FOR CONTRACT NO.: 02-1E2104

INFORMATION HANDOUT

MATERIALS INFORMATION

GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS

ROUTE: 02-Tri-299-38.8/39.1

M e m o r a n d u m

Flex your power!
Be energy efficient!

To: MR. AL TRUJILLO
Senior Transportation Engineer
Safety Design Leader

Attn: Mr. Shaun Alexander

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES – MS 5

Date: October 15, 2009

File: 02-TRI-299 PM 38.8/39.0
02-1E210K
Horseshoe Curve
Improvement Project

Subject: Geotechnical Assessment and Recommendations

As per your request our office (Office of Geotechnical Design North (OGDN)) is providing this memo regarding preliminary geological/geotechnical reconnaissance and recommendations for the Horseshoe Curve Safety Project on State Highway 299 in Trinity County between approximately postmile 38.8 and 39.0. Plate 1 shows an aerial photo with some preliminary design features, including stationing, overlaid. Also shown in this plate is the area specifically requested by design for OGDN to investigate, which is essentially the northeastern half of the topographic promontory that defines this location. OGDN was specifically requested in writing to provide …" a material report for the contractor with maximum slope ratio", in addition to a verbal request to investigate the rock's capacity to stably support vertical or near-vertical cuts. Design voiced intentions and presented OGDN with study cross-sections with the proposed cut slopes standing at 0.1:1.

No drilling or seismic work was performed for this report, due to an effort to limit support costs.

Geology

The project is located in an area mapped (Irwin, 1960 in Strand, 1962) as metasedimentary rock, including metamorphosed limestone or dolomite. Field reconnaissance by Mr. Scott Lewis of OGDN confirmed that the bedrock material throughout the project site is composed of slightly metamorphosed limestone and/or similar moderately hard carbonate rock. Field reconnaissance also resulted in grouping the project area into three areas (Plate 2), based on the structural and surficial geology and the type of slope cuts each area will allow. In most places where the rock is exposed

it is fairly massive (area 1, Plate 2), particularly along the east-facing slope exposure between stations 113+00 and 117+00. West of the promontory ridge (a short distance outside of the specific area of requested investigation) and at the south eastern end of the promontory (stations 110+00 to 111+00; area 2 on Plate 2) relict bedding structures demarcate beds varying up to at least 15 feet in thickness that dip about 25 degrees to the east. The eastern facing cut slope presently exposed along the roadway between stations 112+00 to 117+00 does not clearly show such obvious bedding structures, which likely indicates these structures do not present a structural plane of sufficient weakness for planar failure alone, at least in this north-east facing orientation.

The apparent past wedge failure (Plate 3-A), however, that can be observed at the southern end of the promontory where the roadway turn is tight (area 3 on Plate 2), indicates that there may be planes of weakness, or possibly even offset, in the rock slopes oriented similarly or dissimilarly in this same location. The area located topographically below and to the east-southeast of this failure, where most of the steep cuts are coincidentally proposed, may have large blocks of bedrock offset from the true bedrock- and may therefore be potentially mobile. For example, Plate 3-C shows a portion of the slope where a potential offset scarp can be seen. The apparent offset is at least 7 feet. This may possibly indicate that the entire block below it may be detached and that the cutting of a portion below it may act similarly to removing the toe to a landslide potentially inclined steeply against the bedrock. It is uncertain how this potential failure surface will react when the slope below it is cut at 0.1:1. This area also appears to have several colluvial wedges or lenses of uncertain thickness- field relations indicate they could potentially be as thick as 10 feet in places. Photos A, B, and C in Plate 3 show two steeply inclined colluvial wedges; one on the slope facing the roadway and the other on one of the two wedge failure surfaces facing away from the road. If this colluvium is cut at 0.1:1 the material left ‘stranded’ above the cut (and below the scarp) will likely fail later through sliding and/or periodic rockfall.

Cut Slopes

Cut slopes in the bedrock material should be stable at a near-vertical slope ratio (0.1:1) up to 25 feet in height. Such bedrock material (and such cut slopes) would occur from about station 112+50 to the eastern end of the project.

Cut slopes in colluvium should be stable at a 1:1 slope ratio or flatter. There are lenses and wedges of colluvium between stations 110+00 and about 112+50. Colluvium cut steeper than 1:1 will be unstable and create rockfall issues, slide issues, or both.

Cut slopes in detached bedrock material between stations 110+50 and 112+50 may support near-vertical slopes if the rock is relatively unweathered and if the portion of the

block remaining is stable along its detachment surface. Neither the degree of weathering nor the stability along the detachment surface can be ascertained conclusively, however, due to the lack of subsurface investigation (drilling, seismic) data.

Rockfall and Catchment

Rockfall issues are not expected to occur from any new cuts in the bedrock material, provided controlled blasting techniques (see section below on Blasting) are followed to eliminate potential damage to the remaining cut face.

Rockfall issues are likely to occur from any colluvial material cut steeper than 1:1.

Rockfