The Effectiveness of a Brace in Building Structure

Tiffany Lee

Newport High School

5012 134th PL SE

Bellevue, WA 98006

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Abstract

Today, braces in the constructions play a major role in supporting and integrating the whole structures of the buildings. Furthermore, various types of braces embrace different strengths of force, and among those, the use of X bracing systems for strengthening is a viable solution for enhancing resistance to any natural disasters. Thus, this study examined the effectiveness of types of brace in building structure. Compared to other types of bracings such as diagonal, recent researchers have reported that building with the X types of bracing will most likely produce the reduced lateral displacement when the force is applied. The strength of various types of bracing systems was determined by experiments set up with the spaghetti noodles.

The Effects of the Bracing Systems in Buildings

Over the past centuries, many studies have shown that buildings should

include braces in order to endure a high resistance. For instance, natural disasters have caused many dangers, but the bracing systems have been stabilizing the buildings in the modern world. In detail, the displacement in horizontal direction of building with the X types of bracing has been reduced by average of 69 percent compared to the one without any bracing system. (Viswanath, Prakash, and Desai, 2010) Thus, when buildings are not braced well, they are less likely to resist the force of the strong nature. With the usage of braces such as X-shaped bracings, the world can be safer without any hazards from the displacements of the structures.

Method

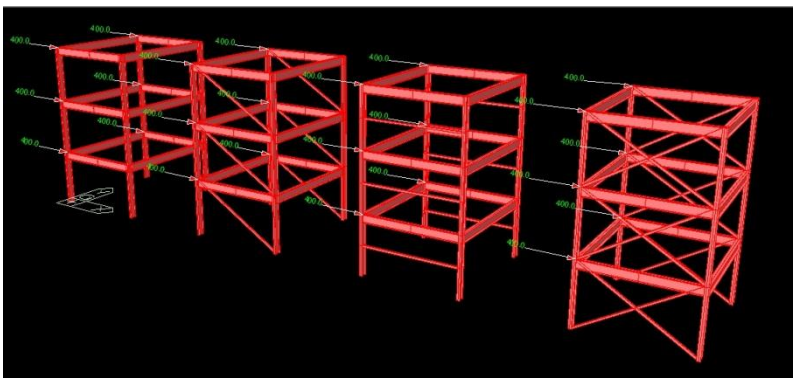
The strength of various types of bracing systems was determined by experiments set up with the spaghetti noodles. After connecting each end of the

noodles by using the glue, vary the types of bracing: none, X, diagonal, and a parallel line. Measure the length of the horizontal and vertical spaghetti noodles.

Then, connect a string and Styrofoam to hang the paper cup for each of them in order to add force on the side ways. In conclusion, the spaghetti noodle structure with the type of X bracing was the strongest with the horizontal displacement of 1mm when 200ml of water was added. Please refer to the graph

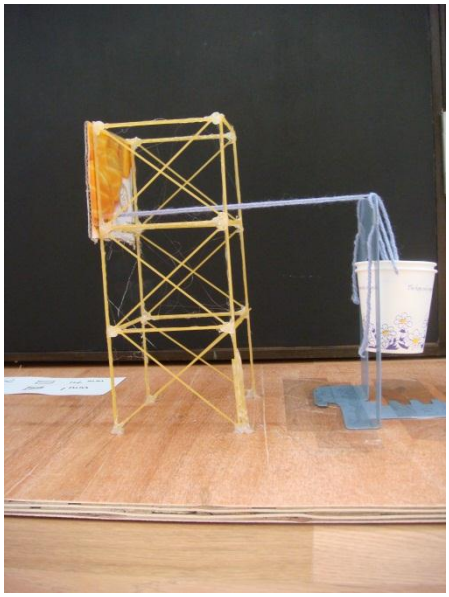
below for the specific information.

