Casualty Collection System

THE RIGHT DISASTER RESPONSE

Elizabeth Rae | Thesis | 2017-2018 | North Dakota State University

Casualty Collection System

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TABLE OF CONTENTS

THESIS ABSTRACT

Our world continuously changes as the population grows, and technology advances to new heights. Each change has different effects on our environment, some are negative while others are positive. Some developments have caused major changes to the point where natural disasters have increased their occurrence, strength, and unpredictability. Since we are unable to predict how nature will develop and which path it will take, we should guide our focus to providing post disaster emergency care.

Locations affected by disasters have the possibility of losing their hospitals to fire, wind, flood, and power shortage. Which in turn makes them unable to provide the required emergency services. Providing mobile units that can be brought in and provide medical relief can help stabilize the community swiftly after disasters and help in the recovery stage with housing units.

These casualty collection units will be stationed at nearby Air Force Bases to provide timely responses. Each unit has a similar core of needed supplies and equipment while being stationed in disaster regions to be used as casualty collection points. The number of units required to be sent is based on multiple factors for example disaster type, injuries involved, population, area, and conditions of existing hospitals. With a disaster relief system in place more people can be helped after a disaster.

NARRATIVE OF THE THEORETICAL ASPECT

Creating a disaster medical response system can improve the knowledge we have about our current emergency health care. This system will look at frequency of events in different parts of the United States and the possibilities of manmade disasters. Aiding in a timely manner and with the required amount of aid are the main concepts behind the design of the response system.

Each casualty collection unit has a similar core of set supplies and equipment that will help with injuries that are common within each disaster. Than focusing on different types of equipment for the variety of injuries involved with each disaster uniquely. These designed casualty collection units will help decrease the major influx of inpatients in emergency rooms at local hospitals and provide needed care if hospitals were destroyed during the disaster. The casualty collection points are helpful since most inpatients reach help under their own power or help form other disaster survivors. Stationing these points in direct paths to the hospitals from the disaster location will provide extra medical help.

The focus of how to design the response system is to look at the different types of disasters, their likelihood, and the injuries involved. Knowing that we can look at the equipment that is required to treat those injuries. Another large part of the study is to look at home base locations for the casualty control units to be stationed at and how quickly they can be transported to the different sites. The way they are transported is another aspect of the response system that is dependent on wind speeds and road conditions.

Designing a response system in many ways is an ideological way of thinking, with the goal of providing aid to as many as possible after disaster strikes as quickly as possible. Using simulations of different casualty collection unit

layouts with the needed equipment and space along with case studies about historical disasters are the main aspects of the research required to design the system effectively. These strategies provide information to start designing the system based on the past influx of inpatients based on the factors of disaster type, injuries, area, and populations. This will also help with designing the different collection unit layouts for optimal care to be provided for each type of disaster involved.

As the different strategies of research are used the evidence from them will be recorded in graphs, charts, tables, and maps to provide a visual aid on how these different events can affect the world. Knowing where disaster locations are likely to occur is important to deciding how many units need to be stationed near high risk areas and where to set base stations at.

Stepping forward with all the research gathered and organizing it in a way to analyze and understand the dynamics of disasters will produce the three products of this project. First of is the designed response system application that will be made available to emergency managers, first responders, hospitals, and government officials on their phones so they can better asses the disaster and send the right amount of aid to the area. Next would be the design of the casualty collection units which are the medical units that will be deployed from nearby bases based on the input of the size of aid required to help. Finally designing housing units that can be deployed to house families and groups of people for a time until power is restored, buildings and homes have started to be erected.

Each element of this project is important to responding and will start the recovery process of establishing a sense of safety. Combining these products into an effective solution to providing a response system that can be used throughout the United States will provide the required support. Overall this research is going

to provide a different way of looking at emergency room design along with a new look at disaster response that will provide better care for disaster survivors.

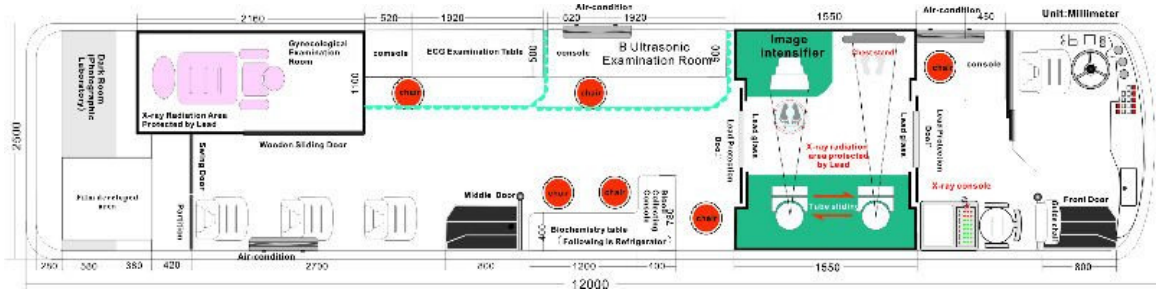
PROJECT TYPOLOGY OR PRECEDENT

This project focuses on emergency care with a typology to be closely related to the needs of treating patients after disasters. Hospitals are a great inspiration to layout and usage of the different areas. However, taking the large spaces of a hospital and condensing it into a mobile unit to supply help closer to areas in need is the true challenge. Hold up, there are ambulances that are a partial hospital on wheels. This is true; however, ambulances are just meant for a few people at a time transporting them to hospitals nearby. Sometimes this mode of mobile hospital is restricted by road conditions and can become over whelmed by the influx of patients during a disaster.

This designs focus is on disasters and improving the way we respond. That focus in many ways can be improved by increasing the availability of medical care being closer to patients. It is completely possible that roads will be destroyed, power grids will shut down, and people are unable to call for help and in most cases people will walk themselves to the nearest hospital which could be blocks away. Provide them with that specialized help by designing casualty collection units that can be sent to where they are needed and capable of providing care to the extra influx of patients no matter the transportation obstacles.

TYPOLOGICAL OR PRECENT RESEARCH

There are mobile units out there that are already designed by architects. Different companies like Life Line Mobile, ASTA Car, Matthews Specialty Vehicles, and Medical Consultancy and Construction Group have developed different ways of creating mobile hospitals or clinics. However, these example companies sell units and are focused on making profit not just sending aid as where my focus is. Don't get me wrong they are helping companies send out different types of units to people that need the care daily or in some cases care that they are not currently receiving. Units developed by these different types of companies are cancer prevention, dental, vision, emergency rooms, and other types of medical care units. Wait again I am proposing something that already exists. In ways, I am and that is why these different but similar companies have been a base for how to go about designing different programs and building knowledge about different equipment. I have studied their compact designs and gained knowledge of different systems to provide different types of equipment like oxygen generation that might be needed by the people in need. These studies of how each company deals with the compactness of mobile medical units helped guide the types of equipment needed.



Talking with outside sources like The Innova Group in Texas I was asked why just stop at casualty collection. That isn't all that the people in those situations need, they need places to clean themselves off and places to rest or gather. Talking with my classmates also lead me to creating the control units because they felt having a base of operation was also important.

The goal of designing the casualty collection units and how to respond to different situations will increase the amount of care available. Looking at different locations to station them so response times can be minimized. These locations will provide different ways to transport the casualty collection unit's dependent on the travel conditions. Along with case studies about historical disasters provide a collection of injury data and seeing how disasters have increased in strength over the years.

MAJOR PROJECT ELEMENTS

Let's focus on what is involved with designing these casualty collection units: transportation, storage, types of disasters, layouts, specialty equipment, affected population, staff needs, and energy collection, storage, and generation.

Transportation: How do we get the casualty collection units to where they are needed? Flying them in by helicopter, pulling them in with semi-trucks or making them into monster trucks? There are so many possibilities and restrictions to the problem of transporting them into the disaster areas. Is there any possible way to get over every obstacle? Impassable roads, high wind speeds, or other restrictions are a few examples of different transportation issues.

Storage: Where to keep the casualty collection units is an important task. Having room for all the different configurations, keeping them safe from the elements but allowing them to soak up the sunshine for energy storage, and deploying them quickly to the areas in need. Are all factors in storing them, however, is it possible to have more usage for them during their down time? Are there ways to utilize these units while disasters aren't occurring?

Types of disasters: The disasters that are in focus for this project are: earthquakes, floods, hurricanes, tornados, tsunamis, wildfires, and volcanic eruption. All have unique injuries involved, however, there are a few that overlap. Having a core unit set will help in response time and cover for the chance of disasters creating other disasters. For example, an earthquake can cause a tsunami, fires, and floods, depending on the size and location of the original disaster.

Layouts: Each type of disaster has different injuries involved causing the design to be unique to every event. However, as stated above there are over

lapping injuries so having a core design will be highly beneficial. The victim population is also a factor in the layout, increasing the demand for medical care.

Specialty equipment: Each kind of injury needs different equipment to help the survivors. Having tetanus shots, burn units, bandages, and extra machines are just a few examples.

Affected population: How many people are in danger and need medical help? The amount that is currently in harm's way. This amount of people will also be affected by how functional the existing hospitals are.

Staff needs: With any kind of health care educated staff is required. Even though they are volunteers the needs of the staff should be considered so they will be able to provide the best treatments possible. Having places to rest and recharge will help them provide the care and attention.

Energy collection, storage, and generation: How can we collect, store and produce the energy needed for all the different types of equipment required? The specialty machines and monitors, lights, air circulation, and other equipment all need power. Providing enough power will require different methods of collection and generation, while being able to store that power for later use. Using solar panels, plug ins, and generators can help provide power. However, is there a better way?

USER OR CLIENT DESCRIPTION

The focus of the casualty collection units is set on how efficient the staff can use the space. Survivors of disasters need a place where they can find shelter along with medical care. Each unit in the area will be wirelessly tied together to provide a log of inpatients this will help people find family and friends that might be at another unit. These logs would provide names and which unit they are currently at and if they are trying to find anyone. The idea is to reunite these people and to let them know their loved ones are safe when there might not be other ways of communication. These units are meant to help people find a place where they can catch their breath in a world that has currently turned completely upside down.

SITE OR CONTEXT

The site and context is a little tricky. Since these casualty collection units will be traveling to places that have been destroyed it is pointless to pick a specific site. Focusing on the context of the areas that are affected the most by different kinds of disasters is the plan. This will let me provide how the system will work for all the different types of disasters with different simulations of possible events, that have been studied in cases studies.

Earthquakes - "a shaking or trembling of the earth that is volcanic or tectonic in origin" (Merriam-Webster)

1700

- January 26th, Washington, Organ, and California, at 9:00 p.m. felt a 9-magnitude quake. This quake was created by the Cascadia fault line that is located about 100 feet off the shore of the west coast of the U.S. stretching from Northern California to Vancouver, Canada. The only reason this event can be calculated to an exact date and time is the combination of the time a large tsunami struck the East coast of Japan, and soil samples taken in Washington, Organ, and California. This event caused many landslides and two large tsunamis. The tsunami that hit the U.S. took out many native villages in its path. This event has a high possibility of occurring again with little to no warning. The Cascadia fault line is dormant most of the time and doesn't let off small shakes to relieve built up pressure. If an event like this occurred again, many lives will be lost because of the tsunami that will be created just 100 feet off the coast line.

1755

- November 18th, Cape Ann fault line rocked New England area at 4:30 a.m. with a 6.3-magnitude lasting a little more than a minute. Boston, Massachusetts took the brunt of the quake, but it was felt in Portland, Maine to New Haven, Connecticut. Even a ship located East of Boston about 70 leagues felt it while in deep water thinking they had run aground. Since Boston has artificial landfill many buildings were destroyed, and many were injured or died. If a quake of same magnitude were to happen today Boston would sustain massive damage with many casualties and injuries, since it has increased the amount of infill that it currently sits on. In ways we are just creating a bigger problem that seems to be just a ticking time bomb without a visual timer.

1811-1812

- December 16th, Northeast Arkansas, at 2:15 a.m. felt a 7.5-magnitude quake. The earthquake was so powerful that it was felt widely over the entire eastern U.S. as far as New York.
- January 23rd, Missouri, felt a 7.3-magnitude quake. Being the smallest of the three it still caused severe landslides, and caving stream banks.
- February 7th, Missouri and Tennessee felt a 7.5-magnitude quake. The final of the three was thought to be the greatest in magnitude as it destroyed the town of New Madrid and caused landslides and caving stream banks. These three major quakes had many aftershocks accounted for. The impact these quakes had was increased with the denser crust in the areas, since the ground is more compacted the quake waves traveled farther compared to quakes on the West Coast with more rocky terrain. Quakes at this magnitude in these areas are few but can still occur.

1868

- April 2nd, Hawaii, around noon felt a 7.9-magnitude quake lasting several minutes that was defined as the breaking point. Form March 25th to April 11th the island was bombarded with frequent quakes that had built up to the larger quake on April 2nd. The breaking point caused several mudslides, eight tsunami waves, and a volcanic eruption. This group of events is known as the Two Weeks of terror, scientists are claiming that aftershocks are still being recorded from the event. These people lived for days wondering if it would be their last not knowing what would come next. They had prewarning before the breaking point that caused other disasters, but they weren't prepared for mass destruction.

1886

- August 31st, Charleston, South Carolina, at 9:51 p.m. felt a 7.6-magnitude quake, foreshocks were felt in Summerville, South Carolina on the 27th and 28th this quake was the largest recorded in the Southeastern part of the United States. Charleston was the source point; however, the damage was as far as Ohio and Alabama with the shaking felt in Boston, Chicago and Cuba. More than a 100-people lost their lives to the quake and the fires. The far-reaching destruction was part of the denser crust allowed the waves of the quake to pass through without losing energy. Since this is the largest recorded earthquake in the Southeastern United States it should be in the backs of people's minds can this happen again? However, since so much time has passed and there aren't any who were there during the quake it has been forgotten.

1915

- October 3rd, Pleasant Valley, Nevada felt a 7.3-magnitude quake with a surface scar stretching 30 miles. This earthquake reminded Nevada that it is

prone to earthquakes of similar magnitudes. The reminder had caused many people to rethink how they were building, however since an earthquake of similar magnitude hasn't occurred since it is likely that this event and the possibility of reoccurrence has dropped out of mind.

1931

- August 16th, Valentine, Texas at 5:40 a.m. felt a 6.4-magnitude quake which was experienced as far as Austin. Buildings were damaged with a few injuries from falling debris. This quake is the strongest one ever recorded in Texas, with its aftershocks experienced for weeks afterward.

1947

- May 6th, Milwaukee, Wisconsin felt a 4.0-magnitude quake lasting about 40 seconds. This occurrence was due to the plate shift in the nearby lake. No injuries or deaths were recorded due to the event. This small quake reminded the Northern states weren't immune to experiencing them.

1959

- August 17th, Hebgen Lake located Northwest of Yellowstone National Park in Montana, at 11:37 p.m. felt a 7.5-magnitude quake, creating a landslide of 73 million metric tons of rock and dirt, which created a natural dame of the Madison River. There had been a 6.3 magnitude foreshock with 350 aftershocks recorded, killing 28 in total. This event has been remembered and is used as an example to remind people in the area and visitors that earthquakes occur in this region.

1964

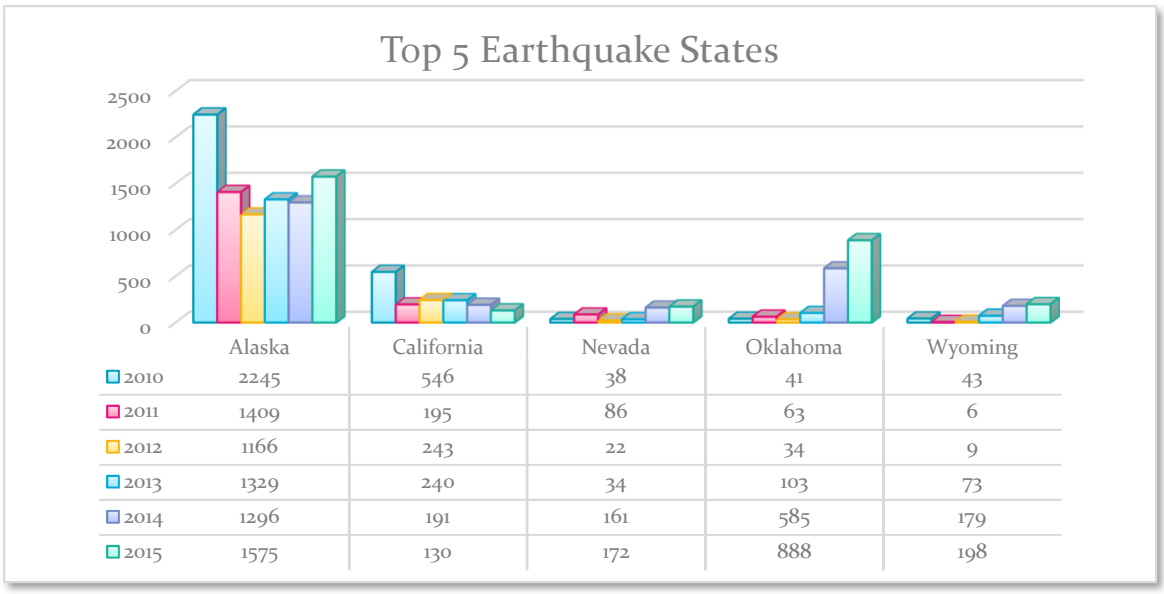
- March 27th, Alaska at 5:36 p.m. felt a 9.2-magnitude quake lasting about 4.5 minutes, this is the most powerful earthquake recorded in the United States, making it the second largest in the world. This quake helped confirm the theory of plate tectonics while it created a landslide in Anchorage and a tsunami in Port Valdez, Alaska at about 100 feet in height, the death toll in the United States was 131. The quake also sent a tsunami out across the Pacific to crash into Japan.

2011

- August 23rd, Mineral, Virginia was located at the epicenter of the quake with a 5.8-magnitude. The quake was felt by one third of the United States that was reported to the USGS Did you fill it? site. This quake served as a learning tool for scientist studying earthquakes in the United States, when the East Coast quakes are compared to West Coast. The data on who feels it is wide spread along the East Coast, while a quake on the West Coast is more centralized this is based on the denser crust being easer for seismic waves to travel through without losing energy.

These are a few of the earthquakes that have happened in the United States with magnitudes greater than 4.0. These are the types of quakes that can cause mass destruction especially since we are unable to predict earthquakes. Response to these events depend on the amount of damage done to road ways, communication, and what other disasters are created along with the earthquake. The studied events help show that an earthquake can happen anywhere in United States. The graph below shows the states with the most number of earthquakes recorded from 2010 to 2015. Many states have recorded small quakes that aren't

always felt or noticed through this period.



	Alaska	California	Nevada	Oklahoma	Wyoming
2010	2245	546	38	41	43
2011	1409	195	86	63	6
2012	1166	243	22	34	9
2013	1329	240	34	103	73
2014	1296	191	161	585	179
2015	1575	130	172	888	198

Floods - "a rising and overflowing of a body of water especially onto normally dry land" (Merriam-Webster) **Flash floods** - "a local flood of short duration generally resulting from heavy rainfall in the immediate vicinity" (Merriam-Webster)

1861-1862

- During the winter months along the West Coast multiple storms lead to floods. After a few decades of drought California, Organ, Washington, Utah, Arizona, and Nevada got the rain they were praying for and inches more. Snow storms deposited large amounts of snow in the mountains, shortly after the atmospheric rives, which are "narrow bands of water vapor about a mile above the ocean that extend for thousands of kilometers." (Ingram), opened and drenched the West Coast. There wasn't a documentation of the amount of lives lost throughout all the regions. It seemed that settlers didn't know how to read the weather as well as the Native Americans and

they didn't listen when informed of the impending storms. This event seems to reoccur in history about every 250 years.

1889

- May 31st at 3:10 p.m. the South Fork Dam washed away. A combination of neglect for maintaining the dam and heavy rain fall created a massive flood down a river valley in central Pennsylvania. This flood killed about 2,209 people and nearly wiped out Johnstown. The dam was owned and maintained by South Fork Fishing and Hunting Club that used the created lake for recreation. At 4:07 p.m. the flood waters rushed into Johnstown and swept through in ten minutes leaving behind complete destruction. Very few survivors were washed up along the path down the valley with numerous corpses for several miles. The old Stone Bridge caught a large pile of debris about 40 feet tall, where 80 flood survivors huddled together until the fire consumed them. Despite the scale of the disaster the town began rebuilding immediately from donations that were brought in by the many news articles published about the tragic event. This event was said to be an act of God and the South Fork Fishing and Hunting Club had no successful lawsuits against it but was widely criticized. This disaster help spurred the United States to regulating engineered dams. We almost saw a similar event in February of 2017 when the Oroville Dam received an excess of water from increased rain fall. The dam had been neglected in maintenance by not repairing the system at the base that would release excess water. When the spill way located next to the dam developed a sink hole they were unable to let water out at the base. Which caused them to continue using the damaged spillway and causing the sink hole to grow causing the water to run down the undeveloped hill side which in turn caused mass erosion.

1927

- April, Mississippi River received heavy amounts of rain over several months prior to April. The levees along the river were unable to hold back the unprecedented levels of the swell causing the first to break on April 16th in Illinois, while another broke April 21st at Mounds Landing, Mississippi, within the weeks to follow the rest of the levee system collapsed. The water covered more than 23,000 square miles, averaging about 30 feet in depth, displacing hundreds of thousands of people, and killing around 250. The submersion lasted two months before completely subsiding. Rescue crews were claimed to have focused mainly on white females and children, while leaving others to sit for days without food or drinking water. This way of thinking has hopefully changed and will decrease the amount of lives that could be lost because of neglect.

1937

- January 24th, the Ohio River flood stretched from Point Pleasant, West Virginia to Cairo, Illinois. Increased rain falls in a 12-day period amounting in 13.68" in Cincinnati, and 20" in Kentucky caused the river to crest at 80'. An estimated 350 people died while one million became homeless. While the water disrupted electrical service to surrounding areas.

1972

- June 9th, the Black Hills west of Rapid City, South Dakota had a huge thunderstorm that produced about 15 inches of rain in six hours. Rapid Creek barreled down the canyon taking 238 people's lives, destroying 1,300 homes, injuring 3,057 and hospitalizing 118. Rapid City leaders decided that it would be unwise to rebuild in the flood plain. They created a buyout

program for all living in the flood plain and developed a series of parks in their place. To this day these areas are still protected from any other kind of development, the city knows that even though flash floods are rear they will happen again. This is a very proactive plan that Rapid City has stand firm behind that developers from out of the city just don't understand.

1976

- July 31st, Big Thompson Canyon had an unusual storm that stayed stationary above the canyon at 6 p.m. The stormed lasted three hours and dumped a foot of rain into the canyon. The run off from the steep mountain walls increased the tiny trickle of a stream into 19 feet of raging water. In its path, down into the valley the water took out houses, campers, tents, trees, and Highway 34. The result was 145 people killed, 418 homes and 152 businesses destroyed. Since this event in the state of Colorado and around similar rivers throughout the United States each state has limited building along rivers, and has inspired people to create early warning systems for flash floods in mountainous regions.

