2.6 Inadequate Mix Design

Description: Inadequate mix-design of concrete constituents such as cement, admixtures and aggregates can result in reduced concrete physical properties, i.e., strength and modulus of elasticity. The reduced physical properties could contribute to stress induced cracking.

Data to be collected and Analyzed:

1. Original mix designs by Law Engineering (FM 2.6 Exhibit 1)
2. Concrete pour reports (Representative sample of pour records are included in FM 2.6 Exhibit 2)
3. Original concrete test reports. (FM 2.6 Exhibit 3)
4. Petrographic examination of core samples performed by Erlin Hime, CTL, and MACTEC (FM 2.6 Exhibits 4a, 4b, and 4c)
5. Strength testing and modulus of elasticity testing of core samples by S&ME. (Selected sample of cores, FM 2.6 Exhibit 5)

Verified Supporting Evidence: None

Verified Refuting Evidence:

a. Compressive strength tests from original construction testing and from cores taken from subject concrete verify compressive strength exceeded the 5000 psi specification. (FM 2.6 Exhibits 3 and 5)
b. Modulus of elasticity testing yielded results ranging from 2.70x10E6 psi to 3.90x10E6 psi with an average of 3.23x10E6 psi. This is lower than the ACI calculated values of 4.20x10E6 to 4.48x10E6 psi, but greater than the 2.5x10E6 psi used in the design. (FM 2.6 Exhibit 5)
c. The original mix design called for 635 lbs cement, 1800 lbs CA and 1140 lbs FA (per cubic yard). This was later modified to 682, 1800 and 1100 lbs respectively. Daily pour records verify that the concrete batched complied with the mix designs. (FM 2.6 Exhibits 1 and 2)
d. The Petrographic evaluation by Erlin & Hime, CTL and MACTEC found well consolidated concrete with coarse aggregate making up about 50% of the total aggregate. Aggregate to paste bond was tight.There was no evidence of any deleterious chemical reactions involving the cement paste and/or aggregates. The concrete is considered to be in good condition. (FM 2.6 Exhibits 4a, 4b, and 4c)

Conclusion:

There is no evidence of inadequate mix design or batching during construction.

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