Emergency Coastline Storm Shelters in Bay County Florida

ROJ SYSTEMS

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11/16/2021

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Executive Summary:

ROJ SYSTEMS was founded shortly after hurricane Katrina in 2005. ROJ SYSTEMS was originally funded by state governments. After the unfortunate casualties caused by hurricane Katrina, ROJ began thinking of ways to help save lives in areas prone to tropical storms, especially those with a low-income population. We began by building small shelters in communities and installing stormproof generators in buildings that were already capable of handling major tropical storms. As the years went by and the number of annual tropical storms increased, we began expanding our storm shelter innovations and increasing the scale of our projects. Our goal today is to help low-income communities have a safe and easily accessible place to take as a temporary shelter during storms.

Introduction:

Hurricanes are a regular occurrence in the state of Florida bringing great amounts of damage and unfortunately casualties. Upon doing extensive research, ROJ SYSTEMS has chosen Bay County Florida as their new area of focus. After hurricane Michael (2018) nearly 20% of those living in Bay County were forced to move due to property damages. Bay County also had the highest death toll of any other county in the state of Florida during the storm.

The reasoning behind this is that in Bay County, the median household income is about $3,000 less than the state's household median of $55,462. At 5.3, Bay's unemployment rate is .01 higher than the state while the percent of households in poverty is 1% lower than the state's 13%. (Jacqueline Bostick, 2020). As a result of lower income, residents of Bay County don’t have the financial ability to storm proof their homes, especially since these renovations are extremely expensive. Furthermore, Bay County is in one of the most hurricane prone areas in the United States, Northwest Florida.

Problem Statement:

Storm surges account for nearly half of hurricane deaths, the rise and rapid approach of water onto land is the biggest risk to humans when thinking about safety. While today many structures all over the state (especially near coastlines) are built to withstand a certain level of flooding, surge, and wind speeds, many people in poorer communities don’t have access to shelters that are sufficient to withstand storms. Proper storm shelters built to withstand storms, provide power, water and food would be extremely beneficial to those living in poor communities near coast lines.

Needs Statement:

Despite hurricanes devastating local infrastructure and claiming the lives of many, there are few fool-proof systems to prevent or mitigate the effects of tropical storms in low-income areas. While evacuation procedures may be implemented, the fact lives are still taken mean that more things can be done to support the citizens of the area. The residents of Bay County are in dire need of an emergency shelter that will guarantee them safety and resources during a tropical storm as devastating as Hurricane Michael was.

Objective:

ROJ systems plans on designing, testing, then building emergency storm shelters that will help reduce casualties and provide guaranteed safe shelter. Our emergency storm shelters will aim to reduce casualties and provide shelter that is sufficient for people to stay in up to 36 hours with access to first aid, power, food, and water. They are going to be raised concrete structures. Our shelters are going to run on renewable energy and will have batteries to store enough energy to have access to charging devices, Wi-Fi and light. These shelters are meant to be permanent structures, however being occupied only during storms to provide protection from harsh conditions as well as provide sufficient shelter until rescue crews will be able to provide help. Food and water will be stored in the form of canned goods and other meals very similar to MREs that are used by armed forces. Water will be provided via regular water supply and sewage because these structures are permanent. The structures will have seating and bunks all around to ensure comfort for those who occupy it. Our team plans to have enough structures to provide enough shelter for at least 100 people since we want these shelters to be a final resort.

ROJ SYSTEMS plans to have the final structures that have undergone and passed all our testing constructed along the coast of Bay County. ROJ systems aims to hopefully reduce hurricane casualties in Bay County entirely by the time another hurricane as major as Hurricane Michael hits northwest Florida.