1993

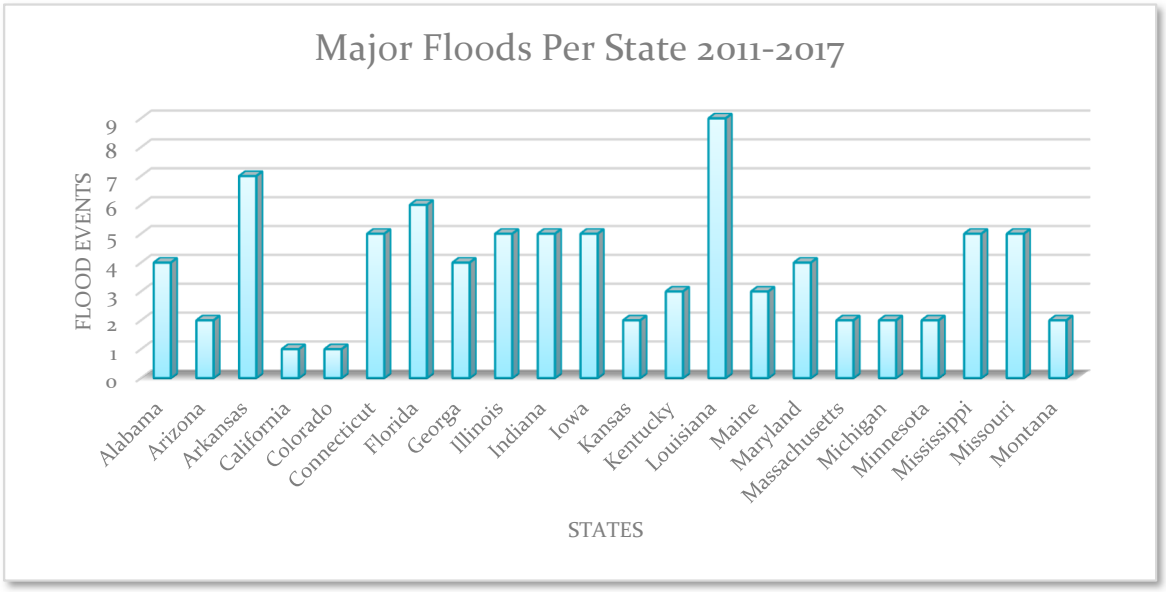
- April to October 7th, the Mississippi and Missouri Rivers flooded their banks and converged together to create a flood to last 103 days. "At the flood's peak on August 1, more than 1,000,000 cubic feet of water rushed past the Gateway Arch in St. Louis every second." (National Weather Service) Increased spring rain fall bombarded the Upper Midwest, with some areas receiving more than four feet. June 7th is when levees along the Mississippi began breaking. Heavy rain falls in July with five to seven inches in 24 hours where common in Missouri, Iowa, Kansas, Nebraska, North Dakota, Illinois and Minnesota. River depths at points where 20 feet above flood levels,

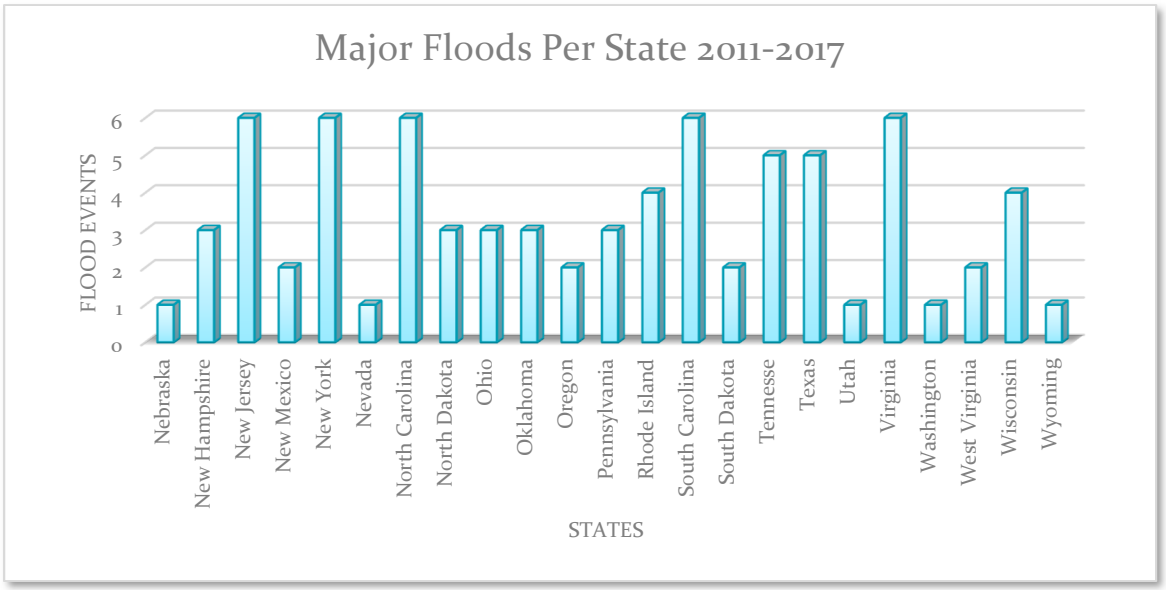
flooding more than 47,000 acres. Some locations along the rivers were under water for 100 to 200 days, with the river dropping below flood stage on October 7th.

These are a few of the floods that have happened in the United States over the years. These disasters are mostly created by nature but some of these were a combination of neglect of engineered elements. As seen with these case studies people can be taken by complete surprise by underestimating the danger. In many ways some of these disasters could be avoided or limited. A great example of this is how Rapid City government is constantly preventing developers from building along the river. Response to these events are difficult for any emergency unit, since they can come in a moment, floods can cause mass casualties, trap survivors, destroy roads, and bridges.

Floods can occur anywhere that has an excess of water in a short period of time or a combination of rain and the melting of snow. Some parts of the United States experience floods annually, while some don't see flooding for decades. Flooding can also occur during other disastrous events like earthquakes and hurricanes, case studies of floods with these events are included in the other categories.

Here are graphs representing major floods per state from 2011 to 2017. These floods include those caused by other disasters.





Hurricanes - "a tropical cyclone with winds of 74 miles per hour or greater that occurs especially in western Atlantic, that is usually accompanied by rain, thunder, and lightning, and that sometimes moves into temperate latitudes" (Merriam-Webster) **Cyclone** - "a storm or system of winds that rotates about a center of low atmospheric pressure, advancing at a speed of 20 to 30 miles an hour, and often brings heavy rain" (Merriam-Webster)

1957

- June, Audrey category 4 with 945mb of pressure and 125kt wind speeds. Affected Texas and Louisiana as a category 4.

1960

- September, Donna category 4 with 930mb of pressure and 115kt wind speeds. Affected Florida's southwest region as a category 4 and its northeast region as a category 2. North Carolina and New York saw it as a category 3. Connecticut and Rhode Island saw it as a category 2. While Massachusetts, New Hampshire, and Maine saw it as a category 1.

1961

- September, Carla category 4 with 931mb of pressure and 125kt wind speeds. Affected Texas as a category 4.

1969

- August, Camille category 5 with 900mb of pressure and 150kt wind speeds. Affected Louisiana and Mississippi as a category 5.

1989

- September, Hugo category 4 with 934mb of pressure and 120kt wind speeds affected South Carolina.

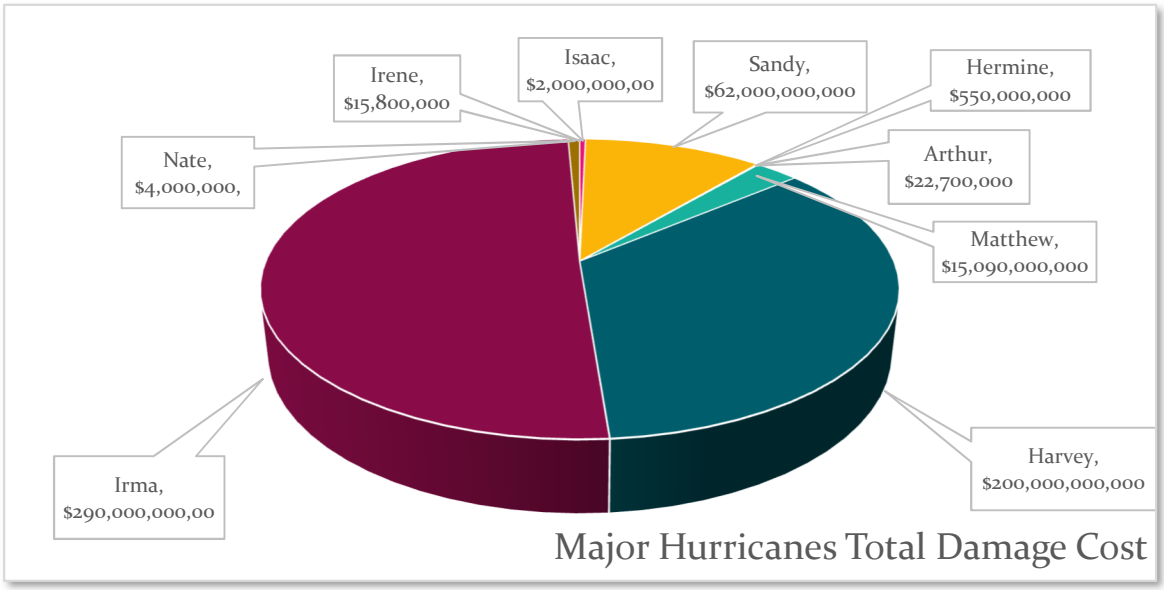
1992

- August, Andrew category 5 with 922mb of pressure and 145kt wind speeds. Affected Florida's southeast region as a category 5 and its southwest region as a category 4. While Louisiana saw it as a category 3.

2004

- August, Charley category 4 with 941mb of pressure and 130kt wind speeds. Affected Florida's southwest region as a category 4, and its east regions as a category 1. While South Carolina and North Carolina saw it as a category 1.

Below is a graph representing the total cost of damage from hurricanes on the United States from 2011 to 2017.



Landslide – "the usually rapid downward movement of a mass of rock, earth, or artificial fill on a slope" (Merriam-Webster)

1868

- April 2nd, Hawaii, around noon felt a 7.9-magnitude quake lasting several minutes that was defined as the breaking point. Form March 25th to April 11th the island was bombarded with frequent quakes that had built up to the larger quake on April 2nd. The breaking point caused several mudslides, eight tsunami waves, and a volcanic eruption. This group of events is

known as the Two Weeks of terror, scientists are claiming that aftershocks are still being recorded from the event. These people lived for days wondering if it would be their last not knowing what would come next. They had prewarning before the breaking point that caused other disasters, but they weren't prepared for mass destruction.

1964

- Alaska landslides from a 9.4 magnitude earthquake. Major damage done to Anchorage, Valdez, Whittier, and Seward.

1980

- Washington State avalanche caused by the eruption of Mount St. Helens with a volume of 2.8x10^9 of material. High property damage but low loss of life due to evacuation of the area prior to the eruption.

1983

- Utah Thistle debris slide caused by snowmelt and heavy rain with a volume of 21x0^6 of material. Destroyed major railroads and highways along with the Spanish Fork which flooded the town of Thistle, with no loss of life.

Landslides can occur in any part of the United States if the right conditions are present. These conditions can include deforestation, erosion, excess rain and snow melt, earthquakes, volcanic eruption, excess weight, and a slope. Regions located near the Appalachian Mountains, the Rocky Mountains, and the Pacific Coastal Ranges have a higher chance to experience more landslides.

Tornadoes – "a violent destructive whirling wind accompanied by a funnel-shaped cloud that progresses in a narrow path over the land" (Merriam-Webster)

1840

- May 7th, Natchez, Mississippi an F5 tornado traveled up the river to the down and killing 317 people. Of course, this number could be highly underestimated due to the period since slaves weren't counted as fatalities.

1896

- May 27th, St. Louis, Louisiana was struck by a F4 tornado that carved through downtown then crossed over to east St. Louis. Killing 255 people along the way as it destroyed or damaged more than 8,800 buildings and the east 300 feet of approach for the Eads Bridge.

1899

- June 12th, New Richmond, Wisconsin a tornado moved in from Lake St. Croix and carved of path of destruction about 3,000 feet long and 1,000 feet wide. Killing 117 people along its path along with 300 buildings.

1908

- April Purvis, Mississippi a F4 tornado cut a path through the town that was 160 miles long and about 2 miles wide injuring 800 people and killing 143. Only 7 of the 150 were left standing.

1925

- March 18th, the Tri-States tornado created mass destruction along its 219-mile-long path through southern Missouri, southern Illinois, and southwest Indiana. The tornado was on the ground for more than three and a half hours moving an average of 62 miles per hour. Gorham, IL, and Griffin, IN, were destroyed. Annapolis, MO and Parrish, IL were 90% destroyed, Parrish was abandoned and became a tornado ghost town. The tornado killed 695

people and demolished 15,000 homes making it the deadliest tornado in the United States.

1936

- April 5th, Tupelo, Mississippi that evening a tornado moved through the north part of the city. The tornado had a path that was 15 miles long and half a mile wide killing 216 people and destroying 200 homes.
- April 6th, two tornadoes converged over Gainesville, Georgia one coming from the west the other from the southwest. Merging onto the city early that morning causing damage four blocks wide along the paths. A total of 203 people killed with 40 deemed missing.