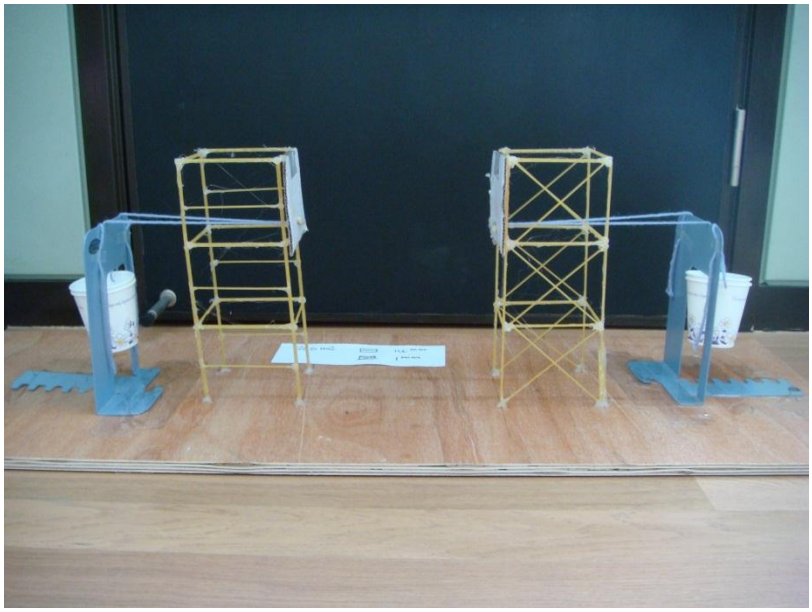
In order to further research on the effectiveness of the braces, the specialized program called Midas was used. Midas is a significant program that engineers eventually have to learn in order to make a simulation of the actual building based on the floor plan and check for the stability of the building that people are about to build. If there are any problems, engineers use this program to reconstruct the structures especially bracing systems in order to strengthen it after considering the environment of the building that is to be built. Thus, with this program, four different buildings were also set up with various bracings. Then, for each of the bar, the force of 400N was applied in order to give a horizontal force similar to the spaghetti noddle experiment.



