# Appendix E

**Material Analysis Reports:**
**Paint Analysis**
**Truman Farm**
Grandview Missouri
Harry S Truman NHS
January 18, 2012

On Thursday, January 13, 2012. David Arbogast, architectural conservator, of Davenport, Iowa, received a set of seven paint samples and five mortar and plaster samples from Elizabeth Hallas, AIA, LEED AP. Senior Associate and Adrienne Antonucci of Anderson Hallas Architects, PC of Golden, Colorado. They are in the process of preparing a Historic Structures Report for the Truman Farm in Grandview, Missouri, which is part of the Harry S Truman National Historic Site. These samples were submitted in an attempt to ascertain historic finishes, mortars, and plasters for the Farm Home and the Garage.

The paint samples were visually examined on Wednesday, January 18, utilizing an optical Olympus microscope having magnification between 14 and 80 power. Each layer observed was color matched to the Munsell System of Color utilizing natural north light. Only opaque, pigmented layers (i.e. paint layers) were matched. It is impossible to color match finishes such as metallic paints and leafs and varnishes because their color is directly affected by their translucency and reflectance.

The Munsell System of Color is a scientific system in which colors have been ranged into a color fan based upon three attributes: hue or color, the chroma or color saturation, and the value or neutral lightness or darkness. Unlike color systems developed by paint manufacturers, the Munsell system provides an unchanging standard of reference which is unaffected by the marketplace and changing tastes in colors.

The hue notation, the color, indicates the relation of the sample to a visually equally spaced scale of 100 hues. There are 10 major hues, five principal and five intermediate within this scale. The hues are identified by initials indicating the central member of the group: red R, yellow-red YR, yellow Y, yellow-green YG, green G, blue-green BG, blue B, purple-blue PB, purple P, and red-purple R. The hues in each group are identified by the numbers 1 to 10. The most purplish of the red hues, 1 on the scale of 100, is designated as 1R, the most yellowish as 10R, and the central hue as 5R. The hue 10R can also be expressed as 10, 5Y as 25, and so forth if a notation of the hue as a number is desired.

Chroma indicates the degree of departure of a given hue from the neutral gray axis of the same value. It is the strength of saturation of color from neutral gray, written /0 to /14 or further for maximum color saturation.

Value, or lightness, makes up the neutral gray axis of the color wheel, ranging from black, number 1, to white at the top of the axis, number 10. A visual value can be approximated by the help of the neutral gray chips of the Rock or Soil Color chart with ten intervals. The color

parameters can be expressed with figures semi-quantitatively as: hue, value/chroma (H, V/C). The color "medium red" should serve as an example for presentation with the three color attributes, 5R 5.5/6. This means that 5R is located in the middle of the red hue, 5.5 is the lightness of Munsell value near the middle between light and dark, and 6 is the degree of the Munsell chroma, or the color saturation, which is about in the middle of the saturation scale.

Five paint samples were submitted in zippered plastic bags and two were in manila envelopes. These were labeled and numbered. The analysis follows the numbering system used in the collection process. The quality of the samples ranged from fair to quite excellent. Because of the exposed nature of many of the samples the paint exhibited weathering and appeared in several cases to be missing older layers seen in other, better samples. The layers are listed from top (most recent) to bottom (oldest). The following results were obtained from the analysis:

| Sample 1 | Munsell |
|---|---|
| Cream | 5Y 8.5/3 |
| White | N 9.5/ |
| White | N 9.5/ |
| Off-white | 5Y 8.5/1 |

The first sample was collected from dining room and contained four layers of paint. The oldest surviving layer of paint was off-white. The small number of layers is a great concern. It is possible that either older layers were removed at some point in time or that the room was rarely painted, which is unlikely.

| Sample 2 | Munsell |
|---|---|
| White | 5Y 9/1 |
| White | N 9.5/ |

The second sample came from the sitting room closet and retained two layers of white paint. Closets are rarely painted. It is possibly, although not very likely, that this closet has only been painted twice in its history.

| Sample 3 | Munsell |
|---|---|
| Off-white | 5Y 9/2 |
| White | N 9.5/ |
| White | N 9.5/ |