1947

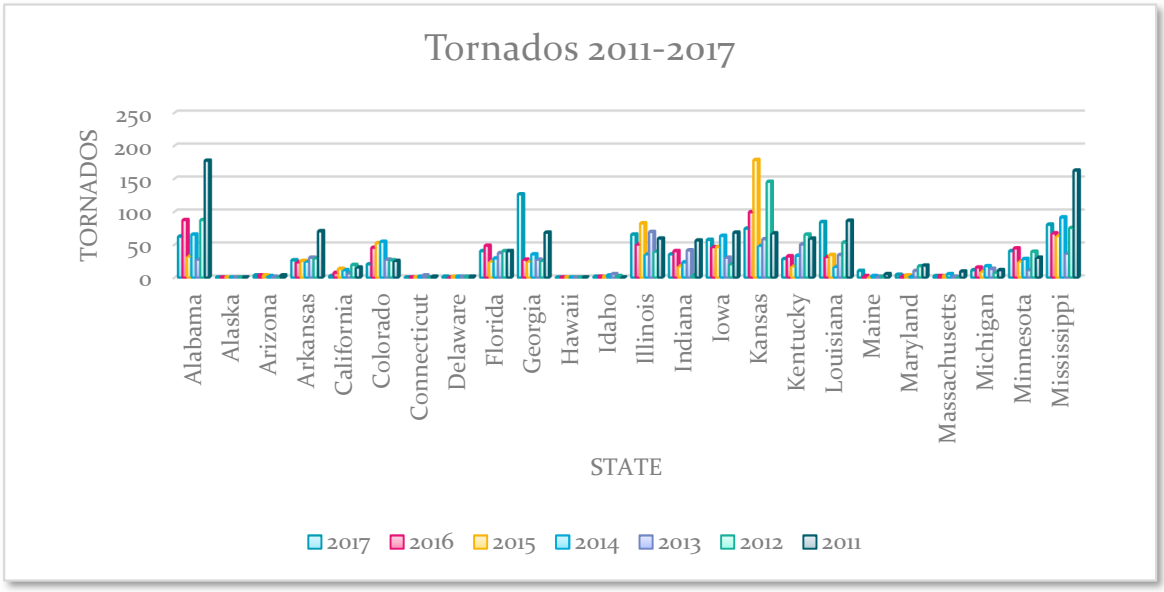
- April 9th, a tornado cut from Texas to Oklahoma leaving 100 miles of destruction and killing 181 people, and over 1,000 injured along the way.

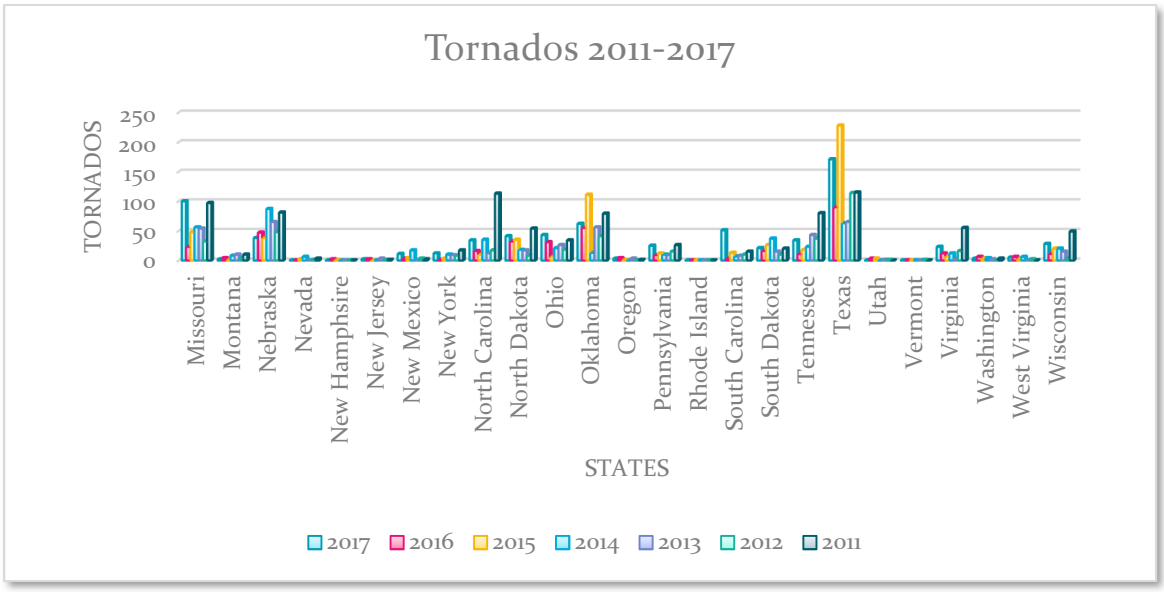
1953

- June 8th, Flint, Michigan a F5 tornado struck injuring 844 people while killing 116. The main tornado was on the ground for 27 miles and destroyed 340 homes. The death toll increased to 141 throughout the day due to seven other touching down in a 24-hour window.

2011

- May 22nd, Joplin Missouri a F5 tornado with winds over 200 miles per hour ripped a 6-mile-long gash through killing about 158 people, destroying 7,500 residential dwellings.





Tsunami – "a great sea wave produced especially by submarine earth movement or volcanic eruption" (Merriam-Webster)

1700

- January 26th, Washington, Organ, and California, at 9:00 p.m. felt a 9-magnitude quake. This quake was created by the Cascadia fault line that is located about 100 feet off the shore of the west coast of the U.S. stretching from Northern California to Vancouver, Canada. The only reason this event can be calculated to an exact date and time is the combination of the time a large tsunami struck the East coast of Japan, and soil samples taken in Washington, Organ, and California. This event caused many landslides and two large tsunamis. The tsunami that hit the U.S. took out many native villages in its path. This event has a high possibility of occurring again with little to no warning. The Cascadia fault line is dormant most of the time and doesn't let off small shakes to relieve built up pressure. If an event like this occurred again, many lives will be lost because of the tsunami that will be created just 100 feet off the coast line.

1868

- April 2nd, Hawaii, around noon felt a 7.9-magnitude quake lasting several minutes that was defined as the breaking point. Form March 25th to April 11th the island was bombarded with frequent quakes that had built up to the larger quake on April 2nd. The breaking point caused several mudslides, eight tsunami waves, and a volcanic eruption. This group of events is known as the Two Weeks of terror, scientists are claiming that aftershocks are still being recorded from the event. These people lived for days wondering if it would be their last not knowing what would come next. They had prewarning before the breaking point that caused other disasters, but they weren't prepared for mass destruction.

1980

- Spirit Lake, Washington caused by the eruption of Mount St Helens, height of 853 feet.

Wildfires – "a sweeping and destructive conflagration especially in a wilderness or a rural area" (Merriam-Webster)

1871

- October 8th in Peshtigo, Wisconsin the Peshtigo Fire scorched 1.2 million acres and killed 2,500 people making this the deadliest fire in the United States history.

1910

- August 21st to August 22nd the Great Fire blazed in Washington, Idaho, and Montana. Scorching three million acres and killing 87 people.

1988

- Yellowstone Fires scorched 793,880 acres which is roughly 36% of Yellowstone National Park in Wyoming. Over 9,000 firefighters attempted to control the blaze, however the losing battle was ended by a snow storm.

2004

- Taylor Complex Fire scorched 6.6 million acres in Alaska.

2007

- Murphy Complex fire scorched 653,000 acres through Idaho and Nevada.

2008

- May 22nd to August 29th, Northern and Central California over 2,780 individual fires occurred killing 23 people and scorching over 1.15 million

acres of land. The fires were believed to be caused by a combination of lightning and heat.

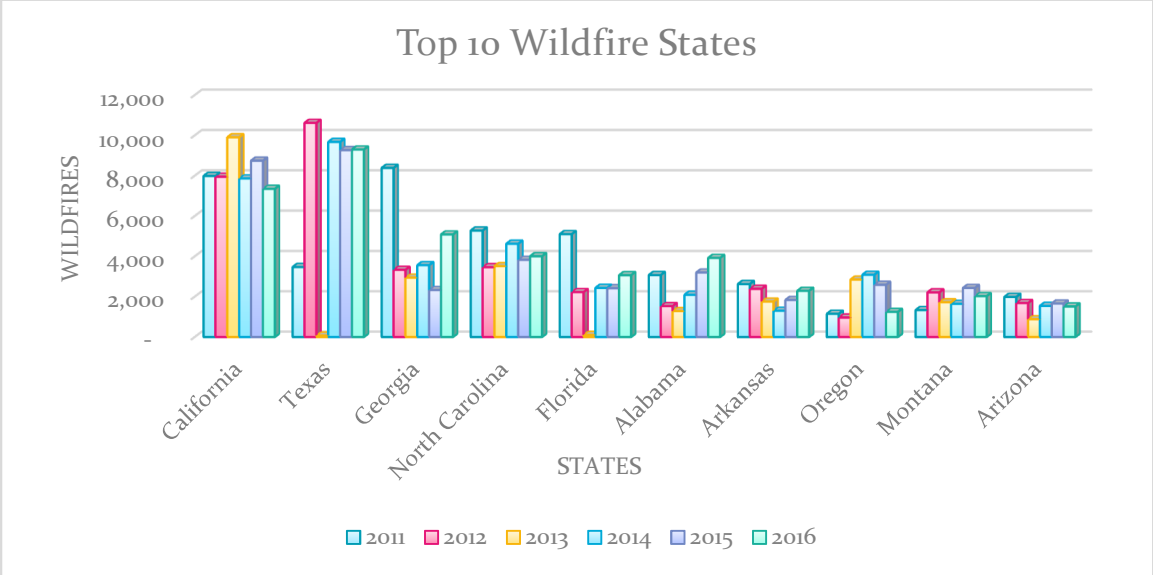
2011

- May 29th to July 8th the Wallow Fire in the Bear Wallow Wilderness located in Arizona and New Mexico scorching over 538,000 acres, killing 16 people and destroying 72 structures. It is believed it started from an abandoned campfire.

2016

- Gatlinburg Firestorm: Gatlinburg, Tennessee consumed late November and early December. Killing 14 people, injuring 130, scorching 17,000 acres in the Great Smoky Mountain National Park, destroying 170 structures, and leaving 2,500 without power.

Wildfires can occur anywhere if the conditions for the fire to start and grow are there. Displayed below are the numbers of fires throughout the United States through 2011 to 2016. There is an average of 2,000 fires a year.



Volcanic Eruption: Volcanic – "related to, or produced by a volcano" (Merriam-Webster) Eruption – "an act, process, or instance of eruption" (Merriam-Webster)

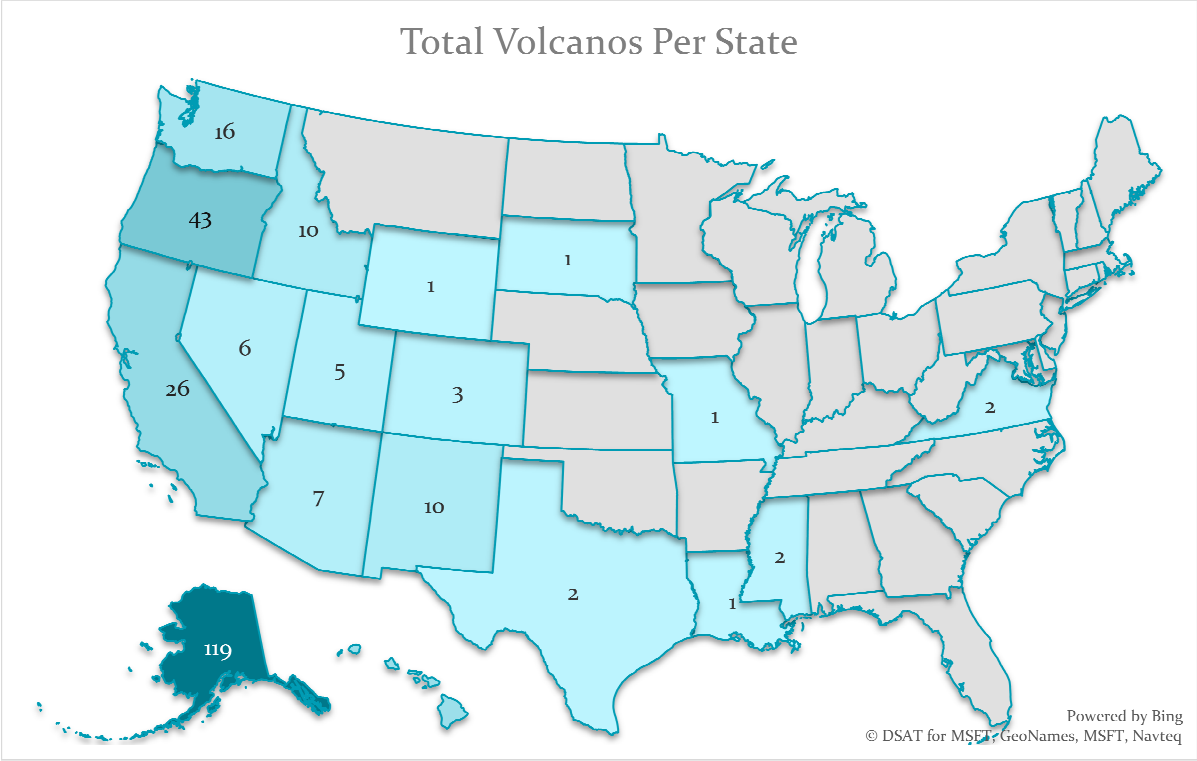
1868

- April 2nd, Hawaii, around noon felt a 7.9-magnitude quake lasting several minutes that was defined as the breaking point. Form March 25th to April 11th the island was bombarded with frequent quakes that had built up to the larger quake on April 2nd. The breaking point caused several mudslides, eight tsunami waves, and a volcanic eruption. This group of events is known as the Two Weeks of terror, scientists are claiming that aftershocks are still being recorded from the event. These people lived for days wondering if it would be their last not knowing what would come next. They had prewarning before the breaking point that caused other disasters, but they weren't prepared for mass destruction.

