



SCOTT, COX & ASSOCIATES, INC. consulting engineers • surveyors

July 26, 2011

Mr. Christopher Mueller
38470 Boulder Canyon
Boulder, Colorado 80302

Project: 11149S

Dear Mr. Mueller:

Enclosed with this letter are three copies of the Subsurface Investigation Report for the proposed new bridge over Boulder Creek at the Red Lion Inn, 38470 Boulder Canyon in Boulder County, Colorado.

If there are any questions regarding our investigation or the report, please do not hesitate to contact us.

Sincerely,

SCOTT, COX & ASSOCIATES, INC.

By: Kevin L. Hinds
Kevin L. Hinds, P.E.

Enclosures

Project: 11149S

**SUBSURFACE INVESTIGATION
New Bridge over Boulder Creek
At the Red Lion Inn
38470 Boulder Canyon
Boulder County, Colorado**

PREPARED FOR:

**Mr. Christopher Mueller
38470 Boulder Canyon
Boulder, Colorado 80302**

July 2011

**Prepared By:
Scott, Cox & Associates, Inc.
1530 55th Street
Boulder, Colorado 80303
(303) 444-3051**

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Project 11149S

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**SUBSURFACE INVESTIGATION
NEW BRIDGE OVER BOULDER CREEK
RED LION INN, 38470 BOULDER CANYON
BOULDER COUNTY, COLORADO**

PURPOSE

This report presents the results of a subsurface investigation performed July 13, 2011, for the new bridge to be constructed over Boulder Creek at the Red Lion Inn, 38470 Boulder Canyon in Boulder County, Colorado. This investigation was made to provide design criteria for the foundation system of the proposed structure to be constructed on the site. Two (2) borings were drilled at the site on either side of Boulder Creek where accessible.

Factual data gathered during the field and laboratory work is summarized in Figure 1. The results of this investigation, our opinions which are based on this investigation and our experience in the general area are summarized in this report.

INVESTIGATION DETAILS

The field investigation for the proposed bridge consisted of drilling two (2) borings in the area of the proposed construction where accessible with a truck mounted drilling rig. The borings were completed with 4-inch diameter, continuous flight power augers.

The augers are utilized to bore and clean the hole to the desired sampling depth. The augers are then removed, and a 2-inch I.D. California spoon sampler is inserted to the desired testing depth. The sampler is then driven with blows of a standard 140 pound hammer falling a distance of 30 inches.

The sampler is driven a total of 12 inches or a maximum of 50 blows. The number of blows required to drive the sampler 12 inches, or a fraction thereof, constitutes the penetration test. The test is similar to the Standard Penetration Test described in ASTM D1586. This test, when properly evaluated, is a measure of the soil strength and density. The results of these tests are shown on the Graphic Boring Log (Figure 1).

All soil samples recovered were inspected by the project engineer. No laboratory testing was performed due to the cohesionless nature of the onsite soils.

PROPOSED DEVELOPMENT

We understand that the proposed bridge is to be single-span, pre-stressed concrete beam or steel railcar structure supported by poured-in-place reinforced concrete abutments.

If additional information is available or if the plans differ from the above description, we should be notified so that our recommendations can be reviewed and revised, if necessary.

SITE CONDITIONS

At the time of our investigation, the site was located adjacent to the existing temporary bridge structure at the Red Lion Inn. The terrain consisted of the hills and valleys with the creek running beneath the proposed construction. Vegetation on the site consists of grasses, weeds, pine and aspen trees. The creek was flowing very full at the time of our investigation.

SUBSOILS

A layer of fill consisting of dark brown to brown, silty, sand and gravel containing some cobbles and boulders was encountered at the surface in the borings and extended to depths of approximately 15 feet or greater than that explored.

The fill was underlain in one of the boring by brown, silty, sand, gravel cobbles and boulders which extended to a depth of approximately 21 feet where drilling refusal was encountered in the boulders.

A detailed description of the soils encountered in this investigation is presented in the Graphic Boring Logs (Figure 1).

GROUNDWATER CONDITIONS

Groundwater was encountered in one of the borings at the time of drilling, at a depth of approximately 13 feet below the existing ground surface. However, the groundwater will fluctuate with the elevation of the creek.

