CONCRETE-FILLED STEEL TUBE INSTALLATION FOR ADDITIONAL LOAD TRANSFER TO RETROFIT AN EXISTING BUILDING

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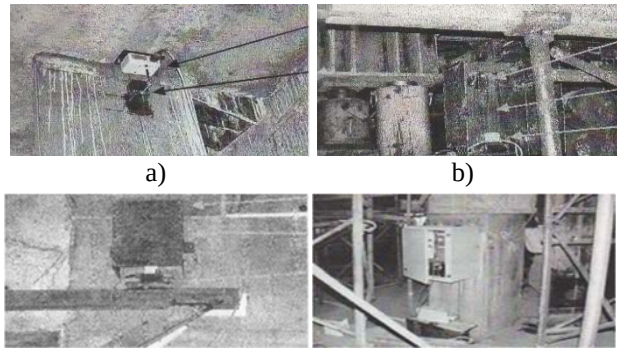
1. INTRODUCTION

In 1997, a 39-floor reinforced concrete building was constructed in Bangkok, Thailand. During construction, the rooftop was modified, which led to additional loads. This required unusual design details to retrofit the building to provide the necessary structural support. In particular, two concrete-filled steel tubes (CFST) [1] were installed, extending from the ground up to the 37th floor (FL). While the CFSTs were being built, construction of the upper floors continued. Provisions were made to transfer the loads to the CFSTs when they were completed.

2. DISPLACEMENT MONITORING SYSTEM

Despite careful provisions to align the CFSTs and balance the loads, there were concerns regarding the transfer of loads. A displacement monitoring system was designed and installed to measure static displacements [2]. Fig. 1 shows the system installation. Fig. 2 shows the north and south locations of each sensor and the reference surface of each measurement.



a) b) c) d)

Fig. 1 System Installation: a) typical sensor attachment, b) sensor attachment 37th FL, c) hinge location, and d) Mt. Whitney recorder

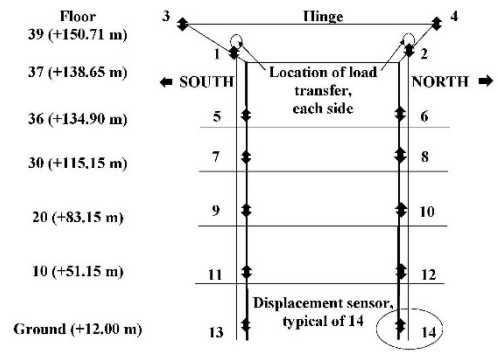


Fig. 2 The location of each sensor

3. RESULTS

The time history for the CFST vertical compression displacements at the 37th FL, and the total displacements by floor are shown in Figs. 3 and 4, respectively. The data show that total displacements at the 37th FL for the north and south CFSTs are 18.42 mm and 20.47 mm, respectively, which are similar to 11%, and are within the requirements of compression members in the code consulted, New Zealand Stand NZS 3404: 1992 [3], which allows vertical deflections between connection points of less than 1/1,000 of length, in this case (as seen in Fig. 2): = (138.65-12.00)1,000/1,000 = 126.65 mm.

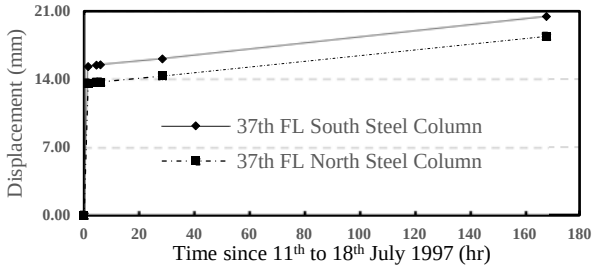


Fig. 3 The CFST displacement time history at the 37th FL

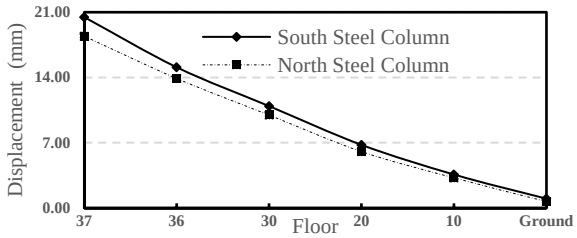


Fig. 4 Total displacements from 11th to 18th July 1997

4. CONCLUSIONS

The CFSTs were monitored by the displacement monitoring system to control verticality and displacements, and to balance loads during construction. The transfer of the additional loads from the rooftop to the CFSTs was successful. The building was opened in 1998.

REFERENCES

[1] A. Kuranovas, A.K. Kvedaras, Behavior of Hollow Concrete-filled Steel Tubular Composite Elements, J. Cem, 2007, Vol. XIII, No. 2, 131–141.

[2] Agbabian Associates, Deflection Monitoring, Report no. 9717-6644, 1111 South Arroyo Parkway, Suite 470, Pasadena, California 91105, 1997.

[3] NZS 3404 Part 1:1992 “Steel structures Standard” - Steel structures Standard, Standards New Zealand, 1992.