New Techniques for Earthquake Reconnaissance

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SUMMARY

Earthquake reconnaissance provides primary data that drives the development of procedures and codes for earthquake engineering practices. Visual documentation of post-earthquake damage can validate code design provisions, or reveal flaws in structures that can lead to the enhancement of structural designs. This project explored a new technique for assessing post-earthquake damage to buildings and bridges. Canon EOS 5D Mark II camera photographs of damaged structures from the Jan. 7-10, 2010 Haiti earthquake were stitched together using PTGui software to create spherical panoramas and three-hundred and sixty degree .mov files. Those photographs were also superimposed onto the Leica Scan Station 2’s laser scanned images, using Cyclone software, to both mathematically and visually reflect the damaged state of the structures. The resultant images provide earthquake engineers with a true representation of the damaged structures and provide accurate measurements. This investigation suggests a precise method of analyzing earthquake damage to buildings and infrastructure. It offers government, construction companies, civil engineers, and architects a new tool to use when gathering data after earthquakes. Refining post-earthquake structure damage analysis practices will aid in coming earthquake aftermath investigations.

RESULTS

Residual displacement can be calculated and deformation can be measured in structural elements. For example, in Fig. 13 residual displacement of a cracked piece in station 2. It measured 0.092m on the scan. MATLAB was used to generate and display the residual displacement of the columns or beams of damaged buildings (Fig. 14). A code was used to interpret the image’s information into points on a graph.

ANALYSIS

The photographs, scans, panoramas, and videos have been stored in a common repository, where future researchers can use the data to investigate the damaged structures of the 2010 Haiti earthquake. Earthquake engineers can calculate residual displacement or measure deformation in structural elements using these reconstruction techniques.

CONCLUSION

The methods used in this project aim at improving the preparedness in situations of similar catastrophes in the US or worldwide.

It is anticipated that techniques employed for this project in gathering and disseminating critical information will have a major impact on revolutionizing the reconnaissance efforts by the earthquake engineering community in the event of a major earthquake in the US.

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REFERENCES


FOOTNOTES

[1] President of AIP Engineers, Inc. Berkeley, CA
[2] Associate Professor; Stanford University, Palo Alto, CA
[3] Professor; UC Berkeley
[4] Senior Development Engineer, UC Berkeley

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The photographs such as Fig. 4 and 5 were stitched together through the creation of control points. The images were then aligned and warped to create a three-hundred and sixty degree spherical panorama.

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