ADDENDUM NUMBER 2

HOYT PARK SUSPENSION BRIDGE – BRIDGE REHABILITATION
Site # 769
1600' E/O Swan Boulevard
Wauwatosa, WI

Project Number: P289-15609
Notice Number: 7041

Date of Addendum: November 16, 2015

This Addendum to the Contract Documents is issued to modify, explain or correct the original documents, dated October 28, 2015, and is hereby made part of the Contract Documents. Acknowledge receipt of this Addendum in the space provided on the Bid Form, or bid may be rejected.

1. Add Appendix – Custom Mortar Match Report (four page report attached to this addendum)

End Addendum No. 2

HERITAGE GROUP
Chicago

Custom Mortar Matching Report

Project: USHG# 15-092

Analysis Date: 7/16/2015 thru 7/24/2015

Project: Hoyt Park Pedestrian Bridge

Client: William Zippel, Alfred Benesch & Co.

1300 W. Canal Street, Suite 150, Milwaukee, WI 53233

Phone: 414-517-4786

Client Requirements: Match Mortar / Package B

Mortar Dating: 1937

Location/Function in Building: Limestone piers mortar

INTRODUCTION

The findings and recommendations presented in this report are premised on the results of tests performed on a mortar sample delivered to our laboratory on July 15, 2015.

The scope of testing was limited to the determination of the physical mix proportions of the major ingredients used in the mortar sample. The testing included visual examination, both with and without magnification, as well as analysis of the aggregate color, particle shape and grain size distribution.

The sample's physical characteristics, original date of construction, and guidelines from the U.S. Department of the Interior National Park Service were used to determine the proposed mortar component recommendations as well as the aggregate ratios for the replacement mix.

U.S. Heritage Group interpreted and adjusted the proposed mortar formulation recommendation based on the information provided to us regarding: current site conditions; present condition and type of masonry; the function of the new mortar; and the degree of weather exposure. Assuming the sample provided is representative of the original mortar, the analysis and mortar-matching diagnosis detailed in this report here will give a reliable indication of the original ingredients and allow U.S. Heritage Group to recommend a historically correct mortar formulation for your project.

PRELIMINARY TESTING

Sample received consisted of several pieces of cured mortar. Total sample weight was 205 grams. The largest piece of mortar measured $2^1/_2$" x $1^1/_2$" x 1" .

Based on the consistencies in color and texture, it appears that all mortar pieces represent similar material. Direct pressure testing of received sample revealed high compression resistance. This suggests the formulation is based on a hydraulic component.

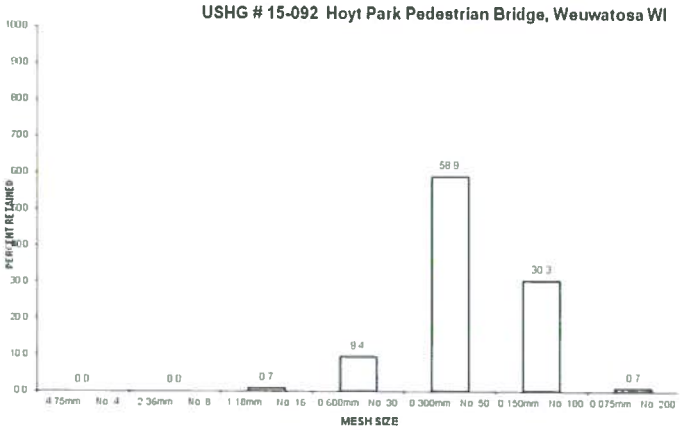
AGGREGATE ANALYSIS

Our laboratory technicians crushed the sample and chemically removed the binder from the aggregate using a dilute acid solution. After drying the aggregate, we viewed it under 40X magnification to determine the characteristics of the particles.

A sieve separation process established the distribution of aggregate particles by a percent of total weight. We prepared a gradation chart to graphically display the color, shape and size of the aggregate particles. This chart can be used to assist in the selection of a new aggregate to match the original material.

The aggregate sieve sizes requisite in ASTM C144 meet ASTM E11 specification requirements. The sand weight retained on each U.S.A. Standard Testing Sieve was as follows:

Testing Sieve Size		% of sand retained
4.75mm,	No. 4	0.0%
2.36mm,	No. 8	0.0%
1.18mm,	No. 16	0.7%
600micro,	No. 30	9.4%
300micro,	No. 50	58.9%
150micro,	No. 100	30.3%
75micro,	No. 200	0.7%
Total sand weight		**100%**



The sand grain distribution chart illustrating the sand isolated from your sample is attached.

