

Awarded Contracts for External Experts to Support the NIST World Trade Center (WTC) Disaster Investigation

Contract No.	Awarded to	Date Awarded
SB1341-03-W-0716 (Area 4)	Teng & Associates, Inc.	7/3/2003

OUTSIDE EXPERTS FOR BASELINE STRUCTURAL PERFORMANCE, IMPACT ANALYSIS, STRUCTURAL RESPONSE TO FIRE, COLLAPSE, ETC.

Under solicitation number SB1341-03-Q-0322, firm fixed-price purchase orders have been awarded to experts in five technical areas for their experience and judgment at the most senior professional level to provide expert technical assistance as follows:

Area 4: Structural System Failure and Collapse Sequences

A purchase order for Area 4 has been awarded to Teng & Associates in Chicago, Illinois to provide technical expertise and assistance for analysis of structural systems, failure, and collapse sequences of WTC 1, 2, and 7. Structural system analysis includes the design, analysis, and behavior of high-rise steel buildings, lateral (wind) and gravity systems, connection design, structural redundancy, and load redistribution. Structural collapse analysis includes failure behavior and characterization of structural systems under extreme loads, finite element modeling of member and system failure, local and global instability, large deflections, yielding, fracture, and creep. The specific tasks the experts will perform include:

- Provide expert technical assistance in finite element and analytical modeling of member failure sequences leading to collapse initiation, appropriate constitutive models for members experiencing thermally-induced capacity reduction and/or increased loads from load redistribution, and failure criteria for members and system failure.
- Conduct in-depth, review and critique of the work done on the collapse analysis of the WTC towers. The review shall include: a) appropriateness of the models for their intended uses, including modeling assumptions, level of detail, model geometry and material properties, and verification and validation procedures; and b) appropriateness of the analyses and accuracy of results.

The team from Teng & Associates consists of a Principal Structural Consultant and two licensed structural engineers (SE) with relevant backgrounds and appropriate knowledge in structural design and analysis of steel high-rise buildings and the behavior and characterization of structural system failure:

- Dr. Shankar Nair, Senior Vice President of Teng & Associates, is the Principal Structural Consultant. Dr. Nair is a licensed structural engineer with a doctorate in civil engineering and over 33 years of experience in the design and analysis of high-rise building structures. He has developed many of the structural designs of Chicago's tall buildings of 30 to 70 stories. Dr. Nair has published numerous technical papers on tall building design, advanced structural analysis methods, and global structural stability theory and analysis. The quality of engineering in Dr. Nair's work has been recognized by awards from the American Institute of Steel Construction, the American Consulting Engineers Council, and twelve awards from the Structural Engineers Association of Illinois, including six of the annual Most Innovative Structure awards. He served as the chairman of the Council on Tall Buildings and Urban Habitat from 1997 to 2001.

- Mr. Miroslav Sulc is a licensed structural engineer with a master's degree in architectural and structural engineering and over 30 years of experience in project management, structural design and analysis, and review of working and shop drawings. Mr. Sulc has a broad range of experience of building types and construction, with a specialization in wind analysis, shear walls, and foundation design.
- Dr. Todd Ude is a licensed structural engineer with a doctorate in civil engineering and experience in structural reliability, extreme loads and dynamic response analysis. His experience includes detailed nonlinear analyses of an existing steel bridge structure that consider yielding, fatigue, and fracture failure modes.