1984

- March 24th, Mauna Loa in Hawaii erupted caused by increased earthquake activity over a three-year period under the volcano. The flow lasted 21 days with a total of 220x10^6 m3 of lava. With a flow speed of 300 to 700 feet per hour the flows moved toward Hilo, people remained on high alert until April 14th.

There is a total of 169 active and 110 dormant volcanos in the United States, graphed below are the states with volcanos.


Total Volcanos Per State
16
43
10
1
1
6
5
3
26
1
2
7
10
2
2
1
119
Powered by Bing
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PROJECT ELEMENTS

The following are questions that will be on the application, followed by the idea of what will be the output of the application. It is important to understand what questions you want answered and how you want to answer them to give the best response possible. Knowing what kind of casualty collection units are needed along with the population that is in the affected area. Having the city affected by the disaster will give an idea of where the units can be sent from to provide the best response time. With the travel conditions known will provide an idea of the needed way of transportation so they units can reach their destination.

This list of questions will develop farther the more research that is performed. In the end these questions will help calculate the amount of casualty collection units and housing units that will be needed by the survivors.

What kind of disaster? This is the major disaster that strikes an area first.

- Earthquake
- Floods
- Hurricanes
- Landslides
- Tornados
- Tsunami
- Wildfires
- Volcanic eruption

What other disasters are created? These are disasters that occur from the original disaster.

- Flood
- Fire
- Landslide
- Tsunami
- Volcanic eruption

What is the location? Which city and state are the center of the disaster or where has it hit the hardest? Extra units will be needed for larger areas since the survivors are farther apart.

What is the amount of population affected? This will aid in deciding the number of units needed. There is a total of about 330 million people in United States.

Are the local hospitals still functional? Sometimes hospitals are damaged during a disaster which will affect the number of units sent. Most times private clinics close and go to aid hospitals which doesn't help the survivors since they will go to where they know help is. Placing these casualty collection points along emergency routes will help get people help quicker.

- Fully
- Three quarter
- Half
- One quarter
- Destroyed

What are the travel conditions? This will help decide the way the units need to be transported into the area.

- Debris Blocking Some Roads
- Some Routs destroyed
- Impassable
- High winds

These are the injuries involved with each type of disaster with the most common at the top of the list.

Common (This influence the core unit.)

- Lacerations – "a torn and ragged wound" (Merriam-Webster) First responder treats with sterile water, suture line, gauze, medical tape, sometimes a combat application tourniquet (CAT), and antibiotics.
- Contusions – "injury to issue usually without laceration: bruise" (Merriam-Webster) Ice is used to slow swelling. **(Ice Machine)**
- Cardiac arrest – "heart stops beating" (Medline Plus) **Cardiac monitor, blood pressure cuff, pulse oximeter**, printer paper, electrodes for cardiac leads, and **defibrillation pads**. **Bag valve mask (BVM), CO_2 detector, tube holder**, **EZ IO and drill**. EPI, amiodarone, magnesium or lidocaine for medication.
- Crush injury – "when force or pressure is put on a body part, likely to happen when a part of a body is squeezed between two heavy objects" (Medline Plus) Large bore IV with salene fluid, amp of sodium bicarbonate, and another amp into a liter of fluid ready. Pain management of morphine or fentanyl depending on blood pressure then splint and bandage.
- Electrical shock – Immediate goal is airway control and fluid administration. Cardiac monitor and lots of bags of normal saline (NS fluid) and lactated ringers (LR fluid). Intubation equipment needed; **tube, larygscope for tube placement, tube holder, BVM, partial pressure or maximal concentration of carbon dioxide at the end of an exhaled breath ($EtCO_2$)**, **and ventilator**. Then cream and bandages for the wound.
- Blunt trauma – trauma by impact or injury. **X-ray machine, splinting equipment**, and pain medication.

- Abrasions – “a wearing, grinding, or rubbing away by friction” (Merriam-Webster) Sterile irrigation saline, bandaging, and tape.
- Fractures – “the act or process of breaking or the state of being broken” (Merriam-Webster) X-ray machine, splinting equipment, sometimes surgery, antibiotics, and pain medication.
- Sprains – “a sudden or violent twist or wrench of a joint with stretching or tearing of ligaments” (Merriam-Webster) ACE wrap, ice, instructions to stay off the injury, and maybe **crutches**.
- Puncture wounds – Basic bandaging for small punctures and a surgical team for large penetration injuries.
- Burns – Similar to electrical shock with the patient receiving fluids. The formula for figuring out the amount of fluid is; 2 mL (LR fluid or NS fluid) **x** percentage of body surface area burned **x** patient weight in kg.

Earthquake (This influences the earth units)

- Chronic obstructive pulmonary disease – “lung disease, makes it hard to breath, related lung illnesses are chronic bronchitis and emphysema” (Family Doctor)
- Myocardial infarctions – “heart attack” (Medline Plus)
- Childbirth

Floods (This influences the water units)

- Gastrointestinal – of, related to, affecting, or including both stomach and intestine
- Rash dermatitis – “contaminated water contacts a person’s skin for long periods of time” (Medline Plus)
- Heat illness
- Vector borne illnesses – infection transmitted by the bite of an insect

- Non-Vector borne illnesses – “transmitted from person to person
- Ulcers – a break in skin or mucous membrane with loss of surface tissue, disintegration and necrosis of epithelial tissue, and often pus” (Merriam-Webster)
- Hypothermia – subnormal temperature of the body

Hurricanes (This influences the wind units)

- Falls

Landslides (This influences the earth units)

Tornadoes (This influences the wind units)

- Contaminated soft-tissue wounds
- Ocular rupture
- Corneal foreign bodies
- Head injury
- Emergency laparotomy
- Cervical spine trauma

Tsunami (This influences the water units)

- Impalement
- Near drowning
- Aspiration pneumonia
- Soft-tissue
- Hypothermia – subnormal temperature of the body
- Heat
- Dehydration

Wildfires (This influences the fire units)

- Respiratory
- Smoke exposure
- Heat stress
- Varying degree of burns
- Thermal injury

Volcanic eruption (This influences the fire units)

- Respiratory
- Varying degree of burns
- Asthma
- Bronchitis
- Silicosis
- Fluoride poising

Medical Equipment that is required to provide aid.

Core unit

- Gauze sponges
- Medical tape
- Non-woven sponges
- Alcohol pads
- Ear loop face masks
- Bandages and dressings (adhesive, medicated, dry gauze, hydrogel, hydrofiber, foam, and alginate)
- Suture tray
- Medical gloves (latex and latex-free)
- Gauze rolls
- Cotton tipped applicators
- Medical drapes
- Cotton balls
- Stethoscopes
- Cardiac Monitor – display of heart rhythm
- Orthopedic equipment – splints
- Ice machine

- Blood pressure cuff
- Pulse oximeter
- Defibrillator
- Bag valve mask
- CO_2 detector
- EZ IO and drill
- Intubation equipment
- X-ray machine

Result of the collected data and placing all the factors into an output that is well detailed and comprehensive. Which will include:

Total of number of casualty collection units are required to provide medical aid to the survivors. These units should include:

Core unit provide services for lacerations, contusions, cardiac arrest, crush injury, electrical shock, blunt trauma, abrasions, fractures, sprains, puncture wounds, and burns. These services are required at many of the different types of disasters.

Number of earth units – providing services for heart attack, child birth, burns, and includes unit core care.

Number of fire units – providing services for varying degrees of burns, respiratory issues, thermal injury, and includes unit core care.

Number of wind units – providing services for varying height of falls, ocular ruptures, varying head injuries, cervical spine trauma, and includes unit core care.

Number of water units – providing services for varying degrees of hypothermia, pneumonia, rash dermatitis, varying illnesses, impalement, and includes unit core care.

Total of number of housing units that are required to support the displaced population.

Transportation of units should be done by all terrain trucks that can self-load (LVSR MKR 18 Cargo, PLS A1 M1075A1) or air travel with crafts able to land in small areas and carry cargo inside or outside of the aircraft. (C-130J Hercules, CV-22 Osprey, CH-47 Chinook, Mil Mi-26) Units shall be sent from nearest Air Force Bases that can reach the destination within an hour or less. If more units are required surrounding bases may send aid.

This is only an estimation of aid needed. That is based on casualty collection units that were designed for an Architectural Thesis project in 2017-2018. If using a different kind of unit another calculation should be performed by a professional emergency manager to double check results.

GOALS OF THE THESIS PROJECT

The main goal behind this project is to develop casualty collection units and a disaster response system that can save lives. Elements that will help this system determine what is needed for each situation is likelihood of occurrence, the types of injuries, the size of the population, and affected area. The entire system will improve the response to disasters throughout the United States. Which in turn will provided closer health care that can be transported into areas that require the extra help.

As mother nature grows stronger and more unpredictable instead of being blindsided, let's role with the punches and design a response system that can provide the needed care.

PLAN FOR PROCEEDING

1. Research
    - Disasters
    - Locations
    - Base points
    - Injuries
    - Emergency Room Layouts
    - Equipment (Needed and energy needs)
    - Power supply
    - Wall types
    - Restrictions
2. Sources
    - Interviews
    - Articles
    - Books
    - Web Sites
3. Compiling Data into Report
4. Designing Emergency Room Layouts
    - Programming different unit types
    - Equipment load
    - Response units
        - Injuries
        - Population
        - Area
5. Adding results and process to report
6. Designing Layout of presentation
    - Boards
    - Power point
    - Display
    - Speech

PROCESS DOCUMENTATION

Figuring out the movement of the floor plates while using Maya:

Set rotation point center

Select object

Move command

“D”

Select center and align with edge

Parent command

Select child

Select parent

Edit – Parenting

I found that setting object up as child and parent you are unable to animate them. They do however move together. Parenting was not used in the making of the animations

First plate animation

1” at closed position

24” legs extend

48” plates slide into position

72” plates are at a 45-degree angle

86” plates are at a 90-degree angle

110” support legs extend

At this point in experimenting with Maya that the time set had to be at Play every frame in real time to make the animation run smoothly and at the speed I wanted.

Figuring out the movement of the stairs was another step that helped me figure out how the different objects in Maya move. When I went to animate the stairs straight from Revit I found out that when objects are one component in Revit they move as one in Maya. This was not helpful in being able to open and close the stairs, move the walls, or moving the structure.

