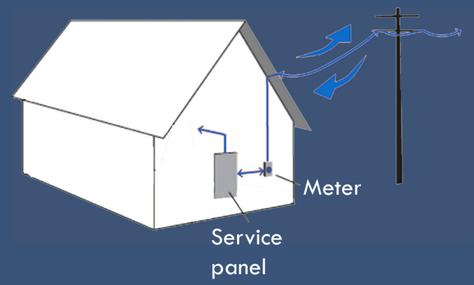
The families after the disaster , they will want to reach their loved ones and everyone will want to charge their phone. A led lamp is a must in order to have a light in the shelter at night. But also the management, security ,food distribution centers will need electricity immediately. In the long term it is necessary also to think about renewable sources.

SHORT-TERM SOLUTION

SITE

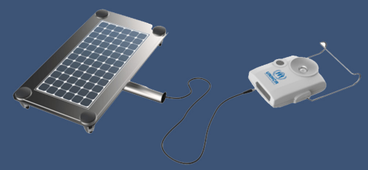
-Electric Generators will be delivered on the site

- Connecting to the existing network with cables.



SHELTERS

-Portable solar panel that can light an LED lamb and charge a phone.



LONG-TERM SOLUTION

SITE

-Solar panels can be installed on the site. Solar light poles can be inserted on the site. And can be connected to the as an on grid system.

SHELTERS

-Off grid system will be inserted on each roof ; 600W Solar Package (2 panel separated) System can charge ;

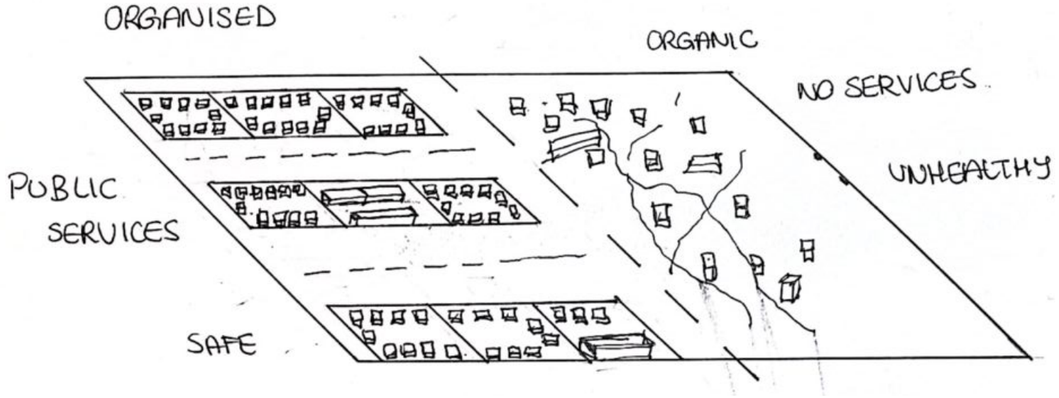
5 Energy Saving Lamps 6 Hours
Small LED Screen TV 6 Hours
Mini Size Refrigerator 24 Hours
Laptop 4 Hours
Cell Phone Charge 24 Hours

The appliances such as controller , inverter and battery will be stored in the additional space area.

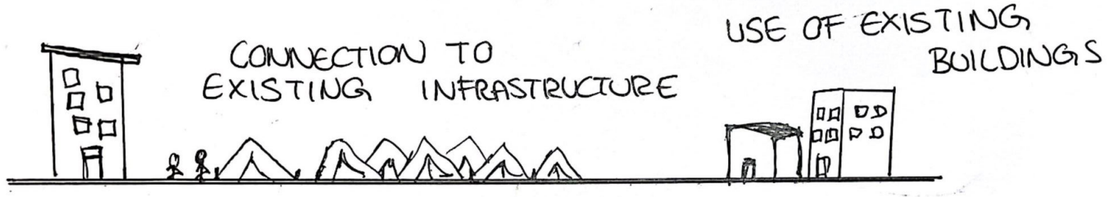
ATATURK AIRPORT TOGATHER CAMP

THE CAMP LAYOUT STRATEGIES

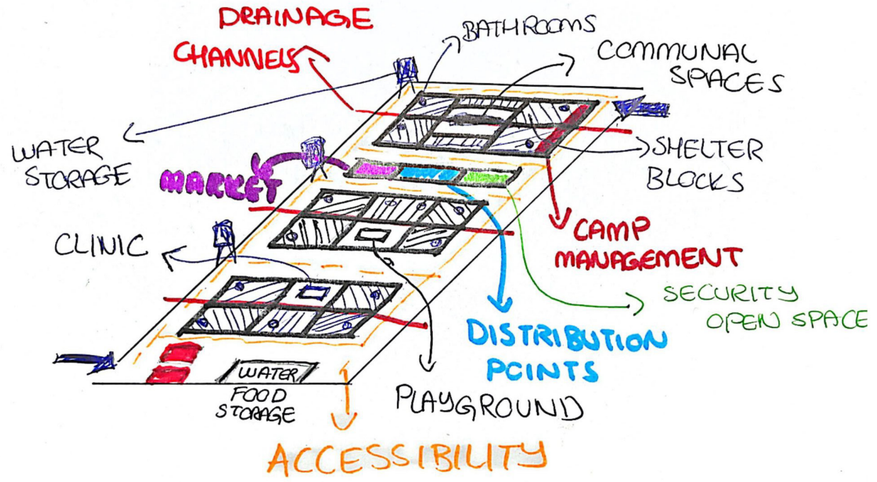
The disaster relief camps are lots of work but for improving the daily life of affected communities it is a must.



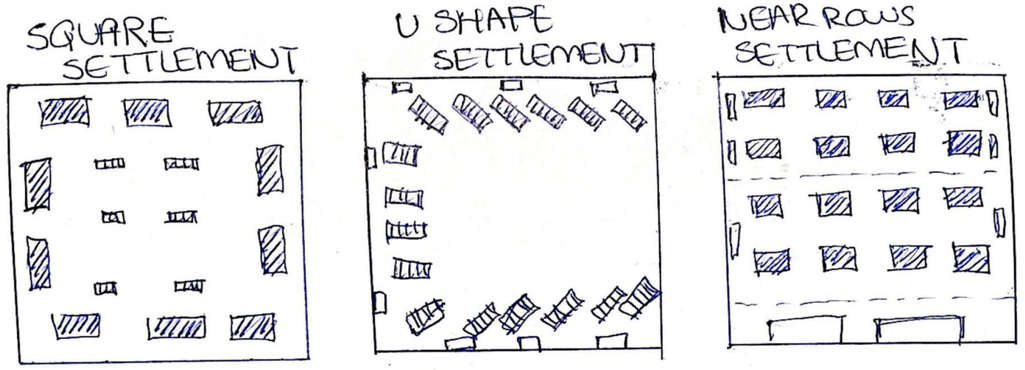
The use of existing facilities can be helpful in order to maintain the successful camp management. The buildings can be used for storages, distribution, and for connecting the existing infrastructure.



