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Inspections Division
Approved with Conditions
Date: 11/12/14

W.S. Langley
Concrete & Materials Technology Inc.

Project No. 13965

December 5, 2013

Mr. Craig Turcotte
S.W. Cole Engineering
286 Portland Road
Gray, ME 04039-9586
USA

Dear Mr. Turcotte:

Re: 660 Congress Street, Portland, Maine

We are in receipt of a sample of mortar which based on its composition is believed to be a historic mortar of the late 1800's. The strength, color and mineralogy tend to indicate that it had a high content of hydrated lime, but also possessed hydraulicity afforded by portland cement.

The mortar samples received from S.W. Cole were too small for a comprehensive analysis, thus, only wet chemistry and optical microscopy was performed on the "grey" non-colored sample. The preliminary analysis was performed by microscopy to determine the mineralogy of sand component and approximate quantity of cementitious materials prior to formulating a test procedure.

The wet chemical analysis of the soluble mortar fraction determines the oxides of the cementitious components and the sand. Insoluble components in the mortar sample analyzed consists principally of high quality natural quartz sand. The main oxides used to compute the cementitious fraction are the oxides of SiO_2, Al_2O_3, CaO and MgO. Through a series of iterations, it is possible to arrive at an approximation only, of the cementitious materials, in this case portland cement and hydrated lime. It is assumed that all the CaO present is combined in the cementitious material. Based on the microscopic examination, there are no calcareous aggregate in the mortar.

The analysis assumes the absence of natural pozzolans, fly ash or slag. This, I believe, is a reasonable assumption if my assumption is correct on the age of the structure (mortar). A significant component of historic mortars is calcium carbonate, formed by atmospheric carbonation of the hydrated lime and to a lesser extent the calcium silicate

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hydrate of the portland cement. This can skew the results, based on chemical analysis only.

The strength of the mortar was assessed to be in the 200 to 400 psi range based on the physical effort to breakup and powder the sample.

The approximate percentages of portland cement and hydrated lime is in the range of 40 percent cement to 60 percent lime (carbonated). The cementitious materials (cement plus lime) are approximately 1 part cementitious to 3.5 parts sand by mass.

The analyzed sample did not contain any pigment. If pigmented mortar is desired, the above mortar proportions can be colored with two to four percent inorganic pigment, depending on the intensity of color desired.

We trust the above information is that which you require at this time. If you have any questions please do not hesitate to contact us at your convenience.

Yours very truly,

W.S. LANGLEY CONCRETE & MATERIALS TECHNOLOGY INC.

Wilbert Langley

Dr. Wilbert S. Langley, M.Eng., P.Eng., FACI, FCSCE

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