Requirements:

Can hold 100 occupants for 36 hours

Must withstand surge speeds of at least 10 mph

Structure must be elevated a minimum of 10 feet above ground level

Powered by renewable energy sources and energy independent

Cannot exceed the price of $200,000 per shelter

10 square feet per person

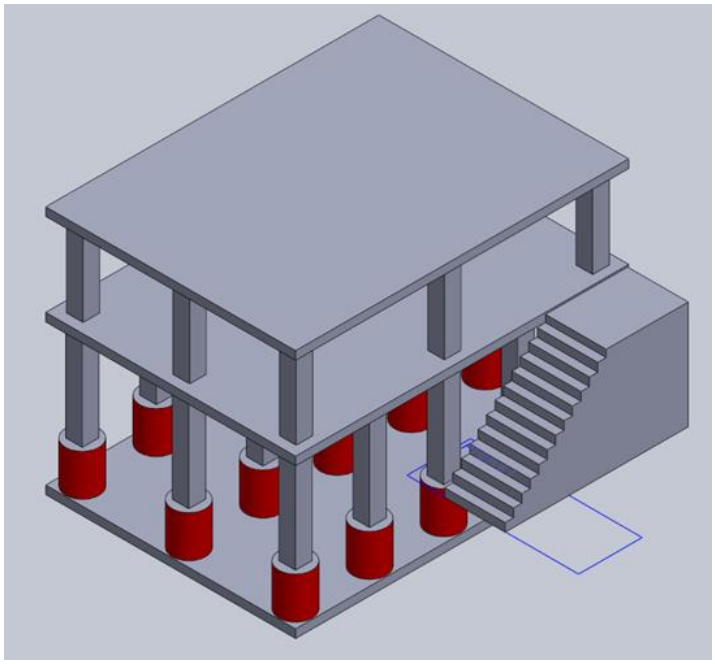
Architecture Design/Technical Description:

Having decided the key specifications a storm shelter should meet, ROJ SYSTEMS got its engineering department together to create a prototype storm shelter. Upon looking at all our options ROJ chose a reinforced concrete construction for several reasons.

1. Reinforced concrete is more than strong enough to handle winds and storm surges
2. While being very strong concrete is relatively inexpensive
3. Concrete is very resistant to water, being hydrophobic on a molecular level

With the understanding that concrete is going to be the safest and most effective material to build our structure out of we next had to look at the size of structure. While having a goal capacity in mind we want our shelters to remain humane and comfortable for those who seek shelter inside them. Upon looking at other shelters such as holding centers and refuge centers we found that 10 square feet per person is a number we are willing to aim for.

Using that number, we calculated that our structure would need a floor area of at least 1,000 square feet. We decided to up the floor space to allow for a bathroom and food storage. The layout will be 40ft by 30 ft by, giving us a floor area of 1200 square feet. Using the designs of other storm proofing projects ROJ SYSTEMS has done in the past we decided to use concrete columns to raise our shelter 12 feet above ground level. The support columns will be 2x2 ft and 12 feet tall. The columns that support the floor will have a 3x5 layout and the columns that support the ceiling will have a 3x3 layout.



Main Concrete pour (anything highlighted red is below ground level)

Under every support column there will be a wider cylindrical column below it that will be 5 feet deep and have a diameter of 4 feet to ensure a proper foundation and the ability to

withstand surges. The walls for the shelter will be constructed from standard concrete brick. The ceiling will be 10 feet above the main floor level.

Since our food storage is going to be in the form of ready to eat packaged meals, they will not require any form of energy to prepare (meaning cooking nor refrigeration is required). Water will be supplied normally through plumbing since these are permanent structures. Energy will be provided through solar panels since power outages are very common during major storms and we want to provide power for those nearby who need it. We decided to go with 75, 300-watt solar panels that will cover the entire roof. This will not only be beneficial during storms because it will allow energy independence but also be a source of clean energy to nearby communities.

Measures of Success:

ROJ SYSTEMS will not mass develop storm shelters throughput Bay County unless the shelters reach every standard we require. The goal of these shelters is to eliminate deaths caused by storm surge in this county. We want these shelters to be comfortable for those who will use them as well as be beneficial year-round by providing power to the communities around them. If ROJ SYSTEMS and Bay County work together completely eliminating storm surge deaths is something we aim for and see being a reality come the next major tropical storm.