First stair animation process

206" Stairs are in end position

182" Stairs are moved into a -45-degree angle

134" Stair unfolds 45-degrees

110" Floor and stairs at 90-degree

96" Floor and stairs at 45-degree

72" Support legs extend

48" Roof slides out

24" Legs extend

1" Closed

This process made me realize that object rotation points must be set before animating anything. If this isn't done items seem to have a mind of their own and move to funny places during the animation. At this point I didn't feel that the movement looked right or smooth, so I delved into researching how to move objects together without parenting them. Through that search I found grouping, this allows object to move

separately from one another but also able to rotate the group around a single group rotation point. This allowed for a smooth rotation of all stair components at once.

Throughout the entire process it helped to plan out my steps and write them down before moving any objects within Maya, which are the steps I am walking through in this documentation. This in many ways helped everything transition smoother in the animation. Each animation is produced backwards, the model is brought in completely open then a time sequence is figured out then executed after rotation points and groups are set then animation beings.

Here is the final animation sequence of the units, all were based on this process, but all are different. During the process of animation, I started to modify steps as I went. In ways this makes each one unique. All materials had to be set before animation or the materials become buggy when objects are moving.

Final animation sequence

500” End position

450” Completely open

420” Side railings collapse

400” Front railings collapse

380” Hand railings move onto or into the unit

350” Stairs collapse

330” Stairs rotate as group to 90-degree angle

300” Extended roof retracts half way, this shows how the structure moves

280” Stairs and floor rotate half way

260” Roof, stairs and floor close completely

230” Center roof drops down into lock position for transport

210” Transportation cables release while legs self-level

150” Legs extend

120” Lifted up mid screen

90” Lifted to top of screen

60” Flies to right half

30” Flies off screen

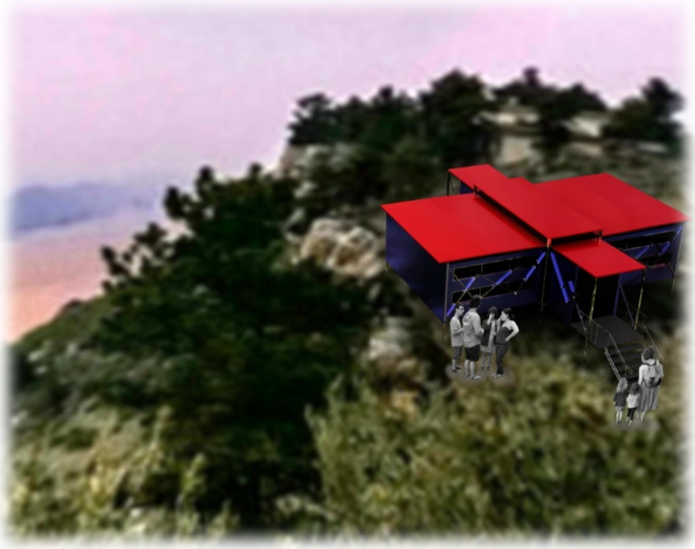
1” Start position

The most enjoyable of this process was thinking of all the different ways for the parts to move and look like it would work. Each animation is 500 frames which means for the total renderings for those animations it was over 2,000 with trial and error for figuring out materials and how they looked with the back grounds.

PROJECT SOLUTION DOCUMENTATION

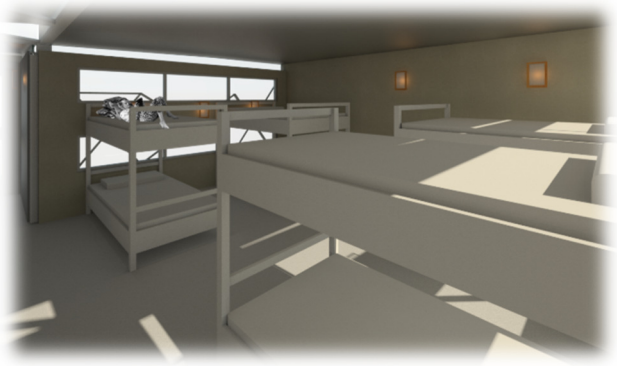
Refresh Unit, portable showers to station near Casualty Collection and Couchette unit types. These units were designed as mobile showers to wash the grim and debris off survivors and volunteers, providing the comfort of running water. Water is collected by rain or pumped into the holding tank using similar methods to fire fighting trucks with hoses that can attach to fire hydrants or that can suck up water from bodies of water.

The water is pulled up from the gray water storage tank into the filtration system, then once filtered it goes into the clean water storage. This system only activates this process when the clean water storage is a quarter empty just so there is enough time between usage and the cleaning process. Water is taking from the clean storage into tankless water heaters that heat all the water on demand and use let energy.

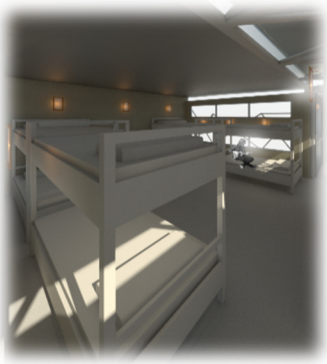


Couchette Units to provide volunteers, evacuated citizens, and survivors a safe place to rest. Comfort of sleeping close to home even though their worlds have been turned upside down. These units have solar panel collection located in the roof panels with the power being stored in the core that can be used on demand by the occupants. The couchette units hold the most stored energy and can generate energy from back up generators that can connect to other types of units and provide them with excess power.

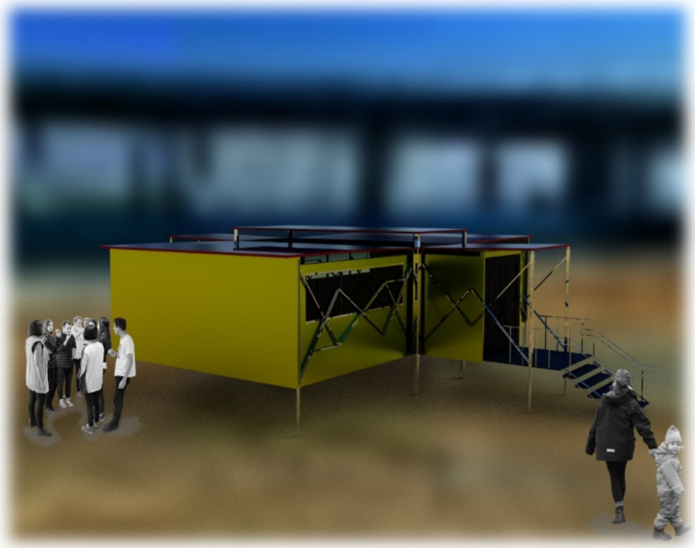
Entry perspective shows how much light comes in through the center. People can enter or exit from either side of the unit. Different types of bunks are supplied some twin size for single people and some that are full size for people that need comfort from other like children from their parents. Having these different types of beds allow for people to have some form of comfort that they can't get from a large shelter.



This bed layout allows people to have room on both sides for storage of any items that they might have taken with them on their way to safety.

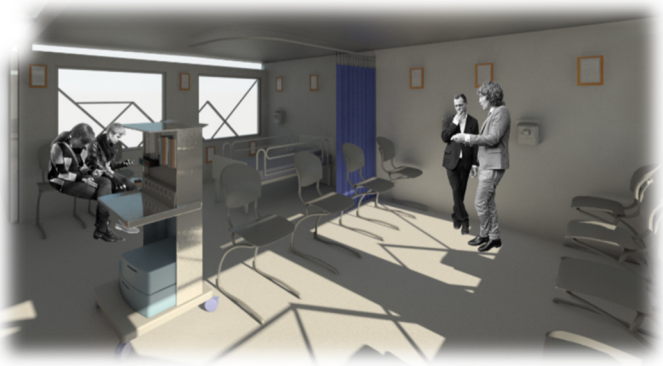


This bed layout shows the beds against the wall which allows there to be extra space in the middle to let people gather in groups to talk and support each other. The natural light pulled through the space allows people to be connected to the world around them.



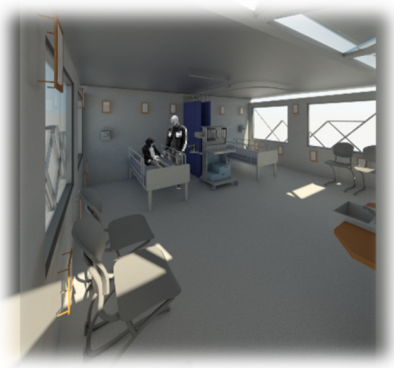
Casualty Collection Units sent in to provide extra medical support. These are helpful for when hospitals are damaged or destroyed. As with the other large unit's people can enter or exit from both sides. The units provide energy for them selves, along with providing oxygen that can be used for patient use or for refilling oxygen tanks. During disasters this is one of the main concerns for people leaving their homes when on oxygen since they can't go far.

People are triaged upon entry. All the equipment is mobile and easily moved around for any kind of use. The volunteers use iPads to keep records with a charging station in the

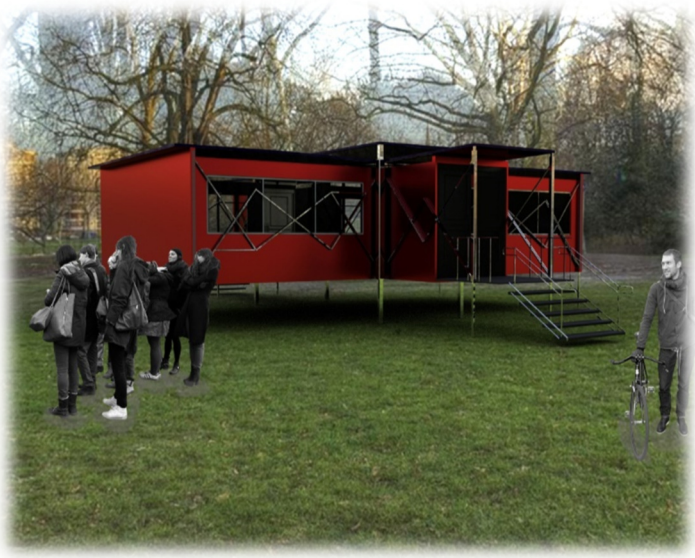


center of the unit. Water is also stored so that people can wash their hands or any other cleaning that is required.

Minor to light injuries are set in the chairs where nurses can clean their wounds, bandage them up, and provide ice packs.



There are three major injury areas that are private for the patients and easily closed off by curtains. The chairs are for family members or friends that helped them to safety. Monitoring equipment are set into the walls to allow for more mobile equipment to have room to wheel around.

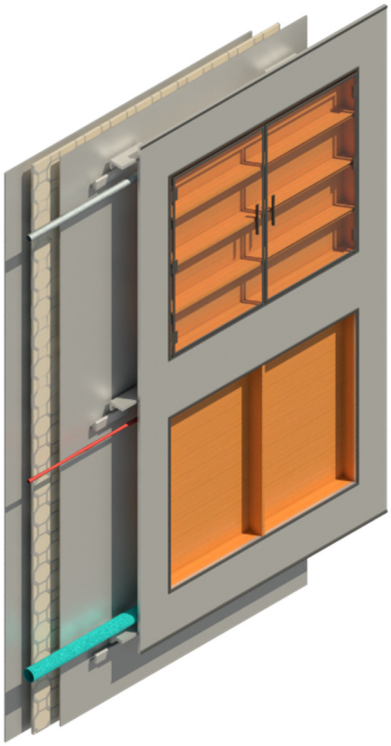


Control Units used to set up different points of command to provide search and rescue, planning, or oxygen refill station. These units supply their own energy along with all the other unit types. From all the different unit type images you can recognize that each is a different color. Since these are placed only when needed the colors allow people to way find easier. They can be directed or tell the difference, so they know where they can find the help they need.

The entry allows people to walk in and see who is in and able to help them.

This desk layout allows people to work together to help with search and rescue areas, accessing the damage, trying to predict weather changes, or to help with excess medical supplies.

This layout allows for larger groups of people to get together or for people to layout large maps or gear and have people gather around.



This detail represents the wall assembly showing how easy it is to replace any damaged components. Outer three pieces represent the outer panel that is constructed as one piece. With an outer layer that is coated in rust resistant paint, the middle layer is a wire mesh insulation, the interior panel is similar to the exterior just this out the paint.

A system of brackets is attached to the system to allow the panels inside or outside to be replaced if damaged. The tubs in the wall all have their own purposes. The top is for oxygen, the middle is electrical, and the bottom is for water. At each of the joints where the walls hinge into close position the tubs are flexible, so they don't break when opening or closing.

