



July 8, 2020
File No.: 20003-r

Asphalt Paving Co.
14802 W 44th Ave
Golden, CO 80403

Attention: Stan Opperman

Subject: Ralston Quarry
Annual Geotechnical Stability Report
Golden, Colorado

PROJECT UNDERSTANDING AND BACKGROUND

Brock Consulting, LLC (Brock Consulting) conducted a geotechnical stability evaluation on June 30, 2020 for the Asphalt Paving Co. (APC's) rock quarry located at 6569 Highway 93, just west of the intersection with West 64th Parkway, in Golden, Colorado.

Over the years a number of geotechnical evaluations have been completed at the project site by Brierley Associates Corporation (Brierley) including a Geotechnical Evaluation and Initial Opinion Report – Phase 1 dated August 2011, a Geotechnical Evaluation Report - Phase II dated November 2013, an Additional Slope Evaluation letter dated July 2014, and a Geotechnical Stability Report dated August 29, 2019.

In 2019, the Division of Reclamation, Mining and Safety (DRMS) added a geotechnical stability report as part of the annual reporting requirement. The extent of this evaluation is limited to the basalt quarry and does not include any peripheral areas. This report presents the observations from the 2020 evaluation and was prepared as a continuation of the prior studies indicated above, which were relied on in preparation of this report.

1.1 Existing Conditions

1) Provide an accurate description of the existing high-wall material(s), geotechnical characteristics, bench, and wall configuration.

According to bedrock geologic maps of the area, the quarry is operating within the western half of the Ralston Dike, or Ralston Plug. Lava was extruded through the Pierre Shale from the Ralston Plug during Paleocene time. An altered zone of the Pierre Shale is adjacent to the Ralston Plug. The contact between that Pierre Shale and the rim-phase of the Ralston Plug is mapped within the quarry as dipping from 60 to 80 degrees to the east (Drewes, 2006). The core-phase of basalt is towards the center of the Ralston Plug.

In general, a thin veneer of basalt overlaying the east-dipping shale contact was left in place on the west side during mine operations. A few “windows” of the altered Pierre shale have been exposed in the upper high walls and appear to be standing well where exposed. Based on 2010 mapping, and subsequently reviewed, the rim-phase basalt is very hard, fresh, gray, and very fine grained, with joint orientation ranging from moderately dipping to vertical. The core-phase basalt was hard, moderately weathered to fresh at depth, light gray, and very-fine grained, with joint orientation ranging from low angle to high angle.

General observations of the high-walls indicate slopes were mined nearly vertical, up to 80 ft in height, with a series of benches and haul roads traversing the site prior to 2010. On the west side of the quarry approximately 230 vertical feet of the east-facing mine wall has been exposed and generally less than 50 vertical feet of the mine wall has been exposed on the east side (west-facing). The current mining practice utilizes a 40-ft tall bench height with a 15-ft to 20-ft bench width.

1.2 Existing Conditions

2) Geotechnical evaluation of the stability of the existing high-wall configuration, with special consideration given to identify existing areas of potential weakness and/or instability, and for recommendations to correct these issues if observed.

Based on observations, the stability of the layer of basalt at the shale contact appears good. Where “windows” of the altered Pierre shale have been exposed in the upper high walls of the quarry, evidence of slaking (disintegrating and crumbling when exposed to moisture) is evident as expected due to weathering. The area of exposed shale is minimal and limited to the upper benches. The current practice of leaving a basalt veneer over the shale appears successful for preventing unfavorable weathering of the shale.

The basalt across the site does present a few local failures along dip-slope joint orientations, however no large-scale slope failures were observed to have occurred at the mine site since the 2019 observation.

1.3 Conformance with Existing Permit

3) Determination if the existing high-wall conforms to the requirements of existing permit.

In a 2014 analysis, Brierley evaluated the allowable slope configuration based on the minimum factor of safety (FOS) of 1.3 for mine slopes. The results of this analysis indicated vertical bench heights up to 80 ft high have an allowable FOS on all exposed aspects of the quarry walls.

Additionally, a vertical height up to 200 ft has an allowable FOS on west-facing slopes (east side of quarry). South-facing slopes (north side of quarry) up to 400 ft high have an allowable FOS with an overall slope dip angle of 79 degrees. East-facing slopes (west-side of quarry) up to 400 ft high have an allowable FOS with an overall slope dip angle of 73 degrees.

Based on the 2014 Brierley analysis and 2020 observations, the existing high-wall benches and overall geometry of Ralston Quarry is above the minimum allowable FOS of 1.3 for mine slopes.

1.43 Conclusion

Brock Consulting did not observe any apparent large-scale slope instabilities during our 2020 site observation. A few dip-slope failures observed within the basalt have been previously noted and our evaluation indicates these surficial failures do not currently pose a significant slope stability hazard and can likely be mitigated during the ongoing mining process. No new instabilities were noted since the past site visit.

The current practice of leaving a basalt veneer over the shale on the west side of the site appears successful for limiting slaking and unfavorable weathering of the shale. We understand that planned reclamation intended to further stabilize the shale and improve the visual aesthetics will be conducted under the direction of a specialized remediation contractor.

Sincerely,
Brock Consulting, LLC

Rebecca Brock, PE, PG
President

