

## **KLINGSTONE 400 GRAVEL TRAIL**

May 2004 Installation

By J. M. Walters, Project Engineer

**LOCATION:** Booker T. Washington National Monument in Franklin County, Virginia.

**CONTRACTOR:** Firvida Construction Company of Fairfax, Virginia.

**MANUFACTURER:** Klingstone Inc. of Waynesville, NC. (800) 942-5151.

### **MATERIALS:**

The gravel was supplied by West Sand & Gravel, Highway 340, Grottoes, Virginia.

The polymeric MDI-based polyurethane binder (Klingstone 400) was supplied by Klingstone Inc., (formerly Green Mountain International, Inc.).

Klingstone 400 is a one component, hydrophobic polyurethane, liquid material designed to solidify aggregates and provide a durable, aesthetically pleasing, handicap accessible walkway for pedestrians and small vehicles that can be open to traffic in 24 hours. The product can easily be repaired if the need arises. Light in color, the natural aggregate shows through.

**BID PRICE:** \$58 per square yard for 100 square yards.

**EXECUTION OF WORK:** After removing the existing asphalt trail and compacting the existing base stone, test areas were constructed at the end of the trail. The third test panel gave the desired finished appearance and was approved for use by the National Park Service. The contractor placed the 108 square yards of new picnic trail in two days with a three-man crew.

The final product was well received by the Park and by the general public. According to Park personnel they have received many compliments and inquiries about the walkway.

**SUGGESTIONS:** From past experience by the Park staff, it was known that the manufacturer- recommended binder / aggregate mix proportions did not result in an acceptable finished product. Before beginning any production work, mix and place one test panel at a time until a suitable mix is achieved, then use that design in production. Aggregate moisture, temperature, placement conditions, and the time of year can all affect the mix design. The final mix design used was 90 ounces of binder per one 5-gallon bucket of gravel mixed in a portable mortar mixer.

### **POTENTIAL PROBLEMS:**

The binder hardens on tools in a short time. Once hardened, it had to be chipped or scraped off. To alleviate hardening, PAM cooking spray was used on all tools prior to and during the placement process.

While this did not completely stop the hardening, it was effective in helping clean the tools after use.

**CONTACT:** Ken Arrington is the National Park Service Facility Manager at Booker T. Washington National Monument and he welcomes any calls concerning its use. Phone: (540)-721-2094.

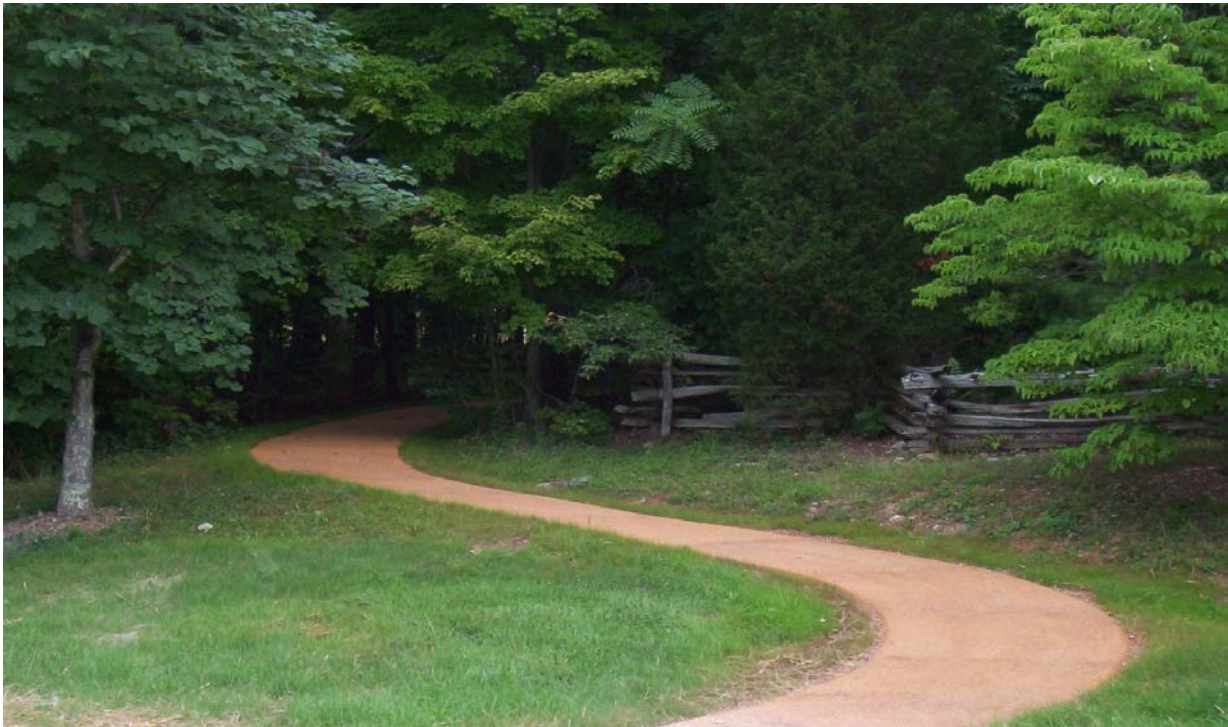
Additional information on Klingstone 400, including pictures of its use by the NPS at Booker T. Washington National Monument, can be viewed at:

<http://www.klingstone.com/Trails/booker.html>

**PROJECT PHOTOS**



**OLD TRAIL REMOVED**



**COMPLETED TRAIL**



COMPLETED TRAIL

## APPENDIX

### SPECIAL CONTRACT REQUIREMENTS to FP-96

#### Section 615.--SIDEWALKS, DRIVE PADS, AND PAVED MEDIANS

615.01. Add the following:

Sidewalks may also be designated as gravel.

615.02. Add the following:

Gravel	703.06
Polymeric MDI-based polyurethane binder	725.29

615.03. Add the following:

**Picnic Trail.** Perform removal of existing asphalt sidewalk and base material under Section 203. If necessary, add suitable base material prior to compaction efforts. Compact base with at least three passes of a lightweight mechanical tamper, roller, or vibratory system.

Provide gravel that is similar in appearance to existing park trails consisting primarily of browns and only a few grays. The gravel is to be crushed so as to not have all smooth faces. Recent projects in the park utilized gravel from West Sand and Gravel, on Highway 340 in Grottoes, VA. This source or an approved equal may be used.

In mixer combine gravel and binder at a rate of 1 gallon of binder per 400 pounds of gravel and mix until thoroughly saturated. Spread saturated gravel on trail section at a depth of approximately 3 inches. Use a roller to achieve a compacted thickness of 2 to 2 ½ inches.

During the curing process, cover the application area to protect from ultraviolet light. If rain is expected, or the overnight temperatures fall below 50°F, the treated area should be covered with a plastic tarp.

Do not allow traffic on the curing sidewalk for at least 48 hours (longer in cool or dry conditions).

#### Section 703.--AGGREGATE

703.06. Delete the second sentence and substitute the following:

Furnish crushed aggregate with a maximum size of ¼ inch as determined by AASHTO T 27 and T 11.

#### Section 725.—MISCELLANEOUS MATERIAL

##### 725.29 Polymeric MDI-based polyurethane binder

Provide Klingstone 400 as manufactured by Green Mountain International, Inc. of Waynesville, North Carolina as the binder for the gravel sidewalk on the picnic trail.

Provide binder with a viscosity of 400 ±50 cps at 75 degrees Fahrenheit and capable of moisture cure within 24 hours at 75 degrees Fahrenheit.