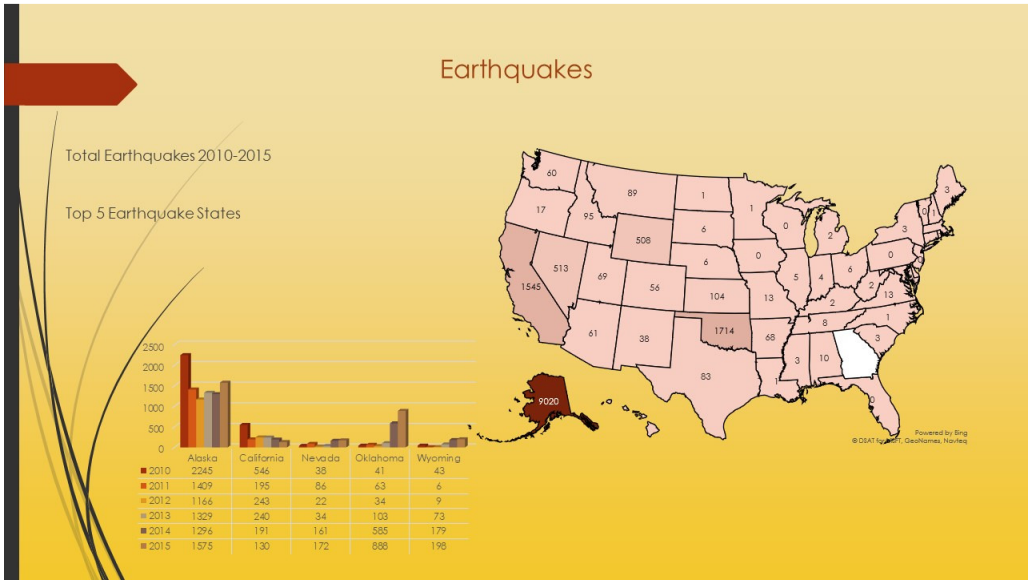
There is storage where ever they are needed that are built into the walls for medicine. The lower proportion is for extra oxygen tanks or large pieces of equipment that can be strapped into place.

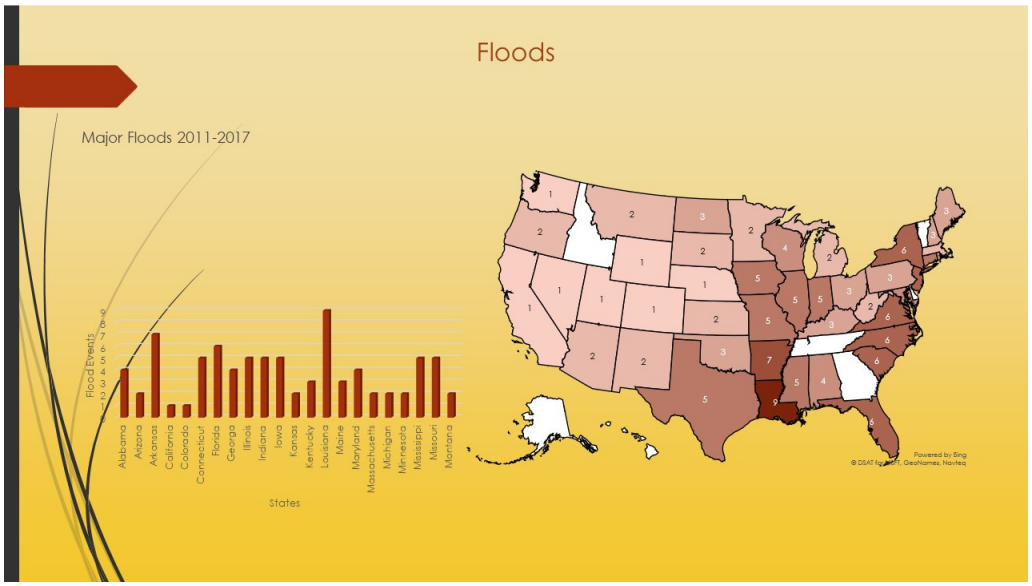
Air movement is circulated through the space between the panels with warm air removed from the top, cold air added from the bottom and clean out side air with the filter are located in the center.

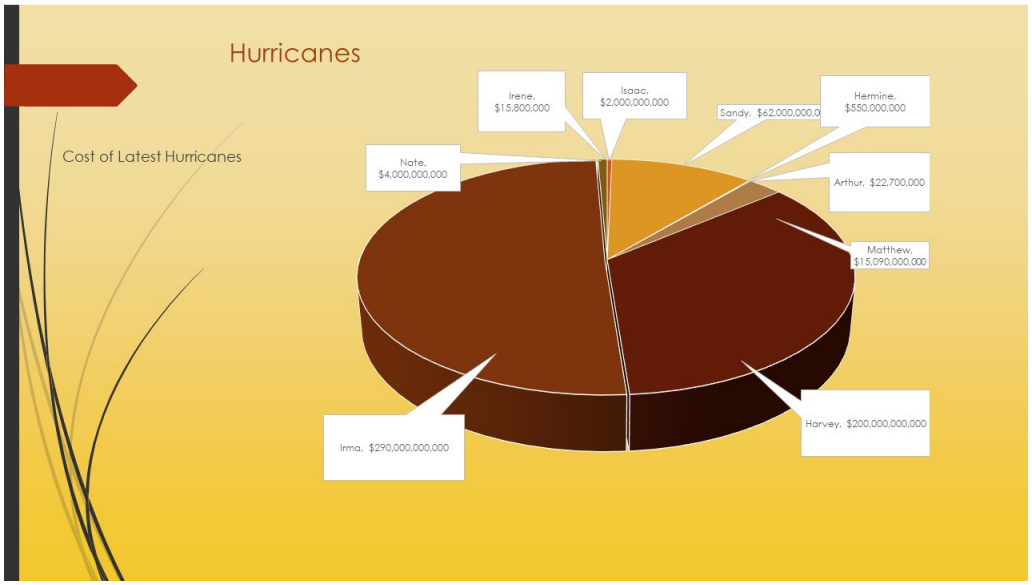
DIGITAL PRESENTATION

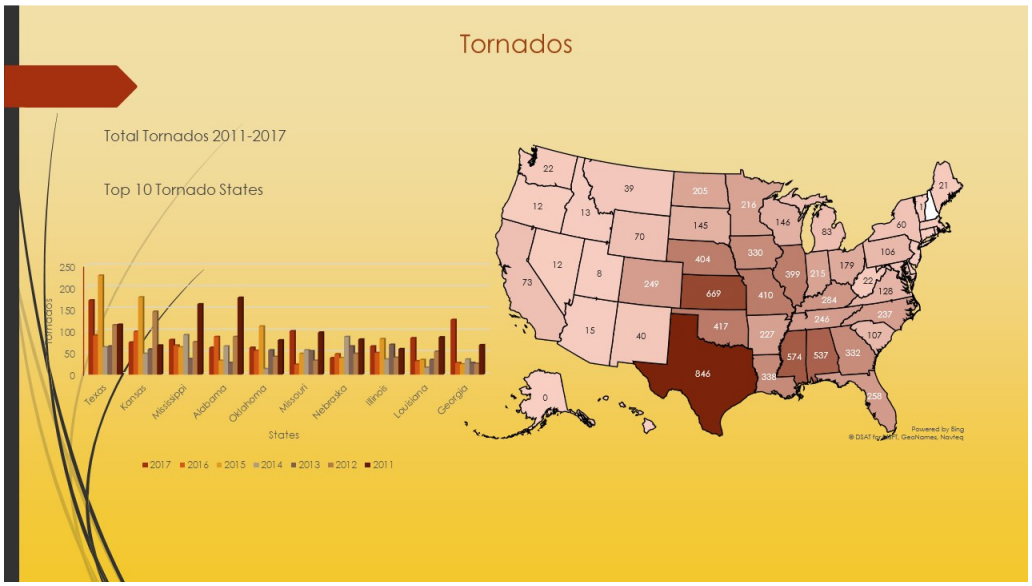
For the presentation I used power point along with using my phone in connection with the Response System Application.

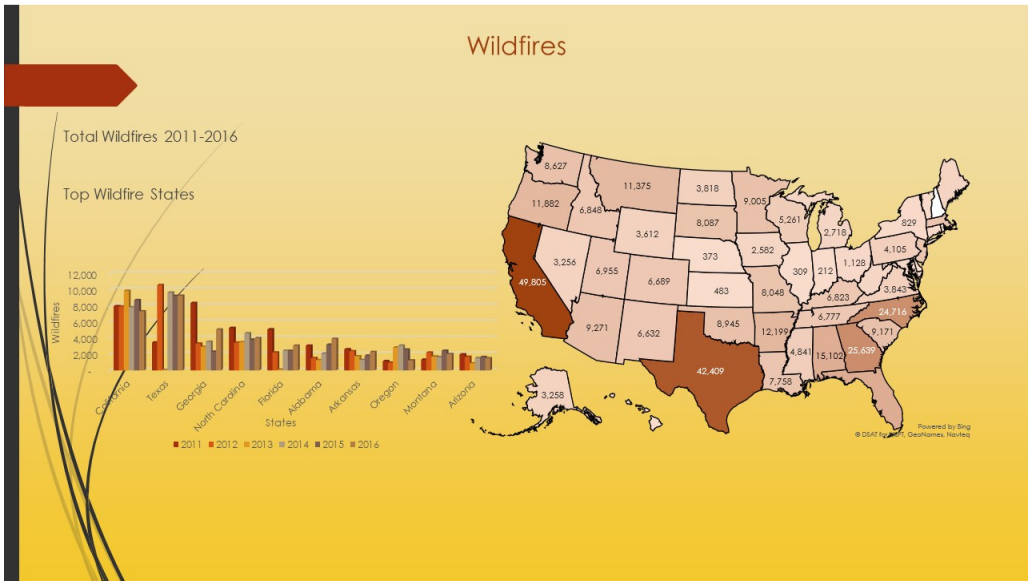
The answer is no place in the United States is safe from disaster. Which is shown in the following slides.

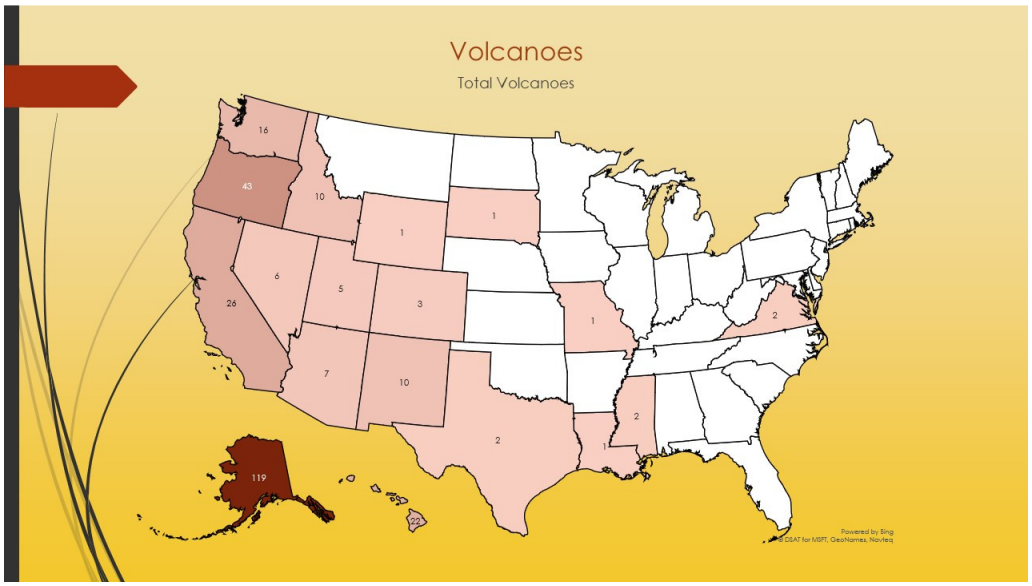



Floods
Major Floods 2011-2017
Flood Events
Alabama
Arizona
Arkansas
California
Colorado
Connecticut
Florida
Georgia
Illinois
Indiana
Iowa
Kansas
Kentucky
Louisiana
Maine
Maryland
Massachusetts
Michigan
Minnesota
Mississippi
Missouri
Montana
States