Qualifications:

Our team consists of mechanical engineers. Using our understanding in structural mechanics and material sciences we will develop structures capable of withstanding storms. Additionally, we will use storm data to analyze an appropriate design that can be used for multiple areas and be equally safe for its occupants regardless of where the shelter is located. Furthermore, our team is in very close contact with environmental and civil engineers to ensure that everything is developed properly and that our shelters will meet requirements without being too costly or having large trade-offs.

Schedule:

TASK TITLE	START DATE	END DATE	DURATION (HOURS)	Month 1	Month 2	Month 3	Month 4
3D Drafting	1/14/22	1/31/22	80				
Strom Simulations	2/1/22	2/22/22	120				
Protype structure testing/trials	2/23/22	3/23/22	160				
Construction	3/24/22	5/12/22	280				

Estimated timeline for Project

Budget:

Testing and development:

Expense	Rate	Est	Total
3D drafting	$100/hr.	80 hours	$8,000
Storm simulations	$100/hr.	120 hours	$12,000
Prototype structure testing/trials	$1000/hr. (Participants get paid)	160 hours	$160,000
Miscellaneous expenses	$50/ every hour spent developing and testing	360 hours	$18,000

Total: **$198,000**

Construction:

Expense	Rate	Est	Total
Grading	$70/hr.	10 hours	$700
Reinforcement	$30/ cubic yard	168 cubic yards	$5,040
Concrete	$112/cubic yard	168 cubic yards	$18,816
300W Solar panels	$210/panel	75 panels (complete roof coverage)	$15,750
Wiring/electrical	$3/square foot	1200 square feet	$3,600
Putting up walls	$10/square foot	1400 square feet	$14,000
Plumbing	$4.50/ square foot	1200 square ft	$5,400
Miscellaneous	$10 square foot	1200 square ft	$12,000

Total: **$75,306**

Service Costs:

Expense	Rate	Est	Total
Maintenance	$500/month	Per year	$6,000 per year
Restocking Food	$16.35/per person	When shelter is used	$1,635 per event
Misc. Supplies	$15 per person	When shelter is used	$1,500 per event

Total: **$6,000** if unused +**$3,135** per event at maximum capacity

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Memorandum Emergency Storm Shelters

To: Greg Brudnicki - Mayor of Panama City, John E. Dailey - Mayor of Tallahassee, Grover C. Robinson IV - Mayor of Pensacola

From: ROJ SYSTEMS; Ryan Zhao, Joenell Cuello, Oliver Wolak

Date: November 21, 2021

Subject: Emergency Storm Shelters along the Bay County Coastline

At ROJ SYSTEMS we care about the people affected by natural disasters such as hurricanes. Our team is working on a large-scale storm shelter program to minimize the loss of life and injuries that are sustained during tropical storms in low-income counties in the state of Florida. We are currently seeking permission and funding to develop, test, and build storm shelters across the coastal areas of Bay County. They are specifically designed to protect and temporarily house a reasonable amount of people in the event of a sudden tropical storm when other nearby structures aren't suited for waiting out the storm.

As our creation started with 2005's Hurricane Katrina, public safety is our number one priority, and we want to prevent casualties of that scale from happening again. As the climate crisis becomes direr, the frequency and destructive power of hurricanes has only increased, strengthening our commitment to this project.

Our initial emergency storm shelter design aims to provide a cost-effective shelter that can be used for 36 hours at a time without hassle. The shelters will be raised concrete structures powered via solar panels with access to first aid, food, and water. They are meant to be occupied only during storms until rescue crews can provide help. Food and water will be stored in the form of canned goods and other meals very similar to MREs that are used by armed forces. The structures will also have seating and bunks to ensure comfort for those who occupy them.

Our company has successfully worked with smaller areas multiple times in the past and together we will be able to make the Florida coastline safer for everyone when disaster strikes. We eagerly await your response and hope that not having any shelter during a storm will be the last thing they people need to worry about. Please contact us at ROJSYSTEMS@gmail.com to aid our mission to protect those unable to protect themselves from the wrath of mother nature.