Camps has to have a social services search at storage points, distribution points, clinics, so those are in living in the camp have safety and access to all basic necessities. For the site location and arrangement the water supply systems and drainage must be considered.



The layout of the shelters can be arranged in different ways. But in this case this changes also the bathroom positions.



THE POSSIBLE LAYOUT OF SHELTERS

NEIGHBOURHOOD SETTLEMENT

The neighbourhood characteristics are very important to design the layout of the shelters, the turkish families that live in the same neighbourhood are very close to each other , they cook for each other and they occasionally socialize on the neighbourhood streets to drink tea. This was the one of the main design critics in order to design the layout of the settlements , 10 shelters are forming 1 neighbourhood with the basic human need services such as ; latrines , showers , communal spaces , waste collection and some communal kitchens.

But each neighbourhood is a part of a bigger neighbourhood that consists water , food distribution points. The camp consists market , storage , management offices, security offices and registration and health clinic.

The camp is divided in 2 camp areas in order to manage better the camp living.
The main road connects to the camp site and there are 2 entrance points to complete the registration.

The area is well lit there fo and the electricity can be connected easily to the shelters and to the services.
The shelters have minimum distance of 2 m from each other and they are positioned in order to have an air ventilation through the dominant wind direction , that is N and NE.

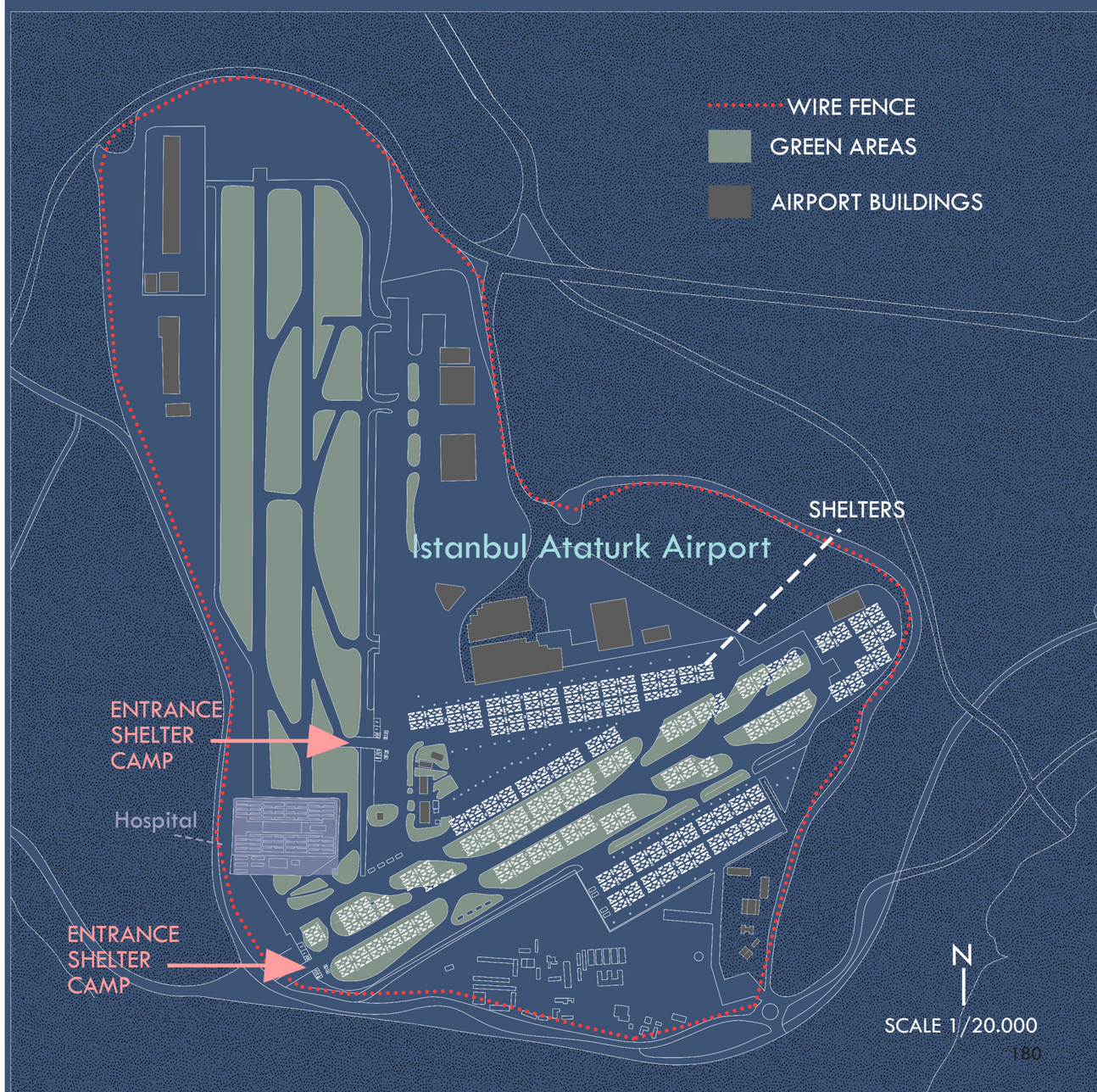
The bathrooms and showers are divided to be used by female and males separately and they are located in the corner area of the neighbourhoods in order to have the open public spaces in the middle.