Hurricanes
Cost of Latest Hurricanes
Irene, $15,800,000
Isaac, $2,000,000,000
Sandy, $62,000,000,0
Hermine, $550,000,000
Nate, $4,000,000,000
Arthur, $22,700,000
Matthew, $15,090,000,000
Harvey, $200,000,000,000
Irma, $290,000,000,000

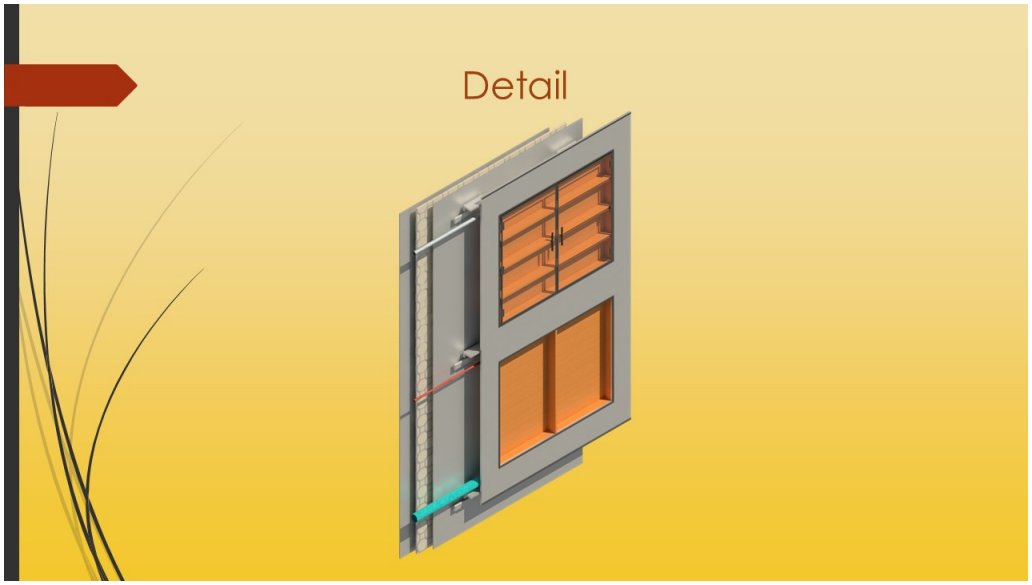

Tornados
Total Tornados 2011-2017
Top 10 Tornado States
Tornados
250
200
150
100
50
0
Texas
Kansas
Mississippi
Alabama
Oklahoma
Missouri
Nebraska
Illinois
Louisiana
Georgia
States
2017 2016 2015 2014 2013 2012 2011
22
12
39
205
216
21
13
145
146
83
60
70
404
330
106
12
8
249
669
410
399
179
73
284
128
15
40
417
227
246
237
107
574
537
332
846
338
0
Powered by Bing


Wildfires
Total Wildfires 2011-2016
Top Wildfire States
Wildfires
12,000
10,000
8,000
6,000
4,000
2,000
-
California
Texas
Georgia
North Carolina
Florida
Alabama
Arkansas
Oregon
Montana
Arizona
States
2011 2012 2013 2014 2015 2016
8,627
11,375
3,818
9,005
11,882
6,848
5,261
2,718
829
3,612
8,087
4,105
3,256
6,955
373
2,582
1,128
49,805
6,689
309
212
483
8,048
3,843
6,823
24,714
9,271
6,632
8,945
12,198
6,777
9,171
4,841
15,102
25,639
42,409
7,758
3,258
Powered by Bing

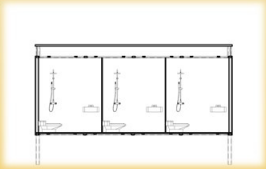


At this point I show cased my smart phone application that I had designed. This included viewing the way it was put together and how many components it took to create. I also pulled up the application on my phone to allow Molly to test out the results.

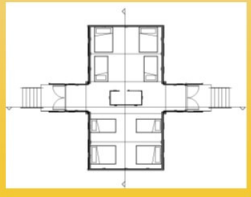
This slide showed what inspired me for this project. My father and brother are wildland fire fighters that travel throughout the United States. My brother in law is a life flight medic who has gone to aid during hurricane Harvey.



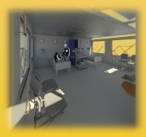
Refresh Units

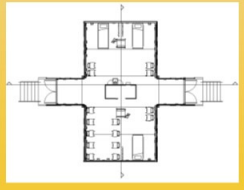


Couchette Units

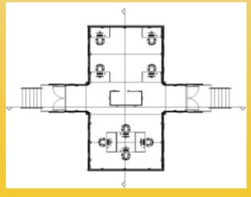


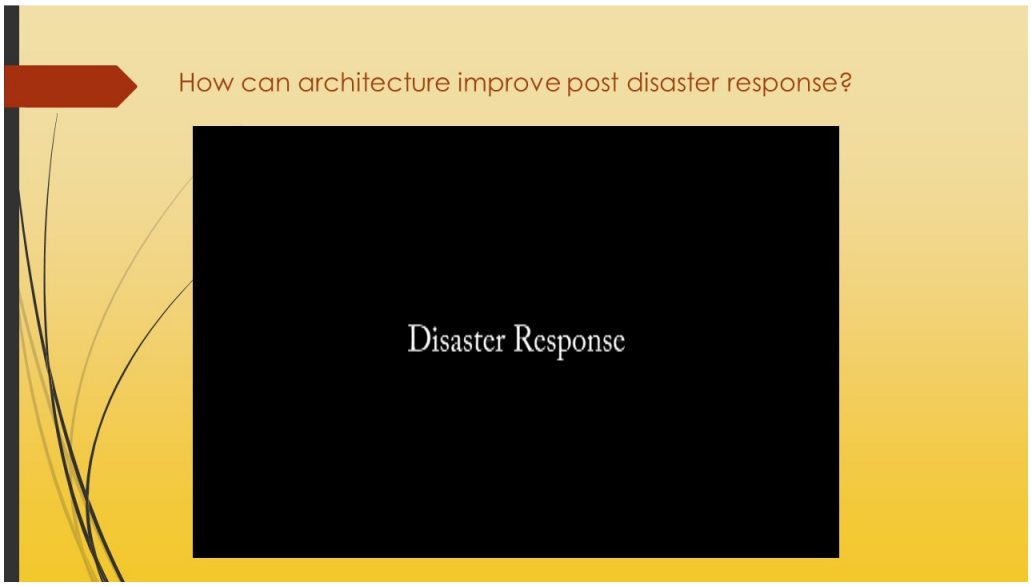
Casualty Collection Units





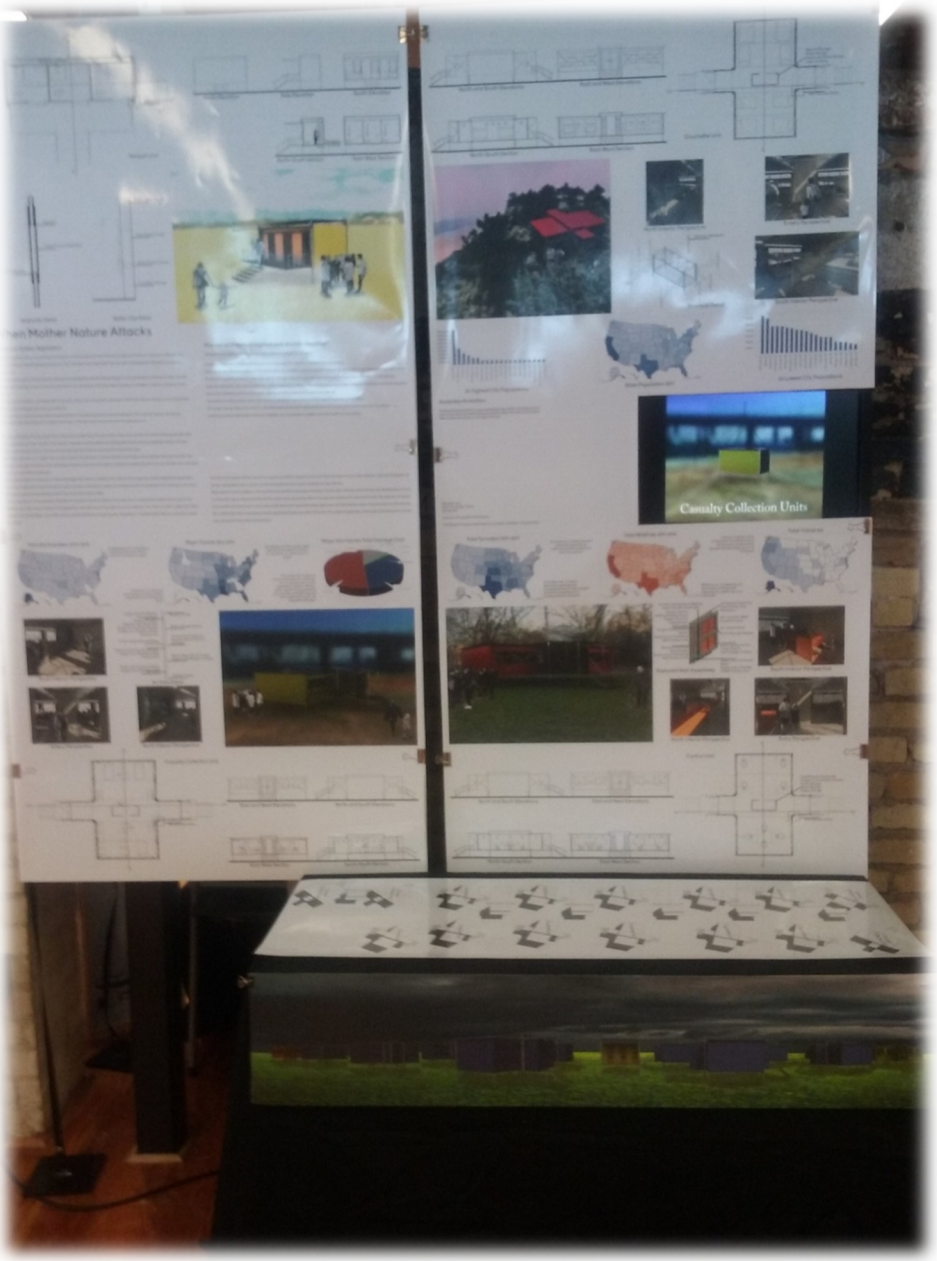
Control Units





This slide showed my animation of the control units. After this point I opened to questions and used my boards to help express my ideas further rather than flipping through slides.

PROJECT INSTALLATION



2017-2018
FARGO, NORTH DAKOTA

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PREVIOUS STUDIO EXPERIENCE

Second Year

Fall 2014:

Tea House – The experience of the path to a traditional tea house located in Moorhead, MN – Cindy Urness

Boat House – A rowing boat storage and club house located in Minneapolis, MN along the river – Cindy Urness

Spring 2015:

Monastery School – Hands on school for children from preschool ages to middle school ages located in Fargo, ND – Darryl Booker

Bird House – Building of a usable bird house with a design based off Richard Meier a Pritzker Prize winner – Darryl Booker

Tiny House – Small on person home that was created using the existing foundation of a water tower located in Cripple Creek, CO – Darryl Booker

Third Year

Fall 2015:

Displaying Art – This was a small project that was inspired by the song Stop and Stare by One Republic – Adam Beck

Community Art Center – Arts Center using wood structure located in Island park in Fargo, ND – Adam Beck

Mid-Rise – Flagship store with apartments and roof top bar using stone structure located in New York – Adam Beck

Spring 2016:

Culinary Arts College – Using concrete structure located in Fargo, ND – Bakr Aly Ahmed

Community Fitness Center – Using steel structure to create large spanning spaces located in South Fargo, ND – Bakr Aly Ahmed

Fourth Year

Fall 2016:

High Rise – Comprehensive design of a high rise located in San Francisco, CA – David Crutchfield

Spring 2017:

City Planning – Creating different built models for different types of city rules in six different cities – Don Faulkner

Archery Center – Marvin Windows competition – Don Faulkner

Fifth Year

Fall 2017:

Research Project – Researching disaster information to develop the system response smart phone application that was used for the thesis project – Ganapathy Mahalingam

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The professors care, if there are issues going on in your personal life they understand and listen to what is bothering you. Professors want us to succeed because they know this is only one stop along our path to become architects.