FOUNDATION RECOMMENDATIONS

Based on the subsurface conditions encountered with the limited exploration and the proposed construction, a footing foundation can be considered as outlined below.

It may be possible to try and find other exploration equipment to determine depths to bedrock at the site if necessary. However, this would likely be very costly and time consuming with unknown outcomes.

Footings or Drilled Pads

Since the bridge is to be constructed utilizing pre-stressed tee or steel railcar, it should be able to withstand some differential movement of the abutments without sacrificing the integrity of the structure. Also, if scour is not a major concern, it is our opinion that the structure could be placed on a spread footing foundation system, placed on the low level sand, gravel, cobbles and boulders beneath the existing fills.

The footings pads should be designed for a maximum allowable soils bearing pressure of 3,000 PSF, based upon dead load plus full live load. Although, it may be possible to increase the bearing at the time of construction and observation of the excavations.

The footing lines should be carefully inspected by an engineer from our office prior to placement of the footings. All footings should be placed below any existing fill. Any areas of soft or loose soils, which are present at the proposed footing level, should be removed down to acceptable undisturbed soils. Footings can then be placed directly upon the acceptable soils or the excavation can be backfilled to the desired footing elevation with compacted select granular fill placed in lifts not to exceed 9 inches in thickness and compacted to a minimum of 100% of the maximum dry density as determined by the moisture/density relationship ASTM D698.

We recommend that the excavation be done with a large, track-mounted backhoe due to the soils conditions that are anticipated to be encountered during excavation.

EARTH RETAINING STRUCTURES

At this site we recommend that the abutments and wing walls be designed using a lateral earth pressure equivalent to that developed by a fluid weighing 60 pcf plus any additional surcharge loads. Use of this value assumes that the wall will be backfilled with the site soils and that these soils will not be allowed to become totally saturated at any time during the lifetime of the wall. Providing adequate compaction, proper site grading, and drainage will help to prevent saturation of the backfill soils.

It should be noted that the equivalent fluid unit weight given above is for a level backfill surface and should be corrected for an upward sloping fill. An upward sloping backfill surface increases the earth pressure on retaining structures. All retaining structures should be designed for appropriate hydrostatic and surcharge pressures, such as adjacent traffic and construction materials.

The abutments and wing walls should be founded on, designed, and constructed the same as the bridge structure.

SITE EXCAVATIONS

The use of heavy construction equipment and possible blasting may be necessary at some locations due to the large boulders that may be encountered.

Temporary cuts in the fill material and overburden soils should not exceed 1.5(H):1(V) slopes. At these slopes some minor sloughing may occur, however, major stability problems should not be encountered unless seepage is encountered in the cuts. If seepage is encountered, we should be notified to evaluate the conditions and determine if remedial measures are required.

All areas excavated for the proposed bridge construction should be backfilled with approved material placed under controlled conditions. We recommend that all backfill be compacted to at least 95% of the maximum density (ASTM D698) near optimum moisture content.

LIMITATIONS

The boring in this investigation presents a reasonably accurate knowledge of the existing subsoils. However, variations of subsoils not indicated by the boring are always possible. Therefore, we recommend that all excavations be inspected by an engineer knowledgeable in foundation soils to confirm that the soils actually are as indicated by the investigation and to make recommendations if differences are noted.

INSPECTION AND QUALITY CONTROL

Placement of any significant thickness of fill, particularly fill which is to remain in place beneath the foundation should be inspected and tested by a qualified soils engineer.

If you have any questions concerning the investigation or this report, please do not hesitate to contact us.

Sincerely,

SCOTT, COX & ASSOCIATES, INC.



By: Kevin L. Hinds
Kevin L. Hinds, P.E.

Reviewed

By: M. Edward Glasgow
M. Edward Glasgow, P.E.

