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May 6, 2013

Summit, LLC
c/o Mr. Rick Everson, P.E.
1335 North 5900 East
Eden, Utah 84310

IGES Project No. 01628-005

Subject: Preliminary Geotechnical Recommendations
Vehicle Bridge No. 3
Powder Mountain Resort
Weber County, Utah

Reference: IGES, Inc., 2012, Design Geotechnical Investigation, Powder Mountain Resort, Weber County, Utah, Project No. 01628-003, dated November 9, 2012

Mr. Everson:

As requested, IGES has prepared the following preliminary geotechnical recommendations for the proposed vehicle bridge to be constructed over a proposed new ski run at approximate Station No. 18+00 (station referenced for the proposed *Road E*) within the Powder Mountain Resort, Weber County, Utah. In preparation of these preliminary recommendations we have reviewed the geotechnical engineering report for the 200-acre resort expansion project, of which the bridge is a part (IGES, 2012).

This report presents preliminary recommendations for construction of the bridge structure *for planning purposes only*; the recommendations presented herein are subject to validation and possible revision based on future site-specific subsurface exploration, which will presumably occur once the site becomes accessible after the snow has melted at the site.

Project Description

Our understanding of the project is based on the plan set prepared by Mulholland Development Solutions titled "Vehicle Bridge 3" (Sheets 1 and 2), dated April 23, 2013, and information provided by The Client. We understand that a new bridge will be constructed to allow the proposed *Road E* to pass over a proposed ski run. Based on our review of the plans we understand that the new bridge will consist of a 144-inch corrugated metal pipe (CMP) founded on structural fill. As currently planned, the pipe subgrade will be very close to existing grade; approximately 14 feet of new roadway embankment fill will be placed to create Road E, which will pass over the pipe. The pipe will be 60 feet long. The plans indicate that the new CMP culvert is designed assuming an allowable bearing capacity of 3,500 psf with a maximum allowable total settlement of 1 inch.

There will be several rockeries associated with the culvert; IGES will provide general recommendations for the rockeries in a separate submittal. The plans suggest that existing grade will be lowered about 1 foot to attain final design grade through the pipe.

Review of Subsurface Data

In preparation of these preliminary recommendations we have reviewed the geotechnical engineering report for the 200-acre resort expansion project, of which the bridge is a part (IGES, 2012). The referenced study included three test pits completed within a few hundred feet of the proposed structure. The subsurface conditions are summarized below:

- TP-10 is located a few hundred feet south of the project site; the test pit log indicates that the upper 2 feet consists lean CLAY (CL); within this layer, abundant roots and animal burrows (krotovina) were noted. Underlying the clay (below about 2 feet), the soils transition to dense silty and clayey sand. A gradation analysis indicates that the sandy soils have a fines content on the order of 20 percent.

- TP-12 is located several hundred feet north-northeast of the project site; the test pit log indicates that the soils consist largely of Silty SAND (SM) with substantial amounts of gravel and cobbles. The upper 7½ feet was generally loose and easy to excavate.

- TP-6 is located several hundred feet west and downhill from the project site; the test pit log indicates coarse, medium-dense Silty GRAVEL with sand (GM) with significant amounts of cobble- and boulder-size constituents; this material was observed to the maximum depth of exploration of 8 feet.

Foundation Recommendations

Considering the likely presence of coarse, dense granular soils at the foundation subgrade, and to help provided a uniform reaction to the applied CMP culvert loads, native soils underlying the CMP pipe should over-excavated a minimum of 1 foot below the lowest point of the pipe or 2½ feet below existing grade, *whichever is deeper*. All fill placed under the pipe should consist of structural fill placed as indicated in our referenced geotechnical report. We recommend that IGES inspect the bottom of the foundation excavation prior to the placement of structural fill to identify any unsuitable or otherwise deleterious soils – additional over-excavation may be necessary based on actual subgrade conditions. Over-excavation of the foundation subgrade should extend 6 feet laterally beyond the pipe to reduce the potential for differential settlement between the pipe and the roadway embankment.

Earth Pressures and Lateral Resistance

Ultimate lateral earth pressures from *granular* backfill acting against the CMP culvert may be computed from the lateral pressure coefficient or equivalent fluid density presented in the following table.

Table 1
Lateral Earth Pressure Coefficients

Condition	Level Backfill	
	Lateral Pressure Coefficient	Equivalent Fluid Density (pcf)
At-rest (Ko)	0.44	53

This coefficient and equivalent fluid density assume no buildup of hydrostatic pressures. The force of the water should be added to the presented values if hydrostatic pressures are anticipated.

Seismic Considerations

The spectral accelerations presented in Table 2 are calculated based on the site's approximate latitude and longitude of 41.3625˚ and -111.7446˚ respectively. For AASHTO bridge design, a spectral acceleration corresponding to a 7PE75 event is typically prescribed without further modification (consult the appropriate AASHTO controlling document for guidance).

Table 2
Spectral Acceleration Design Parameters

Design Seismic Event	Source	Class C Site Coefficients			Spectral Acceleration (g)		
		F_a	F_v	F_{pga}	As	0.2 sec.	1.0 sec.
7PE75	AASHTO 2009[a]	1.163	1.592	1.155	0.283	0.690	0.331

[a]AASHTO 2009, U.S. Design Maps online ground motion calculator, available at the USGS website: http://geohazards.usgs.gov/designmaps/us/application.php, based on the USGS 2002 fault database.

Pipe Installation Notes

IGES has reviewed the pipe installation notes presented on Sheet 2; these notes provide details regarding structural fill ("select granular backfill"), compaction criteria, bedding, etc. In general, IGES takes no exception to these notes, with the following exceptions:

- For placement of structural fill, the use of AASHTO T-180 (same as ASTM D1557 or Modified Proctor) is recommended.

- Compaction to 90 percent of the maximum dry density (AASHTO T-180) is considered sufficient for this structure; however, *placing structural fill dry of optimum is strongly discouraged*.

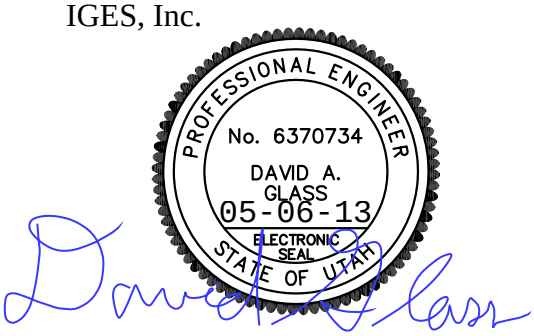
Where more stringent, the recommendations presented on Sheet 2 addressing structural fill should be followed.

Closure

The recommendations presented herein supersede the recommendations presented in our referenced geotechnical report (IGES, 2012). All other recommendations presented in our referenced report remain valid and should be implemented into the design and construction of the project.

We appreciate the opportunity to provide you with our services. If you have any questions please contact the undersigned at your convenience (801) 748-4044.

Respectfully Submitted,
IGES, Inc.



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