Comparison of Concrete Masonry Unit(CMU) from Haiti VS United States

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Abstract

On January 12, 2010, Haiti was hit by an earthquake which caused the destruction of many buildings. One of the reasons for this destruction was due to the poor quality of the Concrete Masonry Unit (CMU) used to build them. At the Multidisciplinary Center for Earthquake Engineering Research (MCEER), the compressive strength of the CMUs manufactured in Haiti were compared against those from the United States(US). Six sets of blocks from Haiti and two set of blocks from the US were used. Each sample was tested according to the ASTM C1716 standard. Based on the results, it can be recommended to the Haitian engineers to upgrade the quality of the materials used to produce the CMUs and to buy CMUs from Pfab, a CMU brand from Haiti

Background

After the January 12, 2010 earthquake, Haiti lost tremendous amount of lives and property. Major towns such as Port-au-Prince the capital and Jacmel were severely damaged. In Port-au-Prince, important buildings such as the National Palace, the Penitencier National, the Cathedral, the National Assembly were destroyed. The national statistics reported that more than 100,000 residencies were destroyed or damaged, and more than 15,000 commercial businesses suffered.

(a) National Palace

(b) Sacred Heart Church

(c) Residential Building

Currently, Haiti is in the middle of reconstruction and still sustains many aftershocks ranging from 2.0 – 5.0 magnitude

Objectives

- Measure maximum compressive force of CMUs
- Measure maximum stress that can be applied on the CMUs
- Desmontrate that CMUs in Haiti are not totally reliable

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Methods

- **Step 1** • Obtained blocks from a random construction site in the United States
- **Step 2** • Acquired blocks from a manufacturing company at Home depot in United States
- **Step 3** • Acquired common construction blocks from Haiti
- **Step 4** • Predicted the data according to the current hypothesis
- **Step 5** • Used Forney Concrete Testing Machines according to ASTM C 1716 standard to test the compressive strength of the blocks

(a) Unloaded machine

(b) Loaded machine

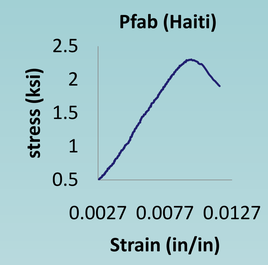
(c) CMU sample

Results

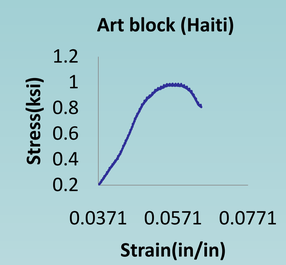
Table 1: Comparison of CMUs of Haiti to those of United States

	United States		Haiti					
	Block USA	Random	Haiti block	UEBH	TEBO	Dura block	Pfab	Art block
Height (in)	7.625	7.625	7.5	8	7.3	7.5	7.2	7
Cross section Area (in^2)	57	57	42.25	53.28	42.25	42.25	45.38	55.25
Max Compressive Force (kips)	180.66	165	63.66	45	44.33	49.33	87.6	54
Max Stress (ksi)	3.16	2.89	1.50	.84	1.04	1.16	1.93	.97

Results (con't)



(a)



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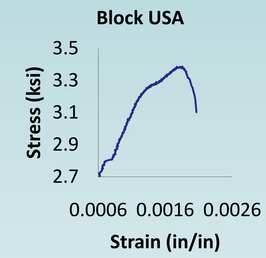

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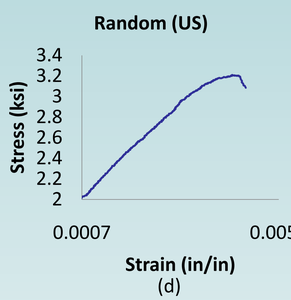

(d)

Figure 1: The block from Pfab has the maximum compressive stress around 2.4 ksi and the art block around 0.9 ksi.
a) Stress-strain curve for a Pfab block from Haiti
b) Stress-strain curve for an art block from Haiti
The two blocks from the US break around the same point with a maximum compressive around 3.3 ksi.
c) Stress-strain curve for a block U.S.A block
d) Stress-strain curve for a random block from the U.S

(a) Failed sample from the US

(b) Failed sample from Haiti

Conclusion

- CMUs in Haiti are made out of poor quality materials
- Pfab only reliable brand of CMUs in Haiti but there is room for improvement
- Recommendations:
  - Test the CMUs for compressive strength before using them
  - Upgrade materials quality

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