**Project Colossus**

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***Technical Description***

 Natural disasters such as earthquakes destroy infrastructure and lives in short amounts of time. Certain regions such as Haiti are prone to these large magnitude earthquakes due to their location. Simple geography is not the only reason as to why Haiti is extremely vulnerable to natural disasters. The combination of poor economic state and political instability, corruption, and violence, are also reasons that Haiti remains to be dangerously exposed to environmental threats. Thousands of Haitians face homelessness and poverty as a result of poor infrastructure.

 Naturally, as a place located directly on a fault line, many natural disasters would take place from tectonic plate movement. There needs to be earthquake-resistant construction incorporated in buildings and proper safety procedures in the instance of one occurring. By fabricating buildings to withstand heavy winds and shaking, collateral damage will drastically decrease. Many human lives will be saved as well as minimizing damage done to structures and buildings. Following examples from Japan, who regularly deals with dangerous threats such as tsunamis and earthquakes, many of the same technologies can be used to develop new construction methods for Haiti.

 As a Computer Scientist familiar with software technology, I can see that while life-saving apps can be developed to be accessed by citizens of Haiti, the problem lies within the poor infrastructure that is not properly managed by relevant government departments. Instead, solutions lie within in developing better infrastructure and civil technology. Civil engineering deals with design, construction, and maintenance of the physical and naturally built environment. Structural components of buildings will have to be prioritized to ensure that people are sheltered from outside elements. First, building materials should be easily accessible and cost efficient without sacrificing levels of safety. Second, homes and other buildings should be built in a timely manner without cutting corners to meet strict deadlines. Following strict regulations and procedures to ensure safety and earthquake-resistance, buildings will be able to withstand strong magnitudes of earthquakes. As a result, less homes will be destroyed and construction priority can be redirected to other areas in need. This project will not directly deal with fixing infrastructure, but also to revitalize the state of the economy by introducing new jobs, supplies, and housing.



*Figure 1: Levitation technology of a house during a sudden earthquake*

 Phase 1 of Colossus deals with the most important component of building houses, the foundation. This technology of a “Shake Table” is used to interpret earthquakes and dampen motions up to an extent.

**Steps of the Levitation Technology:**

1. Once an earthquake is detected, a compressor is switched instantaneously,
2. Air is pumped into airbags that further inflate until the entire house rises to a certain height.
3. For the duration of the quake, the home is “levitating”.
4. The home returns to position by deflating the airbag.

Due to seismic forces that can be described as the shaking of the ground, the soil underneath tends to amplify the shaking as well. Sturdy soil, such as bedrock, combined with concrete will be the first layer. Buildings will follow shorter and wider shapes at the base to deal with lateral and seismic forces. This technology can not only be incorporated into new homes, but also to existing structures as well by retrofitting.



*Figure 2: Basics of corrugated cardboard*

 Phase 2 deals with the building materials to start making up the structure of a house. Instead of traditional building materials such as bricks and steel, corrugated cardboard and wood can be used as well. Since it is low cost, environmentally sustainable, and recyclable, the building material makes a great alternative. Its suitable for mass production as the material is engineered to maintain structural integrity from external weather conditions, humidity, and fire. Cardboard and wood structures are naturally more earth-quake resistant because of its flexibility to adjust to different rates of inertia and momentum. Absorbing energy combined with the Shake Table will enable the building to withstand future earthquakes with large magnitudes.

**Summary/Synopsis:**

The proposed technical project is the development and implementation of Project Colossus in order to relieve the damage of Haitian past and future earthquakes in all aspects including social, political, and most importantly, economical. Taking consideration of many different aspects that impact life, it is critical that this project is both efficient and successful. The state of Haiti disallows continuous failures caused by poor infrastructure and management. These lead to increased rates of homelessness, poverty, starvation, and low qualities of life overall. By building strong infrastructure quickly, many of these effects can be eliminated. Buildings will have a lower chance of being destroyed during sudden earthquakes, leading the community to concentrate for other efforts.

**1. Introduction**

Project Colossus has been researched and developed extensively in other areas of the world that are also prone to natural disasters. Further technology implementation will drastically decrease damage done, allowing society to gradually improve and grow as it did. The primary focus of this project is to ensure quality safety of buildings for residents first and foremost. Project Colossus applies to all buildings but will be focused in small areas gather additional data. With projected results that have high rates of success, this project will be applied to other Caribbean islands and parts of the world. Solving the immediate problem of infrastructure, residents of Haiti can conduct their daily activities without worrying about the state of their homes. During stressful times that only have negative impacts, Project Colossus strives to ensure the revitalization of Haiti and its people through construction.