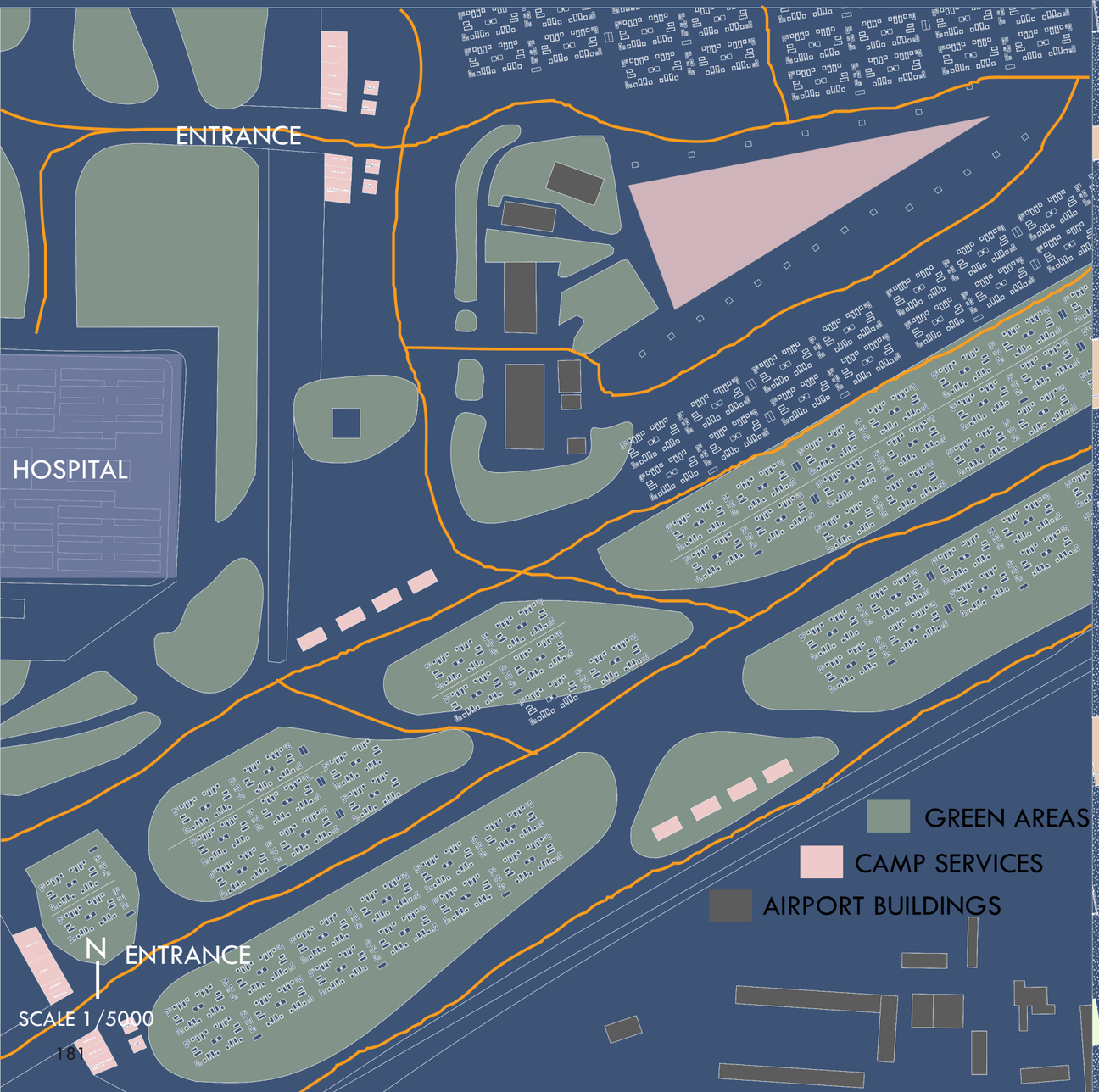
There are electricity generators around the site. In order to not have any problem. If needed the airport has wide green areas in the souther park to be used as other shelter camps.

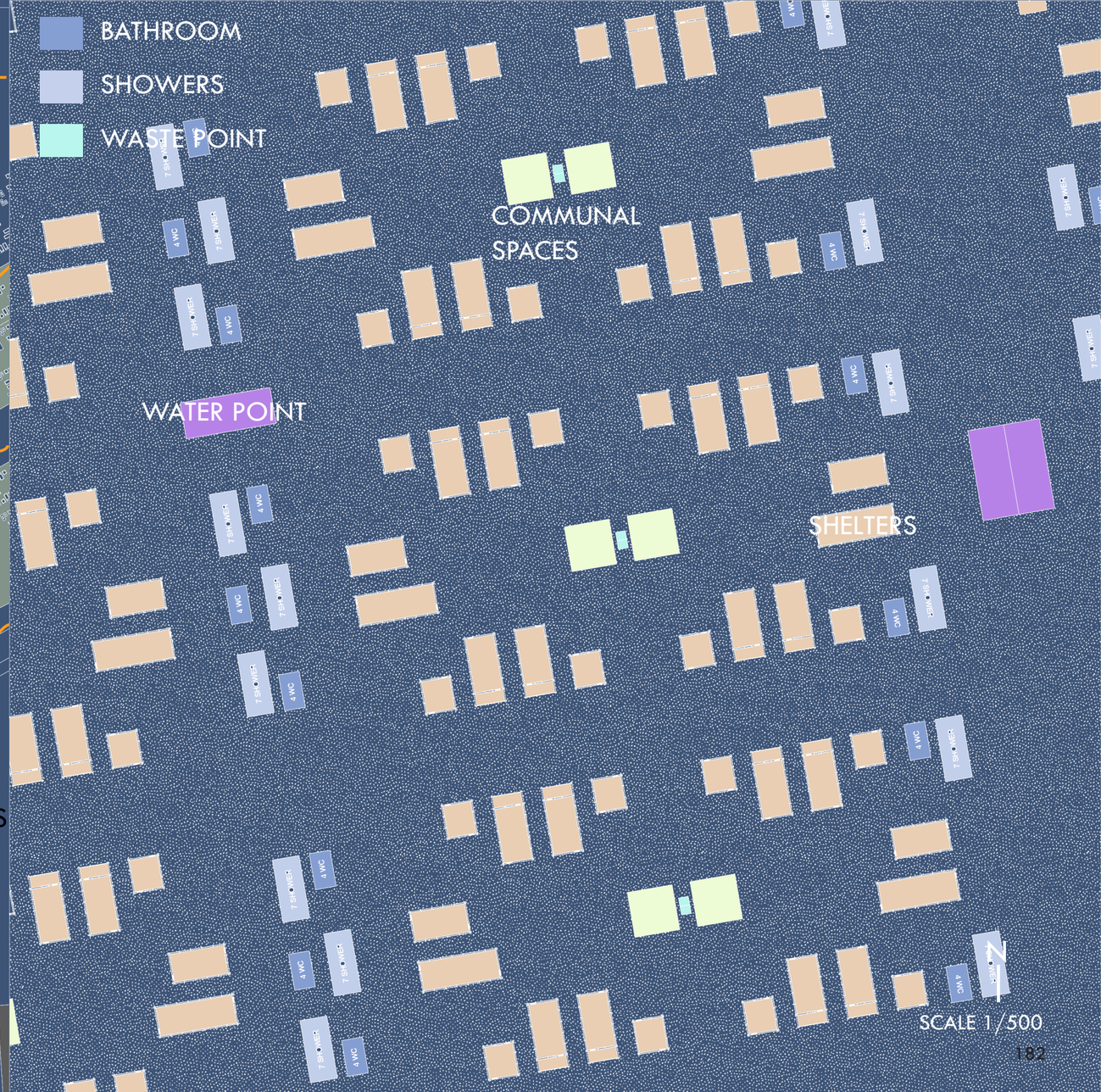
One of the advantages to have a shelter camp in the former airport is the security , all of the territory is surroundedn by wire fence , thus makes the shelterees feel more safe.

The emergency shelters are also located neaar the hospital and it is also in the city center, for this reason it is also accessible even for the people that has no cars.

The buildings that are located in the airport territory can be used for also the food distribution , toilets and for the other services.