The third sample was removed from the north window of Mary Jane Truman's room and revealed three layers of paint. The oldest surviving layer of paint was white. Again, the small number of layers posed a matter of concern.

| Sample 4 | Munsell |
|---|---|
| Off-white | 5Y 8.5/1 |
| White | N 9.5/ |

The fourth sample was from Mary Jane's room closet and had two layers of paint. The oldest surviving layer of paint was white. This sample was very similar to sample 2.

| Sample 5 | Munsell |
|---|---|
| Cream | 2.5Y 8/2 |
| Rose | 2.5YR 6/5 |
| Cream | 2.5Y 9/3 |
| Tan | 2.5Y 6/4 |

The fifth sample was found in Mary Jane's room on the ceiling/wall joint of the attic hatch. It contained four layers of paint. The oldest surviving coat of paint was tan.

| Sample 6 | Munsell |
|---|---|
| Dark green | 5G 3.5/1 |
| Gray-green | 5G 5/1 |
| Dark gray-green | 5G 4/1 |
| Gray-green | 5G 5/1 |
| Dark gray-green | 5G 4/1 |
| Light-blue | 5B 6/2 |
| Charcoal | 5G 2/1 |
| Green | 10GY 5/4 |
| Green | 2.5G 4/4 |
| White | 5Y 9/1 |

The sixth sample was collected from the front door frame and retained ten layers of paint. The oldest surviving layer of paint was white, which given its comparative thickness was most likely a finish coat. The large number of paint layers on this sample relative to the small number of layers found on the previous samples leads one to think that the previous samples were not representative of the entire chronology of finishes on their respective surfaces.

| Sample 7 | Munsell |
|---|---|
| Dark green | 5G 3/2 |
| White | N 9.5/ |
| Dark gray | 10Y 3/1 |
| White | N 9.5/ |
| Light gray | N 7.0/ |
| Gray | N 5.0/ |
| White | N 9.5/ |
| Charcoal | 5Y 3/1 |
| White | N 9.5/ |
| Light gray | 5Y 7/1 |
| White | 5Y 9/1 |

The seventh sample was collected from the pilaster on the west porch and revealed eleven layers of paint. The oldest surviving layer of paint was a thin white coat that most likely

served as a prime coat. The other white layers were also very thin and probably served as prime coats for their succeeding colors. If one takes that into consideration, there appear to have been six finish coats applied to the pilaster.

## Mortar Analysis
## Truman Farm

Grandview Missouri
Harry S Truman NHS
January 18, 2012

As noted in the introduction four mortar samples and one plaster sample were analyzed as part of the fabric analysis for the Truman Farm. The sample sizes were considerably smaller than the standard 20 grams. The samples were analyzed beginning on Monday, January 16, utilizing the standard testing procedure developed by E. Blaine Cliver, Regional Historical Architect of the North Atlantic Region of the National Park Service. This relatively simple procedure dissolves the lime and/or cement content of the mortar using a 20% solution of hydrochloric acid. The carbon dioxide released as a result of the reaction displaces water, which is then measured and used to calculate the soluble content of the mortar. The insoluble fines and sand remaining from the reaction are factored into the equation resulting in a final result. In the case of cement samples, the remaining fines are used to calculate the cement content of the mortar. The remaining sand is then carefully sieved and graded by grain size to provide a means of identification of the various sand types encountered.

The first sample was from the basement mortar of the Farm Home. It was a warm yellow-tan with white specks. It was very soft in consistency. The fast reaction, relatively large water displacement, and rapid filtering time are all indicative of a mixture of lime and sand. It had an approximate ratio of four parts of sand to one part of lime, by volume. There were more fines than sand produced and the sand that remained was extraordinarily fine. In the sand sieve analysis all of the sand passed through all of the sieves except the finest sieve. Almost 95% passed all of the sieves. It appears that the mortar was mixed with local clay and lime without any sand.

The second sample was taken from the basement chimney of the Farm Home. It was gray in color and was soft in its consistency. It's fast and foamy reaction, relatively large water displacement, and rapid filtering time are typical of a lime and sand mortar. It revealed an approximate mixture of nineteen parts of sand to five parts of lime, by volume, or, roughly, four parts of sand to each part of lime. This was similar to the first sample. The sand, however, was not at all similar. It was moderately coarse with exactly 10% passed all of the sieves and 9% trapped in the second-largest sieve.