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LEGEND



SOILS INVESTIGATION
BORING LOCATION



Scale: 1" = 20'

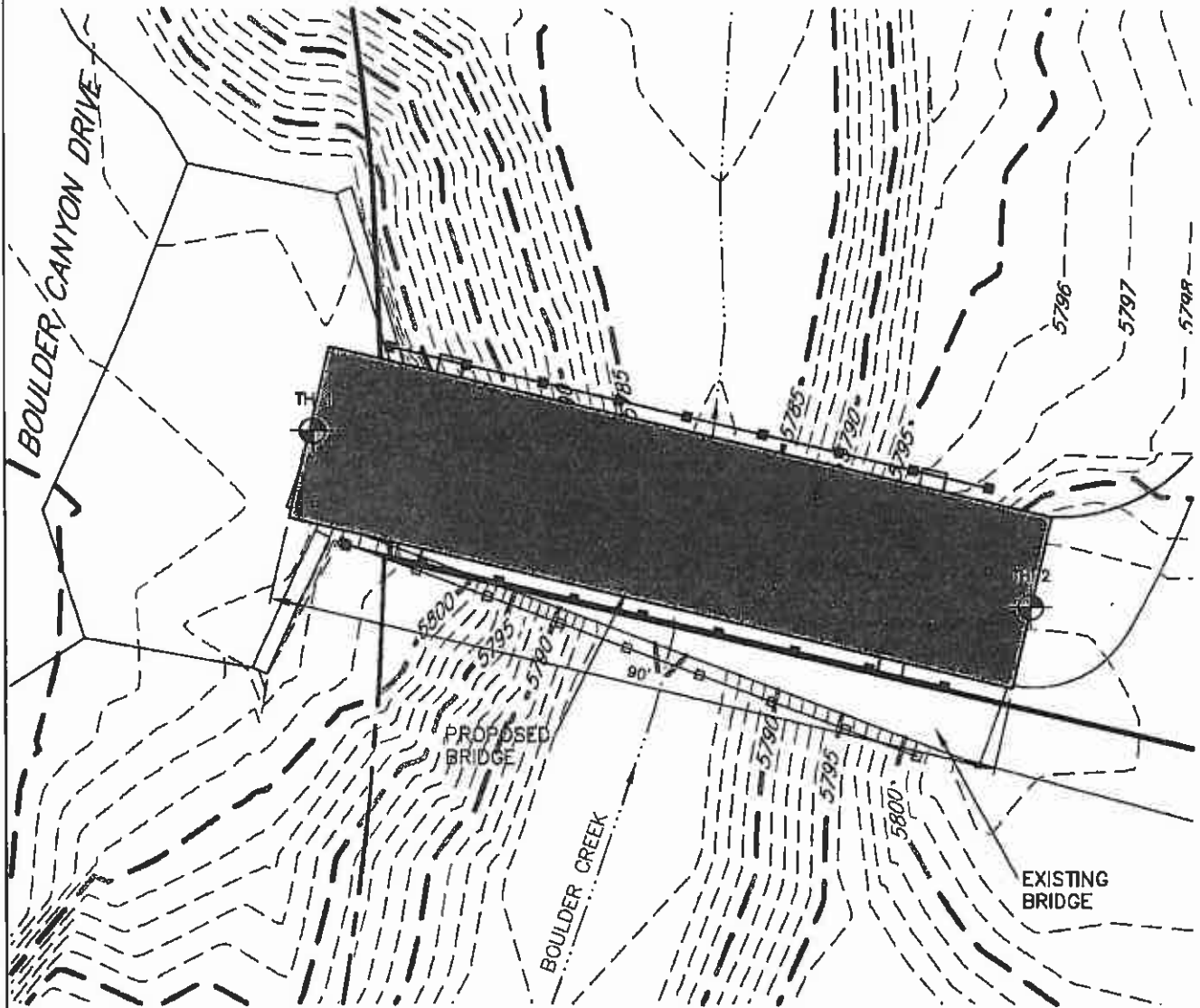


FIGURE 1 BORING LOCATION MAP



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Graphic Boring Logs

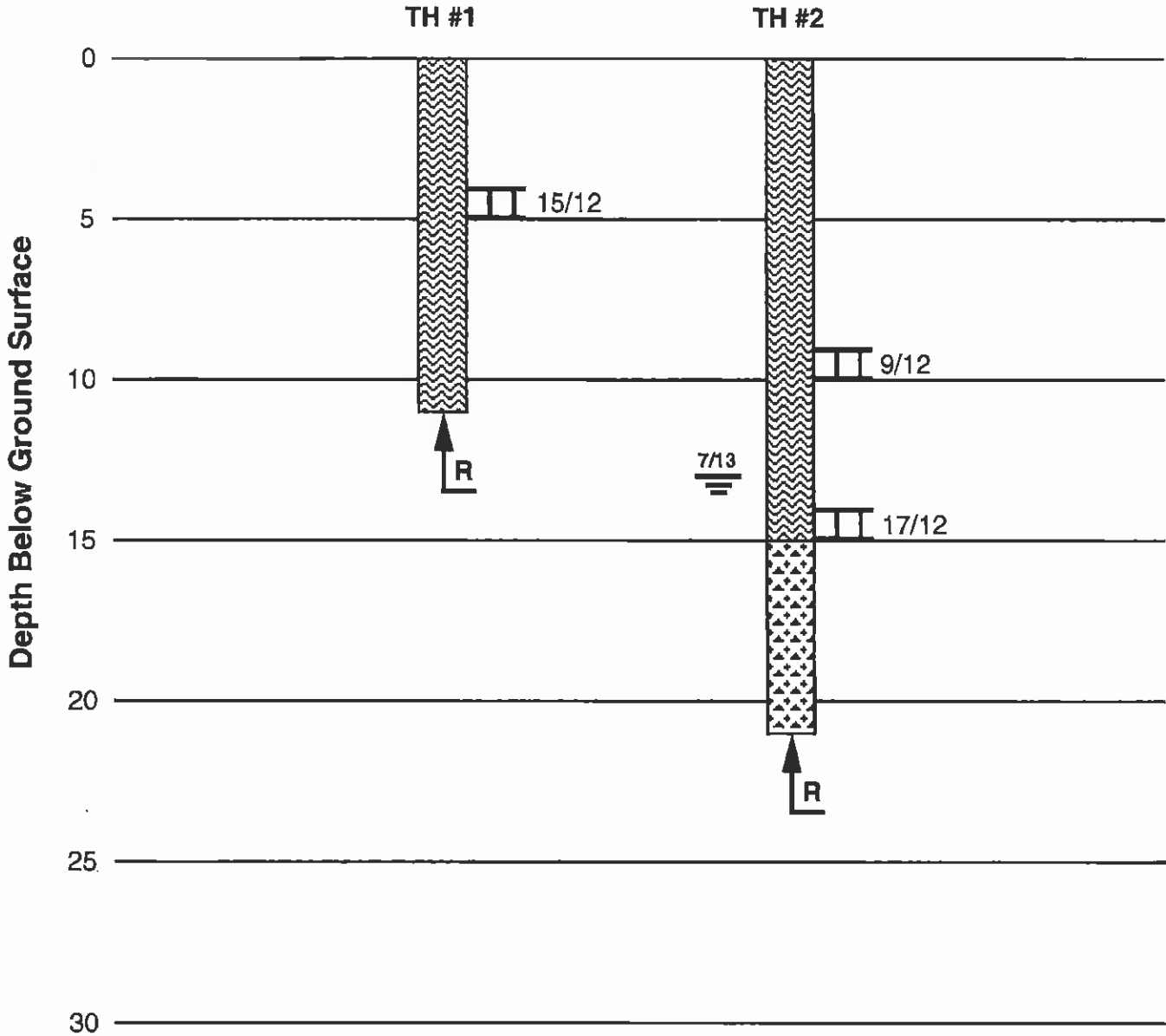


Figure 2
Page 1

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Project 11149S

Description of Soil Types



Fill - Dark brown to brown, silty, sand and gravel - Contains some cobbles and boulders



Brown, silty, sand, gravel, cobbles and boulders

TH #1 Soils investigation boring number



Indicates a change in soil type - May be gradual.



12/12 indicates that 12 blows of a 140-pound hammer falling 30 inches were required to drive a 2-inch, inside diameter sampler 12 inches.



Indicates the groundwater table and the date that the measurement was taken



Indicates depth of drilling refusal on large cobble or boulder

Notes

1. Borings were performed July 13, 2011 with four-inch diameter, continuous flight power augers.
2. Boring logs shown in this report are subject to the limitations, explanations and conclusions of the report.



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