March 22, 2009

Alex Chu
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University City, MO 63130

Dr. Tom Harmon
Concrete Laboratory Supervisor
Washington University in St. Louis
Campus Box 1185

Dear Dr. Harmon,

Fatigue is the progressive damage imposed upon a specimen subjected to cyclic loading. In order to determine the number of cycles a specimen can endure, the maximum applied stress must be less than the specimen's Ultimate Tensile Stress (UTS). If the maximum applied stress is greater than or equal to the UTS, the specimen will fail immediately. Therefore, one must first determine a specimen's UTS so that the appropriate maximum applied stress can be determined for the fatigue testing of another identical specimen.

This entire procedure can actually be accomplished in your Concrete Laboratory at Washington University in St. Louis. I know that you are currently researching the mechanical effects of inserting various carbon fiber reinforcement grids into concrete panels, so I feel that you should implement a fatigue analysis into your research agenda.

The intended objectives of such an agenda would be to:

1. Obtain average UTS values for each type of carbon fiber reinforced concrete specimen

2. Use those average UTS values to determine the appropriate magnitudes of the maximum stresses to be applied during fatigue testing

3. Perform fatigue tests at a range of different maximum applied stress values (such as 70%, 80%, and 90% of the UTS) for each type of carbon fiber reinforced concrete specimen

4. Determine a relationship between the maximum applied stress and the fatigue life (number of cycles required for rupture/failure) for each type of specimen

5. Use this experimental relationship/model to predict the fatigue life of a given type of specimen at *any* maximum applied stress value

6. Use data obtained from each type of carbon fiber reinforced concrete specimen to determine which type of carbon fiber reinforcement best sustains fatigue loading

Because the fatigue testing of carbon fiber reinforced concrete is not a well known procedure, it will be difficult to compare our results to those published in literature. However, I see this is as a perfect opportunity to utilize our resources and thoroughly investigate an unexplored topic.

Another advantage of this proposal is that we can presumably complete our investigation in a relatively short amount of time. By the end of this semester, we can feasibly accomplish our goals according to the following agenda:

Time Period	Tasks
3/23 – 3/29	Recruit other civil engineering students to help with fatigue testing. Perform monotonic tests to obtain Ultimate Tensile Stress values.
3/30	Submit short Status Report outlining UTS data.
4/1	Determine maximum applied stress values from UTS data.
4/2 – 4/5	Begin fatigue testing (presumably two or three specimen per day).
4/6 – 4/12	Continue fatigue testing. Compile/organize fatigue test data for analysis. Submit 1st draft of research report (with incomplete data).
4/13 – 4/19	Finish fatigue testing. Finish analysis of fatigue testing data. Discuss the validity and accuracy of the results. Submit 2nd draft of research report (with complete data and analysis).
4/20	Submit final research report. Give research presentation to Technical Writing classmates.

The completion of this investigation will undeniably result in a detailed understanding of the fatigue behavior of different carbon fiber reinforced concrete specimens. Therefore, the data from this experiment will enable us to accurately predict the behavior of real-world concrete structures subjected to similar loading conditions. Ideally, we will be able to precisely identify which type of carbon fiber reinforcement would adequately strengthen a given concrete structure. Due to the innumerable real-world applications of this research, I strongly urge you consider the benefits of such an endeavor.

Sincerely,

Alex Y. Chu