The third sample was of the exterior southeast corner of the main (west) section of the Farm Home. It was light gray in color and was moderately hard in consistency. It had a fast reaction, moderately large water displacement and rapid filtering time. The analysis revealed an approximate mixture of seven parts of sand to three parts of lime, by volume, if the finest are considered to be dirt associated with the original sand. The sand sieve analysis revealed very fine sand of which all passed the largest sieve and over 46% passed

all of the sieves. Over 30% was trapped in the finest sieve.

The fourth sample was collected from the exterior of the Farm Home under the west porch. It was gray in color and soft in its consistency. It had a quick reaction, relatively small water displacement, and rapid filtering time. It produced a very large amount of fines. It revealed an approximate ratio of seventeen parts of sand to ten parts of lime, by volume, or, roughly, five parts of sand to two parts of lime, if the fines are to be considered to be dirt associated with the sand. The sand sieve analysis revealed fine sand, which passed the largest sieve easily. Almost 30% passed all of the sieves.

The fifth sample was from the garage plaster. Its statistical reliability was somewhat hampered by its small size. The sample consisted of a white skim coat attached to the brown coat. The two coats were separated prior to analysis. A small piece of the skim coat was tested using muriatic acid. Virtually all of it dissolved in the acid, leaving a thin residue of the paint film and small bits of indissoluble white particles. It appears that the skim coat was composed of lime only. The brown coat was light gray in color and soft in consistency. It did not react at all with the acid, indicating that it contained gypsum rather than lime as its binder. The sand sieve analysis produced fine sand, which easily passed the largest sieve. Over 24% passed all of the sieves.

## Mortar/Plaster/Stucco Analysis Test Sheet

Sample No. 1
Building: Farm Home, Truman Farm, Grandview, Missouri, Harry S Truman NHS
Location: Basement mortar
Sample Description: Yellow-tan with white specks, very soft, fast reaction, extremely rapid filtering

Test No. 1 – Soluble Fraction

Data:

| | | | |
|---|---|---|---|
| 1. | 188.9 Container A weight | 8. | No Hair or fiber type |
| 2. | 199.5 Container A and sample | 9. | 7.0 Fines and paper weight |
| 3. | 756.16 Barometric pressure | 10. | 2.7 Filter paper weight |
| 4. | 20 Temperature | 11. | 192.7 Sand and Container A weight |
| 5. | 0.37 Liters of water displaced | 12. | 2.6 cc. of sand |
| 6. | clear Filtrate color | 13. | 23.0 Weight of graduated cylinder and sand |
| 7. | warm tan Fines color | 14. | 19.2 Weight of graduated cylinder |

Computations:

15. 10.6 Starting weight of sample: No. 2 – No. 1
16. 4.3 Weight of fines: No. 9 – No. 10
17. 3.8 Weight of sand: No. 11 – No. 1
18. .68421 Sand density: No. 12 divided by (No. 13 – No. 14)
19. 2.5 Weight of soluble content: No. 15 – (No. 16 + No. 17)
20. .0152697 Mols. Of $CO_2$: No. 5 x No. 3. x 0.016 divided by (No. 4 + 273.16 C.)
21. 1 53 Gram weight of $CaCO_3$: 100 x No. 20
22. 0.97 Gram weight of $Ca(OH)_2$: No. 19 – No. 21

23. .013149 Mols. of Ca(OH)2: No. 22 divided by 74
24. 2.10 Gram total weight of Ca(OH)2: 74 x (No. 20 + No. 23)
25. 0.67 Gram weight CO2: No. 20 x 44
26. 1.25 Gram weight total possible CO2: 44 x (No. 20 + No. 23)
27. 53.6% %CO2 gain: No. 25 divided by No. 26

Conclusions:

| | | |
|---|---|---|
| 28. 9.93 | Gram weight of sample: | No. 15 – No. 25 |
| 29. 43.30 | Fine parts/volume: | No. 16 divided by No. 28 |
| 30. 38.27 | Sand parts/volume: | (No. 17 divided by No. 28) x No. 18 |
| 31. 20.05 | Lime parts/volume: | (No. 24 divided by No. 28) x 1.1 |

