

*FREEDOM  
Tower*

**Gus Sirakis**

**From:** Bhol, Saroj [sbhol@panynj.gov]  
**Sent:** Thursday, August 02, 2007 3:28 PM  
**To:** Gus Sirakis  
**Cc:** Fatma Amer; Dan Eschenasy  
**Subject:** FW: Freedom Tower - 97 ksi Reinforcing steel

Gus,  
As discussed yesterday, Port Authority has decided not to allow the use of 97 ksi reinforcing bars in the shear walls in WTC 1(Freedom Tower).

Thanks for your help.  
Saroj

-----Original Message-----

**From:** Gus Sirakis [mailto:ConstadinoS@bb.nyc.gov]  
**Sent:** Tuesday, July 24, 2007 9:50 PM  
**To:** Bhol, Saroj  
**Cc:** Fatma Amer; Dan Eschenasy  
**Subject:** FW: Freedom Tower 97 ksi Steel Reinforcing  
**Sensitivity:** Confidential

Saroj, Please see the e-mail below of the Department's findings regarding the test reports submitted for the use of 97 ksi reinforcing bars in the Freedom Tower. Feel free to contact the Department if you have any questions.  
Regards,

**Constadino "Gus" Sirakis PE, SECB**

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**From:** Gus Sirakis  
**Sent:** Tue 7/24/2007 5:45 PM  
**To:** Fatma Amer; Dan Eschenasy  
**Subject:** Freedom Tower 97 ksi Steel Reinforcing

Fatma,  
Based on the revised report on the 97 ksi reinforcing bars for use in the Freedom Tower by Constructed Facilities Laboratory (CFL) titled "Bond tests of high strength threaded bars" prepared for SAS Stressteel (Technical Report IS-06-16, rev. May 2007), the Department has the following findings:

5 out of 16 (31%) of the splice test specimens failed to meet the ICC AC-237 "Acceptance Criteria for Threaded High-Strength Steel Bars for Concrete Reinforcing" bond strength criteria (AC 237 dated October 2006, effective January 1, 2007).

3 out of 4 (75%) of the No. 20 bar with 6,000 psi concrete splice test specimens failed the AC-237 bond strength criteria.

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2 out of 4 (50%) of the No. 9 bar with 6,000 psi concrete splice test specimens failed AC-237 bond strength criteria.

The specified concrete strength for the 12,000 psi specimens was not attained in any of the tests

The concrete strength for the 12,000 psi specimens varied from as low as 9,400 psi to 11,300 psi  
the mean measured concrete strength was 10,215 psi, 85% of what was required.

Based on the concrete strength variations and the actual cover provided to the reinforcing versus the "design" cover, the ACI required splice length would have varied up to 25% from what was provided.

The ACI 318 requirement to use a factor of 1.3 for "Class-B" splices was neglected in the splice tests.  
The testing requirements of AC-237 vary from ASTM A 944 for the beam-end testing:

Bar size: ASTM limits bars to sizes from No. 3 thru No. 11; the tests performed by CFL used No. 14 and No. 20 bars

Concrete strength: ASTM requires the concrete strength to be between 4,500 psi and 5,500 psi, CFL performed tests on specimens with concrete strengths of 6,000 psi and 12,000 psi

Thank you,

**Constadino "Gus" Sirakis PE, SECB**

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