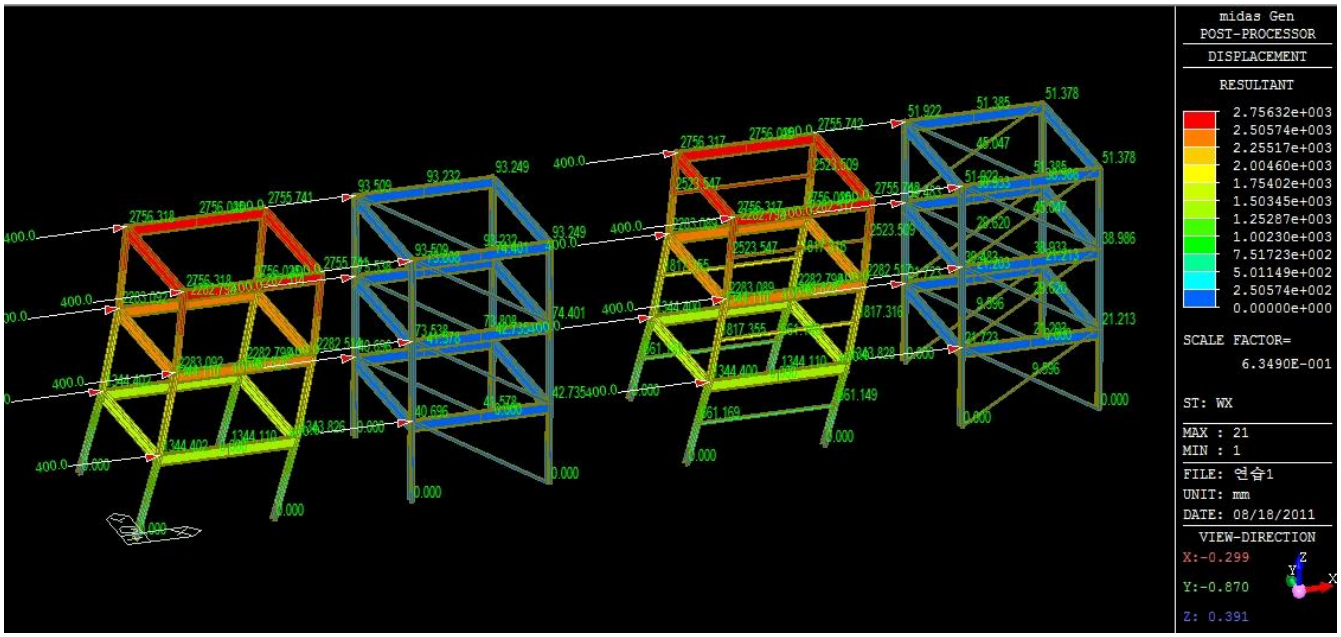
Results

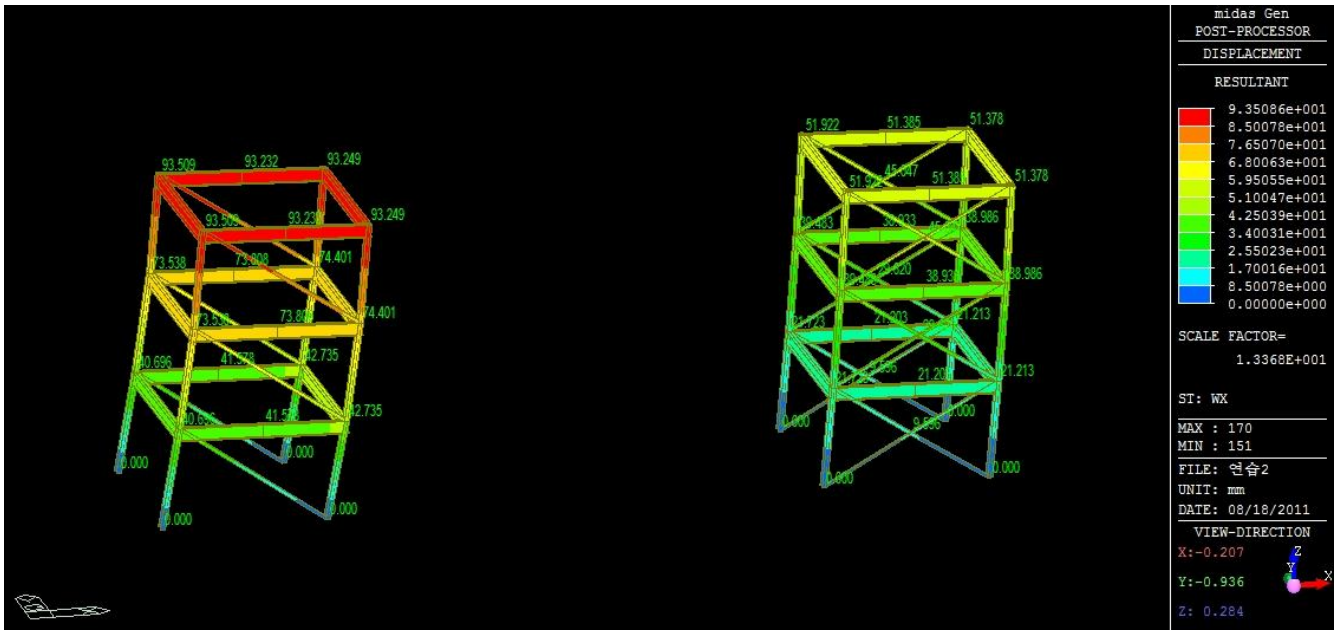
When 200ml of water acting as a force was applied, all four buildings with different types of bracing showed that the X-shaped building moves the least in the horizontal direction from observation. In detail, a building with X type of bracing moved 1mm in the end, with parallel bracing displaced 14mm, with diagonal bracing moved 1.5mm, and without bracing displaced 20mm.





Similar to the spaghetti experiment, when the force was applied, the results also proved the fact that a building with X type of bracing system was the strongest with the least amount of horizontal displacement. According to Midas, one of the corners of buildings had a displacement of 2755.741, 93.249, 2755.742, and 51.378 in an order of bracing of none, diagonal, parallel, and X.





This picture clearly shows the different between X and Diagonal bracings.