Cement (if present)

| | | |
|---|---|---|
| 32. | Portland cement parts/volume: | (No. 16 divided by No. 28) x 0.78 |
| 33. | Natural cement parts/volume: | (No. 16 divided by No. 28) x 0.86 |
| 34. | Lime with cement parts/volume: | (No. 16 x 0.2) divided by No. 28 x 1.1 |

Test No. 2 – Sand Sieve Analysis

| Sieve | Sieve w/ sand weight | Sieve weight | Sand weight | Sand ratio |
|---|---|---|---|---|
| No. 10 | 106.8 | 106.8 | 0.0 | 0.00 |
| No. 20 | 106.4 | 106.4 | 0.0 | 0.00 |
| No. 30 | 99.3 | 99.3 | 0.0 | 0.00 |
| No. 40 | 100.8 | 100.8 | 0.0 | 0.00 |
| No. 50 | 93.4 | 93.2 | 0.2 | 5.41 |
| Base | 74.6 | 71.1 | 3.5 | 94.59 |

## Mortar/Plaster/Stucco Analysis Test Sheet

Sample No. 2
Building: Farm Home, Truman Farm, Grandview, Missouri, Harry S Truman NHS
Location: Basement chimney
Sample Description: Gray, very soft, fast and foamy reaction, extremely rapid filtering

Test No. 1 – Soluble Fraction

Data:

| | | | |
|---|---|---|---|
| 1. 185.1 | Container A weight | 8. No | Hair or fiber type |
| 2. 199.1 | Container A and sample | 9. 3.3 | Fines and paper weight |
| 3. 756.16 | Barometric pressure | 10. 2.7 | Filter paper weight |
| 4. 20 | Temperature | 11. 196.4 | Sand and Container A weight |
| 5. 0.39 | Liters of water displaced | 12. 6.7 | cc. of sand |
| 6. clear | Filtrate color | 13. 30.5 | Weight of graduated cylinder and sand |
| 7. gray | Fines color | 14. 19.2 | Weight of graduated cylinder |

Computations:
15. 14.0 Starting weight of sample: No. 2 – No. 1

16. 0.6 Weight of fines: No. 9 – No. 10
17. 11.3 Weight of sand: No. 11 – No. 1
18. .59292 Sand density: No. 12 divided by (No. 13 – No. 14)
19. 2.1 Weight of soluble content: No. 15 – (No. 16 + No. 17)
20. .016095 Mols. Of $CO_2$: No. 5 x No. 3. x 0.016 divided by (No. 4 + 273.16 C.)
21. 1.61 Gram weight of $CaCO_3$: 100 x No. 20
22. 0.49 Gram weight of $Ca(OH)_2$: No. 19 – No. 21
23. .0066283 Mols. of $Ca(OH)_2$: No. 22 divided by 74
24. 1.75 Gram total weight of $Ca(OH)_2$: 74 x (No. 20 + No. 23)
25. 0.71 Gram weight $CO_2$: No. 20 x 44
26. 1.04 Gram weight total possible $CO_2$: 44 x (No. 20 + No. 23)
27. 68.27 %$CO_2$ gain: No. 25 divided by No. 26

Conclusions:

| | | |
|---|---|---|
| 28. 13.29 | Gram weight of sample: | No. 15 – No. 25 |
| 29. 4.51 | Fine parts/volume: | No. 16 divided by No. 28 |
| 30. 50.41 | Sand parts/volume: | (No. 17 divided by No. 28) x No. 18 |
| 31. 14.48 | Lime parts/volume: | (No. 24 divided by No. 28) x 1.1 |

Cement (if present)

| | | |
|---|---|---|
| 32. | Portland cement parts/volume: | (No. 16 divided by No. 28) x 0.78 |
| 33. | Natural cement parts/volume: | (No. 16 divided by No. 28) x 0.86 |
| 34. | Lime with cement parts/volume: | (No. 16 x 0.2) divided by No. 28 x 1.1 |

