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December 21, 2005

Our Ref: P05-7258

Resource Design Technology Inc.
4509 Golden Foothill Pkwy, # 2
El Dorado Hills, California 95762

Attention: Mr. Dave Brown

RE: SLOPE STABILITY CONSIDERATIONS
DURABILITY QUARRY, INYO COUNTY, CALIFORNIA

Dear Mr. Brown:

Golder Associates Inc. (Golder) is providing our recommendations and conclusions regarding slope stability for the proposed Durability Quarry located in Inyo County, California. This work was completed in accordance with our proposal dated December 20, 2005.

PROJECT DESCRIPTION

We understand that the Durability Quarry located in Inyo County is proposing to mine limestone bedrock. Conceptual plans provided by RDT indicate that maximum quarry slopes are approximately 120 feet in height and will be inclined at 1.5H:1V (horizontal to vertical). A topographic map provided by RDT indicates that portions of the existing slopes have an overall average slope inclination slightly steeper than 2H:1V. Site photographs indicate that portions of the slope may be locally steeper than 1H:1V (see Figure 1).

Additional information regarding the quarry includes:

- The quarry developer anticipates that blasting will be required to excavate the limestone.
- The quarry location is in a remote, undeveloped area.
- The quarry limits are not located adjacent to any property boundaries, streams, or sensitive habitat areas.
- The proposed post-reclamation land use is undeveloped open space.

Based on the above information, an unstable quarry slope would not impact adjacent property owners, result in significant off-site erosion, or impact potentially sensitive habitat areas.

SLOPE STABILITY CONSIDERATIONS

Selection of Factors of Safety

Section 3704 (f) of the Surface Mining and Reclamation Act (SMARA) states that the factor of safety of final excavation slopes shall be consistent with the proposed post-reclamation land use. SMARA does not specify a minimum factor of safety for slope stability, nor does it state that a slope must be stable. However, Title 14, Chapter 8, California Code of Regulations (CCR) Section 3502(b)(3) indicates that final reclaimed slopes shall be flatter than the critical gradient, which implies that static factors of safety should be greater than 1.0.

Based on our experience, most mine reclamation projects require a minimum slope stability factor of safety of 1.3 to 1.5 under static conditions to comply with SMARA and Title 14 CCR. However, it is our experience that these factors of safety are driven by the following:

- Slopes must be appropriately stable to prevent impacts to adjacent property, which is a concern if the mine limits encroach upon property limits;
- If post reclamation land use includes development at the top or near the bottom of the quarry (or includes the slope itself), the slopes must be appropriately stable to prevent impacts to the development(s) and to maintain public safety; and
- Slopes must be appropriately stable to prevent impacts to drainage features or minimize off-site sedimentation transport. This is a concern if critical drainage features (i.e. creek or river) would be adversely impacted by a slope failure.

Title 14, CCR, Section 3502 (b)(3) recognizes these concerns and states "Special emphasis on slope stability and design shall be necessary when public safety or adjacent property may be affected." Based on our understanding of the proposed Durability Quarry project, the above concerns do not apply.

Because of the potential slope instability and the proposed post-reclamation land use, it is our opinion that a static factor of safety against slope failure of 1.3 is appropriate for static conditions for this project. Similarly, a pseudo-static factor of safety of 1.1 is appropriate for seismic conditions.

Stability of Limestone Bedrock Slopes

It is our experience that a 1.5H:1V slope (33.7 degree inclination) is a very flat slope for a competent rock that requires blasting to excavate. For competent bedrock, a common slope design is to incline intermediate slopes at 0.5H:1V with 20-foot wide benches every 40 feet vertically, resulting in an overall slope inclination of 53 degrees. There are many examples of even steeper stable slopes in competent limestone bedrock that reach heights of several hundred feet. However, it should be noted that the steeper slopes described above (steeper than 1.5H:1V) need to be supported by detailed geologic and engineering analyses.

Global stability, or rock mass failure, generally does not control stability in competent, hard bedrock slopes due to the relatively high intact rock strength. As an example, Golder computed a static factor of safety in excess of 2.0 for a rock mass failure in limestone slopes over 500 feet in height with an overall slope inclinations of 53 degrees for the Blue Mountain Quarry located near Columbia, California (Golder, 2004). The computed pseudo-static stability factor of safety exceeded 1.8.Kinematic Failures:

Stability of competent bedrock slopes is generally controlled by kinematic failure modes, which include planar, wedge, and toppling failure modes (Figure 2). Due to the proposed relatively flat slope inclinations (less than 34 degrees), toppling is not a viable failure mode. Furthermore, because the interface shear strength along rock mass discontinuities (joints and bedding) of competent limestone bedrock generally exceeds 35 degrees, the development of planar or wedge failures will not be kinematically viable (shear strength along potential sliding planes exceeds the slope inclination).

General exceptions to the above generalizations include:

- Weathered Zone: Although not evident in the site photographs, a weathered zone can develop in the upper portion of the bedrock. In limestone bedrock, the weathered material can result in a higher clay content with lower shear strengths.

- Fault and Shear Zones. If present, faults and shear zones can result in preferential weathering and development of gouge that may exhibit low shear strength failure surfaces if oriented in a direction adverse to the slope.

- Limestone bedrock can exhibit solution cavities and "widened" pathways along discontinuities, which are sometimes filled in with clay. These features are typically localized and result in locally weakened rock slopes. .

RECOMMENDATIONS AND CONCLUSIONS

Based on our understanding of the project and the proposed relatively flat excavation slopes, we provide the following conclusions and recommendations. These conclusions and recommendations are contingent upon field verification as described below.

For planning purposes, it is prudent to assume that the proposed slopes will result in factors of safety that exceed the above recommended design factors of safety provided the rock conditions are verified per our recommendations below.

- For this project, it is our opinion that a static factor of safety against slope failure of 1.3 is appropriate for static conditions and a pseudo-static factor of safety of 1.1 is appropriate for seismic conditions.

- For planning and initial design purposes, it is reasonable to expect that slopes of 1.5H:1V in competent limestone bedrock will have factors of safety well in excess of 1.3 for static conditions and 1.1 for pseudo-static conditions for the proposed Durability Quarry. Factors of safety for a global rock mass failure mode are generally much higher than the proposed design values for bedrock slopes that are considerably high and steeper than those proposed for this project. In addition, because the final excavation slope is relatively flat, planar, wedge, and toppling failure modes are not likely to be kinematically viable.

- In our opinion, there is a strong likelihood that considerably steeper slopes would be viable in the proposed limestone bedrock (i.e. meet or exceed the recommended factors of safety).

However, steeper slopes would need to be supported by site specific discontinuity mapping and kinematic analyses.

The above recommendation and conclusions are contingent upon verification of bedrock conditions during quarry development. Specifically, we recommend that the slopes be inspected by a qualified Certified Engineering Geologist or appropriately qualified Civil Engineer after the excavation has reached a depth of 20 to 30 feet to verify assumed favorable bedrock conditions. If necessary, slope inclinations should be adjusted (flattened) based on the observed site conditions. This might require flattening the slopes through a highly weathered section or flattening locally to address potentially adverse fault or shear zones or other local discontinuities. Depending on the findings of the initial inspection, it may be prudent to complete additional periodic inspections to verify the bedrock conditions and to develop alternative slope recommendations if appropriate. If necessary, we understand that flattening the slopes is readily feasible based on no significant property and topographic constraints.

Golder appreciates supporting Resource Design Technology (RDT) with this project. Please call if your have any questions.

Sincerely,

GOLDER ASSOCIATES INC.

Kenneth G. Haskell, P.E.
Principal/Senior Consultant