

**GEOTECHNICAL DESIGN REPORT**

US 50 Phase-I HOV CMIA Project, 03-ED-50-0.0-2.9

EA 03-3A7111

El Dorado County, California

BCI Job. No. 1072.2

December 20, 2007

toppling or wedge type rock failure to occur along adversely dipping planes within more steeply inclined (>1.5H:1V) cut-slopes.

We expect that the proposed modified cut-slopes at 1.5H:1V (or flatter) will be appropriately stable. However, a registered geologist should observe rock excavations to evaluate the potential need to flatten (or otherwise modify) rock slopes if adverse bedding conditions are exposed during construction. We recommend crown ditches at the top of cuts to help control slope erosion.

8.2.2 *Rippability*

Based on the results of our seismic refraction survey, we estimate material rippability in Table 13.

Table 13: Material Rippability

Layer Velocity (fps)	Interpreted Material Type	Rippability
≤ 3,000	Fill, colluvium and decomposed to intensely weathered rock	Rippable with heavy-duty construction equipment
3,000 to 7,000	Intensely to moderately weathered rock, with local less weathered blocks	Rippable, with local resistant blocks that may require blasting or alternative excavation methods
≥ 7,000	Slightly weathered to fresh rock	Blasting or alternative excavation methods, with local blocks rippable along natural discontinuities

Section 1-62 of the 2000 Caterpillar Performance Handbook (Edition 31) indicates rock with seismic velocities up to about 7,000 fps are rippable with a Caterpillar D9, and marginally rippable for seismic velocities between 7,000 and 9,000 fps. Based on our boring / test pit data and geologic reconnaissance, we expect the upper 10 to 12 feet of fill and decomposed to moderately weathered rock will be rippable with a Caterpillar D-9 or large excavator equipped with a single shank.

We expect the following areas will require blasting or alternative excavation methods (e.g., splitting, chipping, pneumatic hammers, etc.) to facilitate excavation:

- o the 430-foot-long, 20-foot-high rock outcrop within the median at station interval "A2R" Line Station 104+90 to Station 109+20;
- o the 30-foot-high cut-slope at "B" Line Station 139+50 to Station 145+00; and
- o the 15-foot-high rock cut-slope at "B" Line Station 161+00 to 162+00.

Submitted by Department

at Board Hearing of 11/18/08

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Competent rock and large boulders may also be present at shallower depths at other intervals within the project, which may require alternative excavation methods and/or localized blasting.

Perform any blasting, if required, in accordance with Caltrans "Standard Specifications" (including Sections 7-1.10 and 19-2.03). The specifications and special provisions developed for blasting should address safety issues and avoidance of damage to existing pavement, utilities, structures and other natural and man-made features.

### 8.2.3 Grading Factors

We expect this project to generate excess earthwork volume. Based on data developed for this study, the majority of proposed cuts will be rippable to depths of 10 to 12 feet. We estimate this material will break down to dimension of less than 8 inches and be suitable to use in project fills. Cuts below depth of 12 feet, and the hard rock outcrop located in the median between "A2R" Line Sta. 104+90 and "A2R" Line Sta. 109+20, will encounter hard rock and generate mostly oversize material (> 8 inches greatest dimension). The oversize material will require disposal outside the structural fill limits and should not be included in grading factors. Local, resistant blocks of hard rock that will not readily break down may also be encountered at other locations.

For the usable material ( $\leq 8$  inches greatest dimension), we estimate an earthwork factor (i.e. in-place volume/re-compacted volume) between about 0.90 to 1.0 for materials placed at 90 to 95% relative compaction (per CTM 216). In consideration of material loss during transport, and potential for variability within the weathered / fractured rock, we recommend a grading factor of 0.95 for purposes of construction bidding.

For oversize rock used as "slope protection" or stockpiled away from embankments, we estimate an earthwork factor of about 1.3.

### 8.3 Embankments

Construct embankment and place new fill in accordance with Caltrans "Standard Specifications" (including Section 19, "Earthwork"). Excavate a 3 foot deep by 10 foot wide toe bench ("keyway") into competent material and/or bedrock for all modified fill slopes greater than 10 feet in height.

Where new fill is to be placed onto existing fill slopes or natural slopes exceeding 5H:1V, fully bond into the existing slope by placing on discrete horizontal benches cut fully into the slope and below any loose/soft or otherwise unsuitable materials (per Section 19 of Caltrans "Standard Specifications").