Test No. 2 – Sand Sieve Analysis

| Sieve | Sieve w/ sand weight | Sieve weight | Sand weight | Sand ratio |
|---|---|---|---|---|
| No. 10 | 106.8 | 106.8 | 0.0 | 0.00 |
| No. 20 | 107.4 | 106.4 | 1.0 | 9.09 |
| No. 30 | 102.0 | 99.3 | 2.7 | 24.55 |
| No. 40 | 105.0 | 100.8 | 4.2 | 38.18 |
| No. 50 | 95.2 | 93.2 | 2.0 | 18.18 |
| Base | 72.3 | 71.2 | 1.1 | 10.00 |

## Mortar/Plaster/Stucco Analysis Test Sheet

Sample No. 3
Building: Farm Home, Truman Farm, Grandview, Missouri, Harry S Truman NHS
Location: Exterior southeast corner of Main (west) Section
Sample Description: Light gray, moderately hard, fast reaction, rapid filtering

Test No. 1 – Soluble Fraction

Data:

| | |
|---|---|
| 1. 187.8 Container A weight | 8. No Hair or fiber type |
| 2. 195.6 Container A and sample | 9. 3.3 Fines and paper weight |
| 3. 756.16 Barometric pressure | 10. 2.7 Filter paper weight |
| 4. 20 Temperature | 11. 193.1 Sand and Container A weight |
| 5. 0.28 Liters of water displaced | 12. 3.5 cc. of sand |

6. Pale yel-grn Filtrate color
7. gray-tan Fines color
13. 24.5 Weight of graduated cylinder and sand
14. 19.2 Weight of graduated cylinder

Computations:
15. 7.8 Starting weight of sample: No. 2 – No. 1
16. 0.6 Weight of fines: No. 9 – No. 10
17. 5.3 Weight of sand: No. 11 – No. 1
18. .66 Sand density: No. 12 divided by (No. 13 – No. 14)
19. 1.9 Weight of soluble content: No. 15 – (No. 16 + No. 17)
20. .00115554 Mols. Of $CO_2$: No. 5 x No. 3. x 0.016 divided by (No. 4 + 273.16 C.)
21. 1.15 Gram weight of $CaCO_3$: 100 x No. 20
22. 0.75 Gram weight of $Ca(OH)_2$: No. 19 – No. 21
23. .01 Mols. of $Ca(OH)_2$: No. 22 divided by 74
24. 1.60 Gram total weight of $Ca(OH)_2$: 74 x (No. 20 + No. 23)
25. 0.51 Gram weight $CO_2$: No. 20 x 44
26. 0.95 Gram weight total possible $CO_2$: 44 x (No. 20 + No. 23)
27. 53.68 %$CO_2$ gain: No. 25 divided by No. 26

Conclusions:

| | | |
|---|---|---|
| 28. 7.29 | Gram weight of sample: | No. 15 – No. 25 |
| 29. 8.23 | Fine parts/volume: | No. 16 divided by No. 28 |
| 30. 47.98 | Sand parts/volume: | (No. 17 divided by No. 28) x No. 18 |
| 31. 24.14 | Lime parts/volume: | (No. 24 divided by No. 28) x 1.1 |

Cement (if present)

| | | |
|---|---|---|
| 32. | Portland cement parts/volume: | (No. 16 divided by No. 28) x 0.78 |
| 33. | Natural cement parts/volume: | (No. 16 divided by No. 28) x 0.86 |
| 34. | Lime with cement parts/volume: | (No. 16 x 0.2) divided by No. 28 x 1.1 |

Test No. 2 – Sand Sieve Analysis

| Sieve | Sieve w/ sand weight | Sieve weight | Sand weight | Sand ratio |
|---|---|---|---|---|
| No. 10 | 106.8 | 106.8 | 0.0 | 0.00 |
| No. 20 | 106.5 | 106.4 | 0.1 | 1.92 |
| No. 30 | 99.6 | 99.3 | 0.3 | 5.77 |
| No. 40 | 101.6 | 100.8 | 0.8 | 15.38 |
| No. 50 | 94.8 | 93.2 | 1.6 | 30.77 |
| Base | 73.5 | 71.1 | 2.4 | 46.15 |