The aggregate was well distributed throughout the mess sizes. The material is classified as medium-sized aggregate. The aggregate appears to be sub-angular and sub-round in shape. Under magnification, the majority of the aggregate is transparent white with gray particles scattered throughout the material. The binder is light gray in color.

The aggregate was found to be 42 % of the total weight of the sample; the binder makes up the remaining 58 % of the mix. This mix design would be considered as binder rich formulation. The results of this calculation can be affected by the presence of calcium carbonate (limestone) in the aggregate which would have been dissolved out during the chemical wet process. This factor was considered in the evaluation of the proposed replacement formulation.

SUMMARY OF TEST RESULTS

Direct pressure testing indicated a high compressive strength for the sample mortar. The material reaction noted during the wet chemistry procedures indicates presence of significant amount of hydraulic component in the material (comparable to Type N mortars).

This coupled with the sample's appearance, suggests that it was originally mixed using portland cement, non-hydraulic hydrated lime and sand. Lime inclusions were not detected in the sample. Mortars mixed with lime putty typically leave traces of white lime inclusions – the small particles of un-dissolved lime.

Based on the various tests detailed above, the sample appears to be Type N mix design in ASTM classification.

PROPOSED REPLACEMENT MIX

In light of these findings and the intended use of the replacement material, U.S. Heritage Group recommends specifying a replication mortar formulation consisting of:

1 part portland cement, 1 part hydrated lime and 6 parts sand.

This mix design is specified under the classification "Type N" in ASTM C270. The portland cement should meet ASTM C150; the non-hydraulic hydrated lime should meet Type S in ASTM C207; and the sand should match the original sand as closely as possible in terms of color, size, shape and gradation. The Type N formulation is suggested for its adequate compressive strength and compatibility to existing substrate.

Note: If the masonry substrate is confirmed to be extremely friable, extra soft in compression, or has an elevated rate of absorption calculation - than a more breathable mortar mix design should be specified. Type N mortars are not recommended for soft brick and stone. More information about the masonry substrate is needed in order to specify an alternative mix design if required.

JOBSITE MOCK-UP SAMPLE

The replacement mortar sample should be field-tested through a jobsite mock-up. The mock-up sample should be installed by a qualified craftsperson who understands the curing and application details of traditional mortars. Once the mock-up sample is installed, appropriate precautions should be taken to ensure that the mortar is protected from wind, sun, rain and frost to enable slow curing (i.e. carbonation) to take place.

The sample should be allowed to cure in the wall for a minimum of seven days before final color match is approved. Please see the U.S. Heritage Group guidelines on installation procedures of Type O mortar formulations.

Thank you for seeking our advice and entrusting these important details to U.S. Heritage Group. We are always available to discuss these findings with you in detail. Please contact me directly at 773-286-2100 if you have any questions.

We look forward to providing you with a custom, ready-to-use, historically correct mortar for your project.

Respectfully,
U.S. Heritage Group, Inc.

Tomasz Glab
Laboratory Manager

Note: This information is held in confidence and becomes a permanent record at the U.S. Heritage Group laboratories located at 3516 North Kostner Ave., Chicago, IL 60641. It can be referenced at any time in the future by the property owner named above or by an authorized mason contractor involved with the restoration work. When inquiring about this match please use the project number USHG #15-092.

MIXING BY VOLUME - WARNING

HYDRATED LIME: Hydrated lime measured by volume (using a coffee can from a 50# bag) will experience a volumetric loss of 25% after the addition of water. It is essential to increase the proportion of hydrated lime by 25% to ensure the mix design will meet specification requirements.

SAND: The bulk density of sand can change dramatically depending on the amount of water in the material. The change between dry and damp sand can be as much as 25% to 30% by volume. Sand should always be measured in damp loose condition.
Reference: ASTM C270, Standard Specification for Mortar for Unit Masonry states that the "Aggregate Ratio (Measured in Damp, Loose Conditions)".

PORTLAND CEMENT: There is no volumetric change in the use of portland cement.