**2. Problem Statement**

Haiti is extremely vulnerable to earthquakes and other natural disasters because of the geographic location located above a fault line. Like the magnitude 7 earthquake that hit Haiti on January 12, 2010, over 300,000 people were killed. Many more were injured and left homeless after the destruction done to homes and other buildings. As time goes on, the next earthquake will also arrive. It is crucial to be adapt the infrastructure to withstand these earthquakes as it is inevitable to avoid them in this geographic location. More and more people will continue to be negatively affected if these circumstances do not change. Building proper homes will allow jobs to be created and people to be sheltered (Arnold, C., 2013). The goal of Project Colossus is to create homes using latest anti-earthquake technology developed in the last 100 years. This project will be able to complete mass production and implement it to other areas in need. This construction project will be cost-effective in all aspects whether it’s societal, economical, or political.

Project Colossus employs local citizens and needed experts to finish construction projects in a timely and safely manner. By distributing jobs as well as making homes, this strategy remains to be the most efficient option in constructing Colossus homes. This is most critical for these times as we take into consideration the importance of economy and safety. Strict regulations will be followed whether it is company or government to allow these homes to be mass produced. Following procedures that can easily be replicated, the project can safely expand beyond Haiti. It is a goal to finish this grand scale project not only for Haiti, but other Caribbean regions as well.

According to self-gathered research and development data, Project Colossus is most effective in cost-efficiency. Taking special consideration of Haiti’s economic needs, the project is comprised of volunteers, local workers, international funds, global aid, and much more. The program is designed with the utmost attention to providing homes that will last years, and not only as a temporary replacement. The average cost of a home in Haiti is calculated to be around $25,000 and higher due to the use of traditional materials. This project uses corrugated cardboard and wood as an alternative building material, saving thousands of dollars. It is understandable that some may assume cardboard is not a strong material to work with, but architect Shigeru Ban, who has been building with carboard since 1986, has completely improved its function. It is earthquake-proof, fireproof and will not become soft under rain. Wood and corrugated cardboard can withstand quakes that would otherwise destroy concrete structures made using traditional home building methods. These homes would cost approximately $15,000 to build in general. Compared to the regular $25,000 home that would not survive in an earthquake, a Colossus home is cost-efficient and safe. Additional features can be implemented after the successful test trial run, this can include earthquake-proof furniture, shatter-proof glass, home devices, and so on.

**3. Background**

It has been a decade since a magnitude 7 earthquake hit Haiti on January 12, 2010. The effects are still prominent in terms of homelessness, poverty, death, and more. Ten years later, Haiti has not made any recovery from the disaster that has tragically set them back 50 years instead. The management conducted by the Haitian government and international aid has not yet adapted to the needs of Haiti. There are issues related with overcrowding and unstable urban development as well (Savard, J.-F., Sael, E., & Clormeus, J. J., 2020). Regional development policy and regulations are not being adjusted to anticipate earthquakes despite being located directly above a fault line. Tectonic plate movements are to be expected and readily inevitable. Project Colossus aims to provide guidance and hope to the community of Haiti by providing both housing and employment locally. Using civil engineering experts and qualified architects, the company serves to provide materials and construction necessary in times of natural disasters. Experienced in dealing with previous earthquakes like in Japan and New Zealand, methods used by Colossus can be adapted to Haiti’s regional differences. Like its building materials, Project Colossus is unparalleled when it comes to developing technology in prevention for earthquakes and other natural disasters.

**4. Needs Statement**

As a person who has lived in areas where earthquakes occur, it is clear to see what has to be done in order to continue living life. Project Colossus considers all factors for construction without sacrificing either quality or quantity. The restriction in time and resources will only allow this project to prevail, making its homes even cheaper than projected. The year is 2020, and Haiti’s state has not changed or adapted in any way or form without blame to the citizens of Haiti. Current budget costs and aid will be organized thoughtfully to manage all resources to carrying out the project successfully.