## Mortar/Plaster/Stucco Analysis Test Sheet

Sample No. 4
Building: Farm Home, Truman Farm, Grandview, Missouri, Harry S Truman NHS
Location: Exterior under west porch
Sample Description: Gray, moderately soft, quick reaction, rapid filtering

Test No. 1 – Soluble Fraction

Data:

| | | | |
|---|---|---|---|
| 1. | 192.0 Container A weight | 8. No | Hair or fiber type |
| 2. | 201.4 Container A and sample | 9. 4.2 | Fines and paper weight |
| 3. | 756.16 Barometric pressure | 10. 2.7 | Filter paper weight |
| 4. | 20 Temperature | 11. 197.0 | Sand and Container A weight |
| 5. | 0.21 Liters of water displaced | 12. 3.5 | cc. of sand |
| 6. | Pale yel-grn Filtrate color | 13. 24.2 | Weight of graduated cylinder and sand |
| 7. | gray-tan Fines color | 14. 19.2 | Weight of graduated cylinder |

Computations:

| | | |
|---|---|---|
| 15. | 9.4 | Starting weight of sample: No. 2 – No. 1 |
| 16. | 1.5 | Weight of fines: No. 9 – No. 10 |
| 17. | 5.0 | Weight of sand: No. 11 – No. 1 |
| 18. | .70 | Sand density: No. 12 divided by (No. 13 – No. 14) |
| 19. | 2.9 | Weight of soluble content: No. 15 – (No. 16 + No. 17) |
| 20. | 0.0086665 | Mols. Of $CO_2$: No. 5 x No. 3. x 0.016 divided by (No. 4 + 273.16 C.) |
| 21. | 0.87 | Gram weight of $CaCO_3$: 100 x No. 20 |
| 22. | 2.03 | Gram weight of $Ca(OH)_2$: No. 19 – No. 21 |
| 23. | 0.0274324 | Mols. of $Ca(OH)_2$: No. 22 divided by 74 |
| 24. | 2.67 | Gram total weight of $Ca(OH)_2$: 74 x (No. 20 + No. 23) |
| 25. | 0.38 | Gram weight $CO_2$: No. 20 x 44 |
| 26. | 1.59 | Gram weight total possible $CO_2$: 44 x (No. 20 + No. 23) |
| 27. | 23.90 | %$CO_2$ gain: No. 25 divided by No. 26 |

Conclusions:

| | | | |
|---|---|---|---|
| 28. | 9.02 | Gram weight of sample: | No. 15 – No. 25 |
| 29. | 16.30 | Fine parts/volume: | No. 16 divided by No. 28 |
| 30. | 38.80 | Sand parts/volume: | (No. 17 divided by No. 28) x No. 18 |
| 31. | 32.56 | Lime parts/volume: | (No. 24 divided by No. 28) x 1.1 |

Cement (if present)

| | | |
|---|---|---|
| 32. | Portland cement parts/volume: | (No. 16 divided by No. 28) x 0.78 |
| 33. | Natural cement parts/volume: | (No. 16 divided by No. 28) x 0.86 |
| 34. | Lime with cement parts/volume: | (No. 16 x 0.2) divided by No. 28 x 1.1 |

Test No. 2 – Sand Sieve Analysis

| Sieve | Sieve w/ sand weight | Sieve weight | Sand weight | Sand ratio |
|---|---|---|---|---|
| No. 10 | 106.8 | 106.8 | 0.0 | 0.00 |
| No. 20 | 107.0 | 106.4 | 0.6 | 11.76 |
| No. 30 | 100.4 | 99.3 | 1.1 | 21.57 |
| No. 40 | 101.9 | 100.8 | 1.1 | 21.57 |
| No. 50 | 94.0 | 93.2 | 0.8 | 15.69 |
| Base | 72.6 | 71.1 | 1.5 | 29.41 |

## Mortar/Plaster/Stucco Analysis Test Sheet

Sample No. 5
Building: Garage, Truman Farm, Grandview, Missouri, Harry S Truman NHS
Location: Plaster (brown coat only)
Sample Description: Light gray, soft, no reaction, extremely rapid filtering