ENTRANCE
HOSPITAL
GREEN AREAS
CAMP SERVICES
AIRPORT BUILDINGS
N
ENTRANCE
SCALE 1/5000


BATHROOM
SHOWERS
WASTE POINT
COMMUNAL SPACES
WATER POINT
SHELTERS
N
SCALE 1/500


35
36
37
38

CONCLUSION

As Turkish citizens, living in Istanbul, this thesis topic was inevitable for us. Like the inevitable reality of an probable earthquake that can be happen any second in Istanbul. The disaster topic is very wide and very complex. Through the analysis of the disasters happened worldwide, we understood that this argument has to respond to all problems and so a wider approach needed to be taken. The disaster argument starts with the strategies. As seen from the examples, for minimizing the impact especially vulnerable countries must be prepared. In this thesis the disaster management of Turkey was outlined. Turkey is still not prepared. Unfortunately if an 7.5 earthquake happens in Istanbul the impact will be very intense. Istanbul is very vulnerable geographically but also the poor quality of buildings worsens the stations. The analysis of the 1999 earthquakes and damage studies that can be happened in 7.5 mw earthquake shows that millions of people will be loose their families, friends and their homes. Through different disasters and shelter interventions, it was possible to see the main problems. The temporary shelters provided were not durable and they were not adaptable. A one size shelter will limit the flexibility that a shelter has to have in order to respond to the needs of different households. Generally the shelters were not adequate , sustainable or culturally appropriate. There are some new innovative solutions in order to response shelter needs, but generally speaking they are expensive and has to be manufactured in factories. This creates transportation and time issues. The transitional approach is the most suitable and economical choice. The transitional shelters can be upgraded in time and so the quality of life of the shelterees increases. But in order to response to the shelter needs, the analysis made clear that there is a need to form disaster relief camps. This relief camps have essential services in order to facilitate daily lives of the shelterees. Also for these camps there are some minimum standards to be taken into consideration. The shelters have to be located in the shelter camps and located through the minimum standards.

The proposal outlines; the shelters that has to be provided should be incremental , because the affected community don't know when they will be able to turn to their homes and generally they end up living in the shelters more than 3 months. The shelters have to be adaptable for winter and summer, therefore the base shelter kits have to have the main components such as structure and the panels but they will be upgraded according to weather and needs of the people.The main goal is not just to upgrade and adapt the structure but also the water solutions and energy solutions have to be upgraded in order to improve the quality of life. The former airport of Istanbul is chosen for the camp site. It is selected because its vast area and existing infrastructure. The site was used before for some events therefore the authorities know how to provide basic services to the area .For also the disaster relief camp concept , the services should be improved as the time passes by .Unfortunately for the temporary shelters private bathrooms cost too much and it creates problem for the infrastructure and sanitation. Therefore the camp has public showers and bathrooms near to the small neighborhoods. The electricity can be provided from existing infrastructure but for the long term staying it is better to have solar panels for each shelter. But as we mentioned before these shelters and camps is a temporary solution. Ataturk airport will be back as before when the camp closes. In the end also the shelters are temporary and they can be relocated , reused or recycled. As we mentioned before this thesis underlined the main issues and main solutions that can be taken. But the argument analysed has to be developed more in detail also for adaptability and services for the camp in order to achieve a project that contains all of the characteristics that shelter camps and shelters have to have.

BIBLIOGRAPHY

-Abhimanyua, Humagain and Dahal Khet Rajb. “Study of Debris Generated by the Earthquake with Special Reference to Gurkha Earthquake 2015 in Nepal,”ASRJETS, 2019. https://core.ac.uk/download/pdf/235050724.pdf

-AFAD, Disaster and Emergency Management Presidency, Ministry of Interior, Republic of Turkey. “Strategic Plan 2019-2023”, 2019. https://en.afad.gov.tr/kurumlar/en.afad/e_Library/plans/AFAD_19_23-StrategicPlan_Eng.pdf

-Alexander, David E.. “The L’Aquila Earthquake of 6 April 2009 and Italian Government Policy on Disaster Response”, 2010. https://www.tandfonline.com/doi/pdf/10.1080/19390459.2010.511450

-Altun, Ayşe Özyetgin. “Afet Riski Yönetimi Kapsamında Kent Planlama; Istanbul Planları Ve Uygulamaları”,”Urban Planning in the Scope of Disaster Risk Management; Istanbul Plans and Applications”, Mimar Sinan Fine Arts University, 2017.

-Asian Development Bank. “Global Increase in Climate-Related Disasters”, 2015. https://reliefweb.int/report/world/global-increase-climate-related-disasters

-Babbitt, Callie W. “The role of clean technology research in disaster debris management”, 2019. https://link.springer.com/article/10.1007%2Fs10098-019-01712-1

-Bamgbose, Oluyemisi A. “The Law and Practice on Disaster Issues”, ISBN:978-978-55448-2-4, 2018.

-Baş, Mahmut. “Istanbul Olası Deprem Kayıp Tahminleri”,”Possible Earthquake Loss Estimates for Istanbul”, 2009. http://www.ibb.gov.tr/tr-TR/SubSites/DepremSite/Documents/C_%C4%B0STANBUL%E2%80%99UN%20OLASI%20DEPREM%20KAYIPLARI%20TAHM%C4%B0NLER%C4%B0-rapor.pdf

-Baycan, Filiz. “Emergency Planning For Disaster Waste: A Proposal Based on The Experience of The Marmara Earthquake in Turkey”, Ministry of Environment and Forestry, Republic of Turkey, 2000. http://www.grif.umontreal.ca/pages/papers2004/Paper%20-%20Baycan%20F.pdf

-Better Shelter Organization. “A Home Away from Home”, 2019. https://bettershelter.org/wp-content/uploads/2019/05/Better-Shelter-1.2-Product-Spec-4p-English-1.pdf

-Brown, Charlotte O., Mark Milke, Erica Seville and Sonia Giovinazzi. “Disaster Waste Management on the Road to Recovery”, 2010. https://core.ac.uk/download/pdf/35463264.pdf

-Brown, Charlotte O.. “Disaster Waste Management : a system approach” 2012. https://www.resorgs.org.nz/wp-content/uploads/2017/07/brown_thesis_june12.pdf

-Bündnis Entwicklung Hilft. “World Risk Report 2019”, Ruhr University Bochum, 2019. https://reliefweb.int/sites/reliefweb.int/files/resources/WorldRiskReport-2019_Online_english.pdf
-Cbcnews.com. “Anatomy of a Refugee Camp”, 2007. https://www.cbc.ca/news2/background/refugeecamp/

-Climate-data.org. “Climate Istanbul”, 2021. https://en.climate-data.org/asia/turkey/istanbul/istanbul-715086/

-Climate Adapt. “Crises and Disaster Management Systems and Plans”, 2015. https://climate-adapt.eea.europa.eu/metadata/adaptation-options/crises-and-disaster-management-systems-and-plans

-Coscolluela, Erjo O., Trisha Joi D. Esperanza, Rex Nario. “Disasters Risk Management: Earthquakes”, 2012. http://sv2.jice.org/jenesys/2012/12/21/pdf/Batch%203%20Baguio%20Policy%20Paper.pdf

-Culturalatlas.com. “Turkish Culture”, 2021. https://culturalatlas.sbs.com.au/turkish-culture/turkish-culture-family