**5. Objective**

The implementation of this proposal will take place in the region of Haiti, specifically the capital Port-au-Prince. The city was originally designed for 3,000 people, yet it houses almost a population of almost a million. This rural area will become the center for the test trial run conducted by Project Colossus without any external partners. The goal of this trial is to construct 20 homes that follow strict regulations set by Colossus and then follow Haitian policies. These homes will not be a temporary establishment but can be used as a shelter or permanent residence by people in need and workers. Problems such as poverty, homelessness, job loss will be decreased as a result from Project Colossus. New sources of income will be introduced through new job creations as well as provided housing. The objective is a humanitarian effort to relieve natural disaster damage and implementing new anti-earthquake preventions.

**6. Proposed Technical Approach**

Project Colossus employs professional engineers and experts that directly study earthquakes to develop strategies against it. Collaborating with known architects, Colossus deals with construction with the latest natural disaster technology such as Shake Tables and Levitation Technology. Previous records of success have been done in Japan and New Zealand, who are both prone to earthquakes. Other experience such as working with government officials and the private sector allows Colossus to excel in construction projects across the world. The company designs each program and regulation to adapt to the needs of different disaster-stricken areas, demonstrating unique and specialized approached for each region. Considering the difference in environment, levels of humidity, temperature, and terrain vary from region to region.

**7. Financing**

Every project is limited by starting budget. Along with international aid and contributions, the current budget is $1,000,000. The plan starts with constructing 20 homes in under three months as a trial test run. Even though it is a trial, all regulations and safety procedures are to be followed and strictly inspected after completion. Building materials compared to bricks and steel are only a fraction of the cost for corrugated cardboard (Morad, Abdel-Kader & Faggal, Ahmed & El-Metwally, Yara, 2012). Shake Tables and Levitation Technology are extremely cheap because these technologies are meant to be implemented quickly at low cost rates. With additional contributors and aid, money can be invested in a larger workforce comprised of citizens of Haiti. Once the test trial is done, these homes can be used as shelter or permanent residencies.

|  |  |
| --- | --- |
| Construction workers (subject to change) | $300,000 |
| Building materials | $300,000 |
| Shake Table | $1,000/shake table20x = $20,000 |
| Levitation Technology | $500/implementation20x = $10,000 |
| Home | $15,000/construction20x = 300,000 |
| Utilities | $100/month/home |

**8. Materials**

In developing the Colossus homes for Haiti, many materials will have to be sourced and gathered through shipments. Parts such as Shake Tables and Levitation Technology have to be ordered in from a supplier to reduce time needed to complete the project. Other materials and measurements can be ordered as needed to limit unnecessary budget spending. Considering the state of Haiti, it will be even more difficult to source for local materials. As a result, distribution of supply will arrive in shipments for corrugated cardboard, wood, and additional assembling supplied.

**Materials needed but not limited to:**

* Corrugated cardboard
* Wood
* Assembling nails, screws, binds
* Construction tools
* Shake Table assembly kits
* Levitation Technology including compressor, airbags

**9. Expected Project Results**

The expected project results of Project Colossus is expected to be highly successful based on previous data and construction. Many of these trials have been previously conducted, and only adjustments like measurements have to be made to adjust to the location of Haiti. The implementation of Colossus homes during Phase 1 will be able to eliminate any human error and guarantee quality results in large amounts. This test is for changing the architecture design to fit both aesthetics and function for Haitian citizens without making sacrifices to its primary function. Shake Tables and Levitation Technology already have a tremendous rate of success at withstanding high magnitude earthquakes. Colossus aims to continue developing its construction methods in an attempt at reducing costs and time needed to finish projects. Training employees to follow Colossus’ regulations and methods take less than a month and must be supervised for the first six months of employment. The workforce for the Haiti project will grow exponentially, allowing for the project to see past its deadline and expand in other areas as well. Blueprints and methods can be easily replicated for Colossus partners. As further changes are made for improvement, Project Colossus remains to achieve high rates of success if not beyond expectations.

**10. Architecture Design**The architecture design of this project primarily focuses on earthquake-proof technology. It starts with Shake Table technology, in which the house is built on a mixture of concrete and soil that allows energy to be evenly dispersed. Between the table and the house, Levitation Technology is implemented for sudden earthquakes. This allows the house to raise certain centimeters above the ground (Walters, H., 2014). The Shake Table is engineered to handle various types of ground vibration and seismic force that resembles dangerous earthquakes.



*Figure 1: Levitation technology of a house during a sudden earthquake*



*Figure 3:* Corrugated cardboard, honeycomb structure

**11. Implementation Strategy**

The company works with professional civil engineers and earthquake experts that regularly study natural disaster responses.