Test No. 1 – Soluble Fraction

Data:

| | | | |
|---|---|---|---|
| 1. | 173.9 | Container A weight | |
| 2. | 179.9 | Container A and sample | |
| 3. | 756.16 | Barometric pressure | |
| 4. | 20 | Temperature | |
| 5. | 0.00 | Liters of water displaced | |
| 6. | clear | Filtrate color | |
| 7. | tan | Fines color | |
| 8. | Yes | Hair or fiber | hair type |
| 9. | 3.0 | Fines and paper weight | |
| 10. | 2.7 | Filter paper weight | |
| 11. | 177.9 | Sand and Container A weight | |
| 12. | 2.6 | | cc. of sand |
| 13. | 23.2 | Weight of graduated cylinder and sand | |
| 14. | 19.2 | Weight of graduated cylinder | |

Computations:

| | | |
|---|---|---|
| 15. | 6.0 | Starting weight of sample: No. 2 – No. 1 |
| 16. | 0.3 | Weight of fines: No. 9 – No. 10 |
| 17. | 4.0 | Weight of sand: No. 11 – No. 1 |
| 18. | .65 | Sand density: No. 12 divided by (No. 13 – No. 14) |
| 19. | 1.7 | Weight of soluble content: No. 15 – (No. 16 + No. 17) |
| 20. | 0.00 | Mols. Of $CO_2$: No. 5 x No. 3. x 0.016 divided by (No. 4 + 273.16 C.) |
| 21. | 0.00 | Gram weight of $CaCO_3$: 100 x No. 20 |
| 22. | 1.7 | Gram weight of $Ca(OH)_2$: No. 19 – No. 21 |
| 23. | .0229729 | Mols. of $Ca(OH)_2$: No. 22 divided by 74 |
| 24. | 1.7 | Gram total weight of $Ca(OH)_2$: 74 x (No. 20 + No. 23) |
| 25. | 0.00 | Gram weight $CO_2$: No. 20 x 44 |
| 26. | 1.01 | Gram weight total possible $CO_2$: 44 x (No. 20 + No. 23) |
| 27. | -------- | $\%CO_2$ gain: No. 25 divided by No. 26 |

Conclusions:

| | | | |
|---|---|---|---|
| 28. | 4.99 | Gram weight of sample: | No. 15 – No. 25 |
| 29. | 6.01 | Fine parts/volume: | No. 16 divided by No. 28 |
| 30. | 80.16 | Sand parts/volume: | (No. 17 divided by No. 28) x No. 18 |
| 31. | | Lime parts/volume: | (No. 24 divided by No. 28) x 1.1 |

Cement (if present)

| | | |
|---|---|---|
| 32. | Portland cement parts/volume: | (No. 16 divided by No. 28) x 0.78 |
| 33. | Natural cement parts/volume: | (No. 16 divided by No. 28) x 0.86 |
| 34. | Lime with cement parts/volume: | (No. 16 x 0.2) divided by No. 28 x 1.1 |

Test No. 2 – Sand Sieve Analysis

| Sieve | Sieve w/ sand weight | Sieve weight | Sand weight | Sand ratio |
|---|---|---|---|---|
| No. 10 | 106.8 | 106.8 | 0.0 | 0.00 |
| No. 20 | 106.6 | 106.4 | 0.2 | 4.88 |
| No. 30 | 99.9 | 99.3 | 0.6 | 14.63 |
| No. 40 | 102.0 | 100.8 | 1.2 | 29.27 |
| No. 50 | 94.3 | 93.2 | 1.1 | 26.83 |
| Base | 72.1 | 71.1 | 1.0 | 24.39 |

**Material Analysis Reports:**
**Wood Analysis**

**From:** Clyde Arnette [mailto:carnette@edmlink.com]
**Sent:** Wednesday, December 14, 2011 4:33 PM
**To:** Elizabeth Hallas
**Subject:** RE: Truman farm wood flooring sample

I received the sample(s) today. They are yellow pine. Several characteristics strongly suggest Southern yellow pine rather than Western. As Bruce Hoadley points out in his book, "Even with a microscope, there are no features that consistently and absolutely separate the Southern and Western yellow pines." However, this sample shows features that are more common in the Southern group.

Clyde G. Arnette, Jr., Wood Technologist
EDM International, Inc.