-Gibbens, Sarah. “Hurricane Sandy”, 2019. https://www.nationalgeographic.com/environment/article/hurricane-sandy

-Global Shelter Cluster. “Shelter Projects, Shelter and Cash: 16 Case Studies”, 2018. http://shelterprojects.org/shelterprojects-compilations/Shelter-Projects-Cash-Booklet-2018.pdf

-Gross, John L. and Long T. Phan. “Earthquake Kocaeli Turkey 1999”, 2000. https://www.nist.gov/el/earthquake-kocaeli-turkey-1999

-Holzer, Thomas L., Aykut A. Barka. “Implications for Earthquake Risk Reduction in The United States from The Kocaeli, Turkey, Earthquake of August 17, 1999”, 2000. https://pubs.usgs.gov/circ/2000/1193/report.pdf

-Internal Displacement Monitoring Centre. “Global Report on Internal Displacement”, 2020. https://www.internal-displacement.org/publications/2020-global-report-on-internal-displacement

-International Organization for Migration. “Cyclone Eloise Response Plan”, 2021. https://reliefweb.int/sites/reliefweb.int/files/resources/iom_mozambique_eloise_cyclone_response_plan_final_rev011-2.pdf

-Kemp, Walter. “Disasters and Displacement: Improving Preparedness and Protection”, 2013. https://reliefweb.int/sites/reliefweb.int/files/resources/ipi_e_pub_disasters.pdf

-Khazai, Bijan. “Emergent Issues and Vulnerability Factors in Temporary and Intermediate Shelters Following the 2015 Nepal Earthquake”, 2015. https://www.cedim.kit.edu/download/CEDIM_NepalEarthquake_Report4_ShelterFM.pdf

-Kundak, Seda and Handan Türkoglu. “Istanbul’da Deprem Riski Analizi”,”Earthquake Risk Analysis in Istanbul”, 2007. http://www.itudergi.itu.edu.tr/index.php/itudergisi_a/article/viewFile/846/768

-Mahesh, Pradhan. “Building Resilience Through Disaster Waste Management - UN Environment’s Experiences and Approaches”, 2018. http://jsuese.ijournals.cn/html/2018/3/201800432.html

-Maly, Elizabeth and Tsukasa Iwata. “The Evolution of Localized Housing Recovery in Japan”, IOP Science, 2019. https://iopscience.iop.org/article/10.1088/1755-1315/273/1/012055/pdf

-McClelland, Mac. “How to Build a Perfect Refugee Camp”, New York Times, 2014. https://www.nytimes.com/2014/02/16/magazine/how-to-build-a-perfect-refugee-camp.html

-Meaghan, Kelly. “Disaster Management Cycle”, 2020. https://home.akitabox.com/blog/4-phases-of-disaster-management

-Oliver-Smith, Anthony. “Disasters and Large-Scale Population Dislocations: International and National Responses”, 2018. https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/EGM2019_displacement.pdf

-Oxfam GB. “Guidelines for Post Disaster Housing Reconstruction”, 2003. https://www.ifrc.org/PageFiles/95751/B.d.03.%20Guidelines%20for%20Post%20Disaster%20Housing%20%20version%201_OXFAM%20GB.pdf

-Parwanto, Novia Budi. “Quantitative Study on Natural Disasters Risk Management Policy”, 2014. https://www.grips.ac.jp/cms/wp-content/uploads/2014/11/ExecutiveSummarydoc11101.pdf

-Ramalingam, Ben and David Sanderson. “Nepal Earthquake Response: Lessons for Operational Agencies,”ALNAP, 2015. https://reliefweb.int/sites/reliefweb.int/files/resources/nepal-earthquake-response-lessonspaper.pdf

-Sakai, Shinichi and Sofia Bettencourt. “Knowledge Notes 4-4, Cluster 4: Recovery Planning, Debris Management”, The World Bank, 2012. https://openknowledge.worldbank.org/bitstream/handle/10986/16136/800670drm0kn404000Box0377295B00PUBLIC0.pdf?sequence=1&isAllowed=y

-Smith, Oliver. “Disasters and Large-Scale Population Dislocations: International and National Responses”, 2018. https://www.un.org/development/desa/dpad/wp-content/uploads/sites/45/EGM2019_displacement.pdf

-The Nansen Initiative. “Agenda For The Protection of Cross-Border Displaced Persons in The Context of Disasters and Climate Change”, 2016. https://disasterdisplacement.org/wp-content/uploads/2014/08/EN_Protection_Agenda_Volume_I_-low_res.pdf

-Toros, Hüseyin, Mohsen Abbasnia, Mustafa Sagdıç and Mete Tayanç. “Long-Term Variations of Temperature and Precipitation in the Megacity of Istanbul for the Development of Adaptation Strategies to Climate Change”, DOI:10.1155/2017/6519856, 2017.

UNDP, United Nations Development Programme. “Haitians clear half of quake rubble”, 2011. https://reliefweb.int/report/haiti/haitians-clear-half-quake-rubble

-UNHCR, The UN Refugee Agency. “Quick Guide Post-Disaster Debris Management”, 2005. https://postconflict.unep.ch/humanitarianaction/documents/02_05-04_01-03.pdf

-UNHCR, The UN Refugee Agency. “Shelter and Sustainability”, 2021. https://www.sheltercluster.org/sites/default/files/docs/shelter_and_sustainability_overview-unhcr.pdf

-UNHCR, The UN Refugee Agency. “Transitional Shelter (T-Shelter) Design for Azraq Camp, Jordan”, 2015. https://reliefweb.int/report/jordan/transitional-shelter-t-shelter-design-azraq-camp-jordan-16-march-2015

-UN-SPIDER, Office for Outer Space Affairs. “Risks and Disasters”, 2021. https://un-spider.org/risks-and-disasters

-Water, Engineering and Development Centre, Loughborough University. “Disasters and Emergencies: Definitions, Impacts and Response”, 2011. https://wedc-knowledge.lboro.ac.uk/resources/booklets/G002-Disasters-and-emergencies-on-line.pdf

-Designing Buildings Wiki. “Wikihouse”, 2011. https://www.designingbuildings.co.uk/wiki/Wikihouse
-World Health Organization. “Managing disaster risks in communities”, 2015. https://www.preventionweb.net/files/45892_whomanagingdisasterrisksincommuniti.pdf

-World Meteorological Organization. “Tropical Cyclone Eloise hits Mozambique”, 2021. https://public.wmo.int/en/media/news/tropical-cyclone-eloise-hits-mozambique

-Wróbel, Aleksandra. “Emergency Center Proposal Provides Adaptable Shelter to Sub-Saharan Communities in Need”, 2020. https://www.designboom.com/architecture/emergency-center-proposal-adaptable-shelter-sub-saharan-communities-need-06-15-2020/

-Wynveen, Reneé. “Shelter and Sustainability”, UNHCR, 2021. https://www.sheltercluster.org/resources/documents/unhcr-shelter-and-sustainability