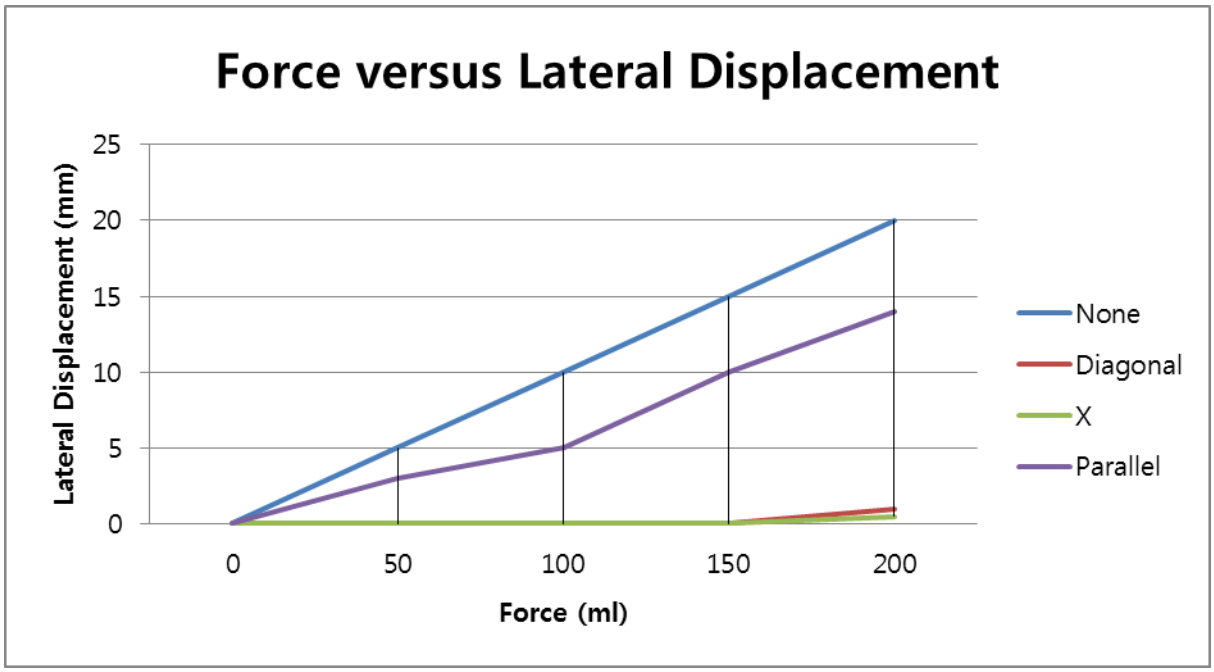
Conclusion

The results of the experiment clearly supported and proved the initial expectations. Thus, the hypothesis of stating that the building with X-type of bracing will have the most stable structure with the least horizontal displacement is valid. From this result, we might learn that utilizing bracing systems when building structures is necessary for people's safety, and among those, X-shape bracing will be most likely to be used often for the protection. Future research on this subject might specifically address how does the force affect the beams of the structure, because it is very significant to work and research to improve the living conditions of people by strengthening and stabilizing the building in our society. Thus, when a strong natural disaster occurs, we can trust in the strong buildings for the safety and

protection.

References

K.G, Viswanath, Prakash K.B, and Anant Desai. "INTERNATIONAL JOURNAL OF CIVIL AND STRUCTURAL ENGINEERING." *Seismic Analysis of Steel Braced Reinforced Concrete Frames*. 1. Belgaum: 2010. Print.



PROJECT TITLE :

MIDAS	Company		Client	
	Author		File Name	output(displacement)4

NODE DISPLACEMENT AND ROTATIONS DEFAULT PRINTOUT

Unit System : kN , mm

NODE	LC	UX	UY	UZ	RX	RY	RZ
1	WX	0.000	0.000	0.000	0.0	0.0	0.0
2	WX	1344.398	0.000	3.351	0.0	0.0	0.0
3	WX	0.000	0.000	0.000	0.0	0.0	0.0
4	WX	1343.821	0.000	-3.351	0.0	0.0	0.0
7	WX	0.000	0.000	0.000	0.0	0.0	0.0
8	WX	1344.398	0.000	3.351	0.0	0.0	0.0
9	WX	0.000	0.000	0.000	0.0	0.0	0.0
10	WX	1343.821	0.000	-3.351	0.0	0.0	0.0
13	WX	1344.110	0.000	-0.011	0.0	-0.0	0.0
14	WX	1344.110	0.000	-0.011	0.0	-0.0	0.0
15	WX	2283.086	0.000	4.850	0.0	0.0	0.0
16	WX	2282.509	0.000	-4.850	0.0	0.0	0.0
17	WX	2282.798	0.000	0.000	0.0	-0.0	0.0
18	WX	2283.086	0.000	4.850	0.0	0.0	0.0
19	WX	2282.509	0.000	-4.850	0.0	0.0	0.0
20	WX	2282.798	0.000	0.000	0.0	-0.0	0.0
21	WX	2756.313	0.000	5.228	0.0	0.0	0.0
22	WX	2755.736	0.000	-5.228	0.0	0.0	0.0
23	WX	2756.025	0.000	-0.000	0.0	-0.0	0.0
24	WX	2756.313	0.000	5.228	0.0	0.0	0.0
25	WX	2755.736	0.000	-5.228	0.0	0.0	0.0
26	WX	2756.025	0.000	-0.000	0.0	-0.0	0.0
151	WX	0.000	0.000	0.000	0.0	0.0	0.0
152	WX	40.452	0.000	4.450	0.0	0.0	0.0
153	WX	0.000	0.000	0.000	0.0	0.0	0.0
154	WX	42.674	0.000	-2.274	0.0	0.0	0.0
155	WX	41.563	0.000	1.111	0.0	0.0	0.0