Ronald H. Brookman, Structural Engineer

March 19,2012

Catherine S. Fletcher, FOIA & Privacy Act Officer
National Institute of Standards and Technology
100 Bureau Drive, STOP 1710
Gaithersburg, MD 20899-1710

Re: Freedom of Information Act Request, 5 U.S.C. § 552

Dear Ms. Fletcher

I respectfully request all available public information under the control of NIST regarding the documents and questions listed below. These documents and questions relate to the 7 World Trade Center (WTC 7) collapse initiation outlined in Chapters 8 and 11 of NIST NCSTAR 1-9.[1] I understand that you are not required to create a record that does not exist; I am asking for all information in NIST's possession that bear on these questions and the decisions that NIST or its subcontractors made in relation to them.

Copies of the following drawings were obtained from the NIST FOIA office:

- **Irwin G. Cantor P.C., Structural Engineers (1985). Structural Design Drawings, 7 World Trade Center**
- **Frankel Steel Limited (1985). Erection Drawings, 7 World Trade Center**
- **Frankel Steel Limited (1985a). Fabrication Shop Drawings, 7 World Trade Center**

Specific questions include the following:

1. **NCSTAR 1 -9 states that the girder spanning between columns 44 and 79 at floor 13 lacked shear studs to provide composite action with the concrete floor slab,[2] and this agrees with a partial framing plan included in the report.[3] An article appeared in the Canadian Structural Engineering Conference Proceedings — 1986 describing the**

[1] Therese P. McAllister et al., NIST NCSTAR 1-9, Structural Fire Response and Probable Collapse Sequence of World Trade Center Building 7. Washington: U.S. Government Printing Office, November 2008.

[2] McAllister et al., p. 342.

[3] McAllister et al., p. 343. This is taken from Cantor sheet S-8 revision H dated 8/5/85.

fabrication and construction of the steel structure.[4] Figure 5 of this article clearly shows 30 shear studs equally spaced along the girder at typical floors including floor 13. How did NIST confirm that shear studs were in fact omitted from the girder at floor 13?

2. **Frankel Steel drawings E8/9 through E20 and E24 through E44/45 all note: "FOR ADDITIONAL STUDS SEE CUST. DWG. S8 REV. I." Cantor sheet S-8 released by the NIST FOIA office includes revision H but not revision I. Sheet S-8-10 revision I shows 30 shear studs on the girder. Sheet S-8-19 revision I shows an additional bottom flange plate on the girder and no shear studs on the W24 beams east of the girder. Sheet S-8-20 revision I shows 30 shear studs on the girder and an unidentified number of studs on the W24 beams. Was sheet S-8 revision I included in the construction documents for this building? What additional floor loading was present on floors 10, 19 and 20, and were these variations in loading and section properties included in the analytical models?**

3. **NCSTAR1-9 Section 8.8 describes the partial-floor LS-DYNA model used to develop failure modes of floor framing and connections. The seated-beam connection shown in Figures 8-21 and 8-23[5] was compared to Frankel Steel drawing 1091. This drawing illustrates the one-inch thick bearing plate was 12 inches long. Does the partial-floor model account for the full length of the bearing plate? Why does the 16-story ANSYS model account for only an 11-inch long[6] bearing plate?**

4. **The seated-beam connection shown in Figures 8-21 and 8-23 was also compared to Frankel Steel drawing 9114. This drawing illustrates ¾ -inch thick partial-height web stiffeners welded to the girder web and bottom flange. Fillet welds connecting the stiffeners were more than adequate to transfer the vertical shear from the girder web to the stiffeners. Why were these stiffeners omitted from the partial-floor model?**

5. **Thermal expansion caused erection bolts to shear off at each end of the girder. The elongated girder then contacted the column 79 flange in the partial-floor model.[7] The girder was then restrained from excessive lateral displacement by the column side plates. Figure 8-27[8] appears to show the girder rotated but restrained between the column side plates. The girder was also restrained from excessive lateral displacement at column 44 by the column flanges as shown in Frankel Steel**

[4] John J. Salvarinas, "Seven World Trade Center, New York, Fabrication and Construction Aspects," Canadian Structural Engineering Conference Proceedings—1986. (Canadian Steel Construction Council, Willowdale, Ontario, 19S6), pp. 11-1-11-44.

[3] McAllister et al, pp. 349 and 351.

[6] McAllister et al., p. 527.

[7] McAllister et al., p. 352.

[8] McAllister et al., p. 354.

drawing 9102. How did lateral walk-off or rocking occur considering these restraints at both ends?

6. **Table 8-2[9] lists observed failures in the partial-floor model, but lateral walk-off of the girder from its seat is not listed as an observed failure. How was walk-off verified as a possible failure mode[10] if it was not observed in the partial-floor model?**

7. **Table 8-2 shows that the northern floor beam (W21x44) buckled laterally before other beams buckled in the partial-floor model. Frankel Steel drawing E12/13 shows three W12xl9 beams that laterally braced the W21 to the perimeter frame, but Figures 8-22 and 8-27[11] indicate that the partial-floor model did not include these framing members. Why were these beams omitted when they obviously affect the buckling characteristics of the northern floor beam?**

8. **NCSTAR 1-9 has numerous references to walk off due to thermal expansion. One reference[12] says the lateral walk off at columns 79 and 81" … was monitored during the analysis." How does the analytical model shown in Figure 11-15[13] measure and monitor lateral walk off during the analysis?**

9. **The ANSYS analytical model for the seated-beam connection at column 79 shown in Figure 11-15[14] does not account for the presence of web stiffeners shown in Frankel Steel drawing 9114. A lateral displacement of 5 ½ inches[15] would not cause a loss of vertical support with the stiffeners in place. The assumption that the girder flange would yield in flexure when the girder web moves past the edge of the bearing seat is incorrect. Why were these stiffeners omitted from the 16-story ANSYS model when they obviously affect the bending characteristics of the girder bottom flange?**

10. **Please describe or illustrate quantitatively the displaced shape (translation and rotation) and temperature of the girder cross section at each end and at intermediate points along the span where beams were attached on the east side for the ANSYS Case B 4.0-hour analysis. What were the axial forces (magnitude**

[9] McAllister et al., p. 353.

[10] McAllister et al, p. 359.

[11] McAllister et al., pp. 350 and 354.

[12] McAllister et al, p. 482.

[13] McAllister et al, p. 483.

[14] McAllister et al, p. 483.

[15] McAllister et al, p. 482.

and direction) and temperatures in the five beams framing into the girder on the east side at this stage of the analysis?

This inquiry is made for a scholarly purpose; it is not for any commercial use. Thank you for your consideration; I look forward to your response.

Sincerely

Ronald H. Brookman, SE