-Yonetani,Michelle Internal Displacement Monitoring Centre (IDMC). “Disaster-related displacement in a changing climate”. https://public.wmo.int/en/resources/bulletin/disaster-related-displacement-changing-climate

-Şener Sinan and M. Cem ALTUN. “Design of a post disaster temporary shelter unit” ,2009. https://www.humanitarianlibrary.org/sites/default/files/2014/02/06seneraltun0602.pdf

-Özden, A. T. “Architecture and Disaster: A Holistic and Risk-Based
Building Inspection Professional Training Model for Practicing Architects in Turkey”,2003

-CHS Alliance, Sphere Association and Groupe URD. ”Core Humanitarian Standard on Quality and Accountability”, 2018

-Plywood Characteristics - http://www.matweb.com/search/datasheet_print.aspx?matguid=bd6620450973496ea2578c283e9fb807

IMAGE REFERENCES

-Figure 1- Unknown Author. “After the 1999 Marmara Earthquake”, Anadolu Ajansı, Image edited by authors, 2020. https://www.aa.com.tr/tr/pg/foto-galeri/turkiye-19-yilda-yaklasik-211-bin-depremle-sallandi/2

-Figure 2- Casilli, Remo. “Corso Umberto, Central Italy Earthquake”, Reuters, 2016. https://temblor.net/earthquake-insights/nasa-radar-maps-reveal-massive-extent-of-amatrice-damage-from-italy-earthquake-1271/

-Figure 3- Bündnis Entwicklung Hilft. “The WorldRiskIndex and its components”, World Risk Report 2019, 2019. https://reliefweb.int/sites/reliefweb.int/files/resources/WorldRiskReport-2019_Online_english.pdf

-Figure 4- Number of people affected per disaster type 1998-2017, Economic Losses, Poverty & Disasters 1998-2017, https://www.undrr.org/publication/economic-losses-poverty-disasters-1998-2017

-Figure 5- The Data of Natural Disasters in The World Between 1900-2019, EMDAT (2020): OFDA/CRED International Disaster Database, Université Catholique de Louvain – Brussels – Belgium

-Figure 6, 7- Risk Map of Earthquake Around The World. https://iresim.org/dunya-dogal-afetler-haritasi-652041.html

-Figure 8- Unknown Author. “After the 1999 Marmara Earthquake”, Anadolu Ajansı, Image edited by authors, 2020. https://www.aa.com.tr/tr/pg/foto-galeri/asrin-felaketinin-uzerinden-21-yil-gecti-

-Figure 9- Unknown Author. “Devastating Aquila Earthquake”, Agence France Presse, Image edited by authors, 2009. https://www.independent.co.uk/news/world/europe/scientists-go-trial-failing-warn-public-about-l-aquila-quake-2358188.html

-Figure 10- Raedle, Joe. “Haiti Earthquake of 2010”, Getty Images, Image edited by authors, 2010. https://www.britannica.com/event/2010-Haiti-earthquake

--Figure 11- Unknown Author. “The 2011 Tohoku Earthquake Caused Devastation in Japan”, Asahi Shimbun, Getty Images, 2011. https://www.nature.com/articles/nature.2016.19252

-Figure 12- Groll, Mike. “Aerial photo after Hurricane Sandy”, Associated Press, 2012. https://www.washingtontimes.com/multimedia/image/bloomberg_5158_20121030/

-Figure 13- Unknown Authors. “The scenes of devastation following the second earthquake to strike Nepal in three weeks”, PA Images, Image edited by authors, 2015. https://www.irishnews.com/news/2015/05/13/news/nepal-hit-by-second-earthquake-in-the-space-of-three-weeks-127205/

--Figure 14, 15- Grassani, Alessandro. “Amatrice, Italy, one week after a 6.2-magnitude earthquake hit the city”, The New York Times, 2015. https://www.nytimes.com/2016/09/19/world/europe/italy-art-quake-amatrice.html

-Figure 16- Unknown Author. “Japan floods: Heavy rain in Kumamoto prefecture destroys houses”, BBC News, Image edited by authors, 2020. https://www.bbc.com/news/av/world-asia-53292137

-Figure 17- Petinga, Tiago. “A woman searches for materials to rebuild her home after the passage of Cyclone Idai, in Beira City, central Mozambique”, EPA-EFE, 2019. https://theconversation.com/poor-coverage-of-floods-in-southern-africa-blame-the-media-bosses-114314

-Figure 18- Kelly, Meghan. “Recreation of Diagram of 4 Phases of Disaster Management”, 2020. https://home.akitabox.com/blog/4-phases-of-disaster-management

-Figure 19- Lindell, Michael K. and Prater. “Disaster Impact Model”, 2003.

-Figure 20- Augustino, Jocelyn. “The National Fire Academy holds a table-top emergency preparedness exercise with firefighters from across the country simulating a structure fire and other emergency situations in a mock city”, FEMA News, Image edited by authors, 2003. http://www.city-data.com/disaster-photos/7657.html

-Figure 21- Bullock, Jane A., George D. Haddow and Damon P. Coppola. “Tangible and Intangible Consequences of Disasters. Mitigation, Prevention, and Preparedness”, 2013. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7158272/

-Figure 22- Disaster Response Operations. https://rewardvolunteers.coop/volunteer-with-disaster-relief/

-Figure 23- Heathcote, Charles. “Construction of The Pilot House in Nepal”, 2015. https://www.redcross.ie/about-us/charity-transparency/

-Figures 24, 25- Knowles, Joshua. Illustration, 2021. https://disasterdisplacement.org/staff-member/in-conversation-with-mr-joshua-knowles

-Figure 26- Internal Displacement Monitoring Centre. “Disaster Displacements in 2019 by Location”, 2020. https://www.internal-displacement.org/global-report/grid2020/

-Figure 27- Internal Displacement Monitoring Centre. “New Displacements in 2019, Broken Down by Conflict, Violence and Disasters”, 2020. https://www.internal-displacement.org/global-report/grid2020/

-Figure 28- Onyodi, Denis. “Aftermath of Cyclone Idai in Mozambique”, IFRC, Image edited by authors, 2017. https://climateoutreach.org/talk-about-climate-linked-migration-media/

-Figure 29- Lorca, Álvaro, Melih Çelik, Özlem Ergun and Pınar Keskinocak. “A Decisi¬on-support Tool for Post-disaster Debris Operations, Flow of Debris Management Operations Throu¬ghout The Disaster Timeline”, DOI:10.1016/j.proeng.2015.06.069, 2015.