**The primary goals include:**

* Low cost
* Short times
* Increased safety measures
* Easy maintenance
* Additional features

These homes are designed to be implemented rapidly as soon as materials and workers are readily available. The implementation strategy starts with concocting a special mixture of concrete along with soil as the first layer before construction. Then, the assembly kits for Shake Tables are used to put together the platform, compressor, and airbags. The tables are checked for seismic force tolerance of at least magnitude 7 to pass Anti-Earthquake tests. Ensuring that proper regulations and policies are being followed, only then can the house be built. Corrugated carboard tubes and wood logs make up the actual materials of the house. The blueprints are to be directly followed with minor changes to appearance and aesthetics. Additional features can be included if requested before the construction of the Colossus home.

**12. Quality Assurance**

As a construction company, Colossus strictly follows regulation and policy set up by the local government for any construction projects. Not only that, the company has its own set of rules and procedure for projects. Inspectors from the local area will handle occasional inspections and maintenance needs once projects are completed. Many tests are completed in the duration of these home constructions, and if failed, the home does not proceed. In the rare instance of failure to occur, isolation of the base is required to fix the problem. Once a project is finished, management staff from Colossus will conduct quality assurance checks before allowing any inhabitants for the home.

**These checks include:**

1. Provide routine and consistent checks to ensure project integrity, correctness, and completeness.
2. Identify and address errors and omissions.
3. Document, archive and record all activities.

**Schedule**

|  |  |
| --- | --- |
| **To-Do** | **Deadline** |
| Gather building materials:* Wood logs
* Corrugated cardboard tubes/flats
 | Begin: May 20, 2020End: June 1, 2020 |
| Phase 1: Construction of Shake Tables with Levitation Technology | Begin : June 5, 2020 |
| Phase 2: Full construction of homes | Begin: June 30, 2020 |
| All trial construction above | End: August 1, 2020 |
| Gather data from inhabitants and employees | Start: June 5,2020 (monthly) |

### **Audience Profile Sheet**

|  |  |
| --- | --- |
| Reader's Name:  |  |
| President Jovenel Moise of Haiti |
| Reader's Job Title: |  |
| Political Official, President, Council of Ministers |
| Kind of Reader: | Primary X Secondary  |
| Primary receiver or secondary receiver |
| Reader’s Level of Education: |  |
| Secondary education in geography, political science, entrepreneurship |
| Reader’s Professional Experience: |  |
| Political experience mainly for bio-ecological agriculture |
| Reader’s Job Responsibilities: |  |
| Managing Haiti |
| Reader’s Personal Characteristics: |  |
| N/A |
| Reader’s Cultural Background: |  |
| N/A |
| Reader’s Attitude Toward the Writer (you): |  |
| Indifferent |
| Reader’s Stance |  |
| Supportive  |
| Notes: Pushes for universal education and health care, energy reform, rule of law, creation of sustainable jobs, environmental protection, development of Haiti |  |
|  |
| Need other translations of this document to reach non-English speakers |  |
|  |
| Reader’s Way of Reading the Document: | Skim it Yes Study it Yes Read a portion of it Yes Modify it and submit it to another reader \_\_\_\_\_\_\_\_ |
|  |
| Reader’s Reading Skill: |  |
| Higher education reading skill level |

References

Morad, Abdel-Kader & Faggal, Ahmed & El-Metwally, Yara. (2012). Efficiency of Corrugated Cardboard as a Building Material. 10.13140/RG.2.2.24879.53927.

Savard, J.-F., Sael, E., & Clormeus, J. J. (2020, January 12). A decade after the earthquake, Haiti still struggles to recover. Retrieved from <https://theconversation.com/a-decade-after-the-earthquake-haiti-still-struggles-to-recover-129670>

Walters, H., (2014, April 23). Buildings made from cardboard tubes: A gallery of Shigeru Ban architecture. Retrieved from <https://blog.ted.com/buildings-made-from-cardboard-tubes-a-gallery-of-shigeru-ban-architecture/>

Building Seismic Safety Council, NEHRP Recommended Provisions for Seismic Regulations for New Buildings and Other Structures, Part 2 Commentary, FEMA 450, 2003, Washington, DC.

Arnold, C. (2013). EARTHQUAKE EFFECTS ON BUILDINGS. Retrieved 2020, from https://www.fema.gov/media-library-data/20130726-1556-20490-0102/fema454\_chapter4.pdf