-Figure 30- Bellini, Giuseppe. “Buildings in Pescara del Tronto were reduced to a pile of rubble by the earthquake as the search for survivors continues”, Getty Images, 2016. https://www.latimes.com/world/europe/la-fg-italy-quake-20160825-snap-story.html

-Figure 31- Sakai, Shinichi and Sofia Bettencourt. “Separation and Treatment of Earthqueake Waste”, The World Bank, 2012. https://openknowledge.worldbank.org/bitstream/handle/10986/16136/800670drm0kn404000Box0377295B00PUBLIC0.pdf?sequence=1&isAllowed=y

-Figure 32- Sakai, Shinichi and Sofia Bettencourt. “Classification and Treatment of Earthqueake Waste”, The World Bank, 2012. https://openknowledge.worldbank.org/bitstream/handle/10986/16136/800670drm0kn404000Box0377295B00PUBLIC0.pdf?sequence=1&isAllowed=y

-Figure 33- Pradhan, Mahesh and Qing Xu. “Reported Waste Quantities From Previous Disasters. Building Resilience Through Disaster Waste Management-UN Environment’s Experiences and Approaches”, DOI:10.15961/j.jsuese.201800432, 2018.

-Figure 34- Belizaire, Thony. “Workers remove rubble from a destroyed school in Port-Au-Prince”, Agence France Presse, 2010. https://www.npr.org/templates/story/story.php?storyId=125170774

-Figure 35- Kazuo, Ide. “Treatment of disaster waste generated by the Great East Japan Earthquake-Typical Basic Treatment Flow”, DOI: https://doi.org/10.3208/jgssp.ESD-KL-6, 2016.

-Figure 36- International Organization for Migration. “Shelter teams are building robust emergency shelters for Rohingya”, 2018. https://www.iom.int/news/un-migration-agency-rohin¬gya-refugees-work-together-build-emergency-shelters-funding-crisis

-Figure 37- Alexander, David E. “Full sequence of Post-Disaster Shelter”, The L’Aquila Earthquake of 6 April 2009 and Italian Government Policy on Disaster Response, Journal of Natural Resources, 2010.

-Figure 38- Bellini, Giuseppe. “General view of a tent camp for the earthquake refugees in Arquata del Tronto”, Getty Images, 2016. https://www.ibtimes.co.uk/thousands-left-homeless-after-entire-italian-villages-are-destroyed-by-earthquake-1578004

-Figure 39- Laporta, Mario. “Shelter Set Up in a Gymnasium of L’Aquila Sport Center -University”, Agence France Press, 2009. http://archive.boston.com/bigpicture/2009/04/the_laquila_earthquake.html

-Figure 40- Donati S.P.A.. “PROJECT C.A.S.E - L’Aquila”, 2009. https://donatispa.it/portfolio-articoli/progetto-c-a-s-e-l-aquila/

-Figure 41- Unknown Author. “Aerial Photo of Onna Village”.

-Figure 42- Baker III, Fred W.. “A Tent City in Post-Earthquake Haiti”, Wikimedia, Image edited by authors, 2017. https://phys.org/news/2017-09-caribbean-colonialism-inequality-hurricanes-harder.html

-Figure 43- Espinosa, Ramon. “A Wider View of A Tent City Set Up for Earthquake Victims in Port-au-Prince”, AP Photo, 2010. http://www.haitian-truth.org/haiti-ten-months-later-now-fighting-losing-battle-against-minustah-introduced-cholera-200000-infected-and-number-increases-some-cry-genocide/

-Figure 44- Habitat for Humanity. Post-Earthquake Recovery. https://www.habitatforhumanity.org.uk/country/haiti/

-Figure 45- Shimbun, Yomiuri. “Overcrowded Shelter Following The Great East Japan Earthquake”, 2011. https://www.researchgate.net/figure/Overcrowded-shelter-following-the-Great-East-Japan-Earthquake-2011-Tohoku-Earthquake_fig1_241691065

-Figure 46- Unknown Author. “Permanent Public Housing for Those Displaced”, 2019. https://www.nippon.com/en/news/yjj2019030500831/8-years-on-2011-disaster-temporary-housing-being-reused.html

-Figure 47- Unknown Author. “An Aerial View of Construction of New Permanent Housing”

-Figure 48 - Humanitarian profile: people sheltering by camp site types (Source: UNOCHA 2015e)

-Figure 49- Unknown Author. “Image of Tents Used After The Nepal Earthquake”.

-Figure 50- The World Bank. “EHRP Beneficiary in Front of Her Newly Reconstructed House, Holding Her Participation Agreement”, SW Nepal.

-Figures 51, 52, 53, 54 - UNHCR, The UN Refugee Agency. “Shelter and Sustainability. ”, 2021. https://www.sheltercluster.org/sites/default/files/docs/shelter_and_sustainability_overview-unhcr.pdf

-Figures 55, 56, 57- Rural Urban Framework. “Jintai Village Reconstruction”, 2014. https://www.archdaily.com/882714/jintai-village-reconstruction-rural-urban-framework

-Figure 58, 59, 60- Ha, Doan Thanh. “Bb Home / H&P Architects”, 2013. https://www.archdaily.com/431271/bb-home-h-and-p-architects

-Figure 61 - EXO Modular Units https://inhabitat.com/wp-content/blogs.dir/1/files/2011/08/Exo-Reaction-Housing-System-Easy-to-Assemble-Flat-Pack-Emergency-Shelter-24-600x424.jpg

-Figure 62 - The Tentative Shelter www.designnobis.com.tr/wp-content/uploads/2020/10/1-69.jpg?ssl=1

-Figure 63 - The people in need of shelter scheme - Created by Zeynep Peker - Furkan Uman

-Figure 64- Unknown Author. “Collapsed Building as a Consequences of 17 August Marmara Earthquake”, Image edited by authors, 2019. https://www.star.com.tr/guncel/17-agustos-1999-depreminde-kac-kisi-oldu-17-agustos-1999da-neler-yasandi-haber-1474620/

Figure 65 - Alkan, Göker. “Building Damages After 17 August Marmara Earthquake”, Image edited by authors, 2017. https://silo.tips/download/kentsel-dnm-srecinde-kentsel-afet-risk-ynetimi-ne-dair-kocaeli-glck-deirmendere

-Figure 66 - Aygılı, R. “The Map of Earthquake Zones in Turkey”, Image edited by authors, 2014. https://www.milliyet.com.tr/egitim/haritalar/turkiye-deprem-haritasi-deprem-bolgeleri-nerelerdir-1-2-3-4-ve-5-derece-deprem-bolgeleri-6307462

-Figure 67 - Neves, Miguel. “Map of The Marmara Sea Earthquakes Analyzed in The Study and Main Faults in The Area”, Image edited by authors, 2020. https://temblor.net/earthquake-insights/earthquakes-in-turkey-support-two-disparate-models-of-earthquake-initiation-12026/attachment/marmara_sea_eq/

-Figure 68 - Unknown Author. “Image of People Sleeping on The Roof”, Image edited by authors, 2009. https://www.milliyet.com.tr/galeri/turkiyenin-en-aci-45-saniyesi-38573/72

-Figure 69 - Palaska, Binnur. “Image of Injured People in Street”, Image edited by authors, 1999. http://www.ndthd.org.tr/images/hemodiyaliz-tedavisi-srasinda-acil-durum-ve-afet-yonetimi.pdf

-Figure 70 - Unknown Author. “Image of A Tent City After Marmara Earthquake”, Anadolu Ajansı, 2019. https://www.hurriyet.com.tr/galeri-20-yil-once-20-yil-sonra-41303698/1

-Figure 71 - Istanbul Metropolitan Municipality. “Datas collected from Kandilli Observatory and Earthquake Research Institute”. https://depremzemin.ibb.istanbul/guncelcalismalarimiz/#next

-Figure 72 - Güler, Ülker Aslı. “Waste Management Strategies and Problems Occurred ,’Waste Management in Sustainable Disaster Management”.,

-Figure 73 - “The Prefabric Houses of Kızılay Organization”, 2017. https://www.kizilaysistemyapi.com.tr/haberler-duyurular/kizilay-prefabrik-evleri-kendisi-uretecek/

-Figure 74 - “Image of Prefabric Shelters in Sakarya, Turkey”, Cihan Haber Ajansı, 2013. https://www.haberler.com/depremzedeler-icin-yapilan-prefabrikler-14-yil-4942801-haberi/

-Figure 75 - Authors. “Satellite Image of Turkey”, Google Earth Pro. 2021

-Figures 76 - AFAD, Disaster and Emergency Management Presidency, Ministry of Interior, Republic of Turkey. “Earthquake Hazard Map of Turkey”, 2018.

-Figure 77 - Authors. “Istanbul Road Map”, Google Earth Pro, 2021.

-Figures 78 - Authors. “Satellite Image of Turkey”, Google Earth Pro. 2021

-Figures 79, 80 - Balamir, M. “Painful Steps of Progress from Crisis Planning to Contingency Planning: Proposed and Realized Changes for Disaster Preparedness in Turkey”, https://doi.org/10.1111/1468-5973.00179, 2002.

-Figure 81 - Unknown Author. “Gecekondu slum in Ankara, Turkey”, 2009. http://ankaratarihi.blogspot.com/2009/12/cevre-sini-arayan-ankara.html

-Figure 82, 83, 84, 85 - Newspaper Headlines in Regional Newspapers

-Figures 86, 87, 88- Istanbul Metropolitan Municipality. “Datas collected from Kandilli Observatory and Earthquake Research Institute”. https://depremzemin.ibb.istanbul/guncelcalismalarimiz/#next

-Figure 89, 90 - Climate-data.org. “Weather by Month, Weather Averages of Istanbul”, 2021. https://en.climate-data.org/asia/turkey/istanbul/istanbul-715086/

-Figure 91- Authors. “Satellite Image of Turkey”, Google Earth Pro. 2021

-Figure 92 - Authors. “Map of Districts of Istanbul, Turkey”, 2021

-Figures 93, 94 - Unknown Author. “Render of Possible Urban Park, Ex-Istanbul Atatürk -Airport.”

-Figure 95 - Unknown Author. “Possible repurpose of area, Ex-Istanbul Atatürk Airport.”

-Figure 96 - Unknown Author. “Emergency Assemble Area After The Earthquake Struck in Turkey”.

-Figure 97- Unknown Author. “Temporary Shelters Were Situated in Open Space”.

-Figure 98 - Unknown Author. “Organisations Collecting The Possessions of Survivors in an Emergency Tent”

-Figure 99 - Unknown Author. “Photos Found in a Rubble”

-Figures 100, 101, 102, 103- Unknown Author. “Photos of Temporary Settlements After The 1999 Earthquake”

-Figure 104 - Unknown Author. “Diagram of What To Do After An Disaster Occurs”

-Figure 105 - Hutzler, Tobias. “Kilis, A Refugee Camp in Turkey Near The Syrian Border”,The New York Times, 2014.
-Figure 106 - Unknown Author. “A Photo of An Turkish Family”.

Figure 107 - Unknown Author. “Interior of An Gecekondu”.

-Figure 108 - Unknown Author. “Aerial Photo of A District Formed by Gecekondus”.

-Figure 109 - Unknown Author. “Interior Photo of A Gecekondu”.

-Figure 110 - Unknown Author. “Plywood Board”.

-Figure 111 - Authors. “Plywood Manufacturers in Istanbul”, 2021.

-Figure 112 - Unknown Author. “Plywood Layers”.

-Figure 113 - Unknown Author. “CNC Router Cutting Parts for A WikiHouse”.

-Figure 114 - Galilee, Beatrice. “WikiHouse”.

-Figure 115 - Unknown Author. “Structural System, The Unique Facit Chassis”.

-Figure 116 - Unknown Author. “Concept For A Prefabricated Shelter Which Is Easy To Fabricate, Ship and Assemble”.

-Figure 117 - Wróbel, Aleksandra, Agnieszka Witaszek and Kamil Owczarek. “Emergency Center Proposal Provides Adaptable Shelter To Sub-Saharan Communities in Need”.

-Figure 118 - Unknown Author. “Indonesia: Transitional Shelter Construction”.

-Figure 119 - Unknown Author. “Shelter Cash and Markets Community of Practice”.

-Figure 120 - Unknown Author. “Better Shelter Kit” https://bettershelter.org/wp-content/uploads/2019/04/IMG_6836-1.jpeg

-Figure 121, 122 - The Material Recycle - Created by Zeynep Peker - Furkan Uman

-Figure 123 - Space division according to functions - Created by Zeynep Peker - Furkan Uman

-Figure 124 - https://theoffgridcabin.com/how-to-build-the-best-foundation-for-an-off-grid-cabin/

-Figure 125 - https://www.huffpost.com/entry/porches-making-a-comeback_n_5630321

-Figure 126 - https://www.cbsnews.com/news/glaxos-dirty-laundry-on-troubled-diabetes-drug-avandia-a-rogues-gallery-of-images/

-Figure 127 - https://www.hgtv.com/design/make-and-celebrate/handmade/how-to-make-a-house-shaped-kids-bed-with-storage

-Figure 128 - https://www.hepsiburada.com/kumtel-kh-lx-7020-7021-2500-w-2-gozu-elektrikli-ocak-pm-mtkumkh7021

-Figure 129 - https://www.haberler.com/kultur-ve-yasam-evinden-kadinlar-ve-aileler-13514601-haberi/

-Figure 130 - https://www.enstocks3k.top/products.aspx?cname=majlis+floor+sofa+set&cid=154

-Figure 131 - https://www.walmart.com/ip/RoomDividersNow-Premium-Heavyweight-Room-Divider-Curtain-8ft-Tall-x-15ft-Wide-Harbor-Blue/445766161

-Figure 132 - Satellite image of Atatürk Airport, Google Maps.

-Figure 133 - A child from the Za’atari Refugee Camp in Jordan raised a flag to represent Goal 6, Safe Water and Sanitation. Photo: UNICEF Jordan/badran. https://www.unwater.org/water-facts/human-rights/

-Figure 134 - Generators in Istanbul Atatürk Airport, Google Earth Pro.

WAITING THE INEVITABLE ,2021 FURKAN UMAN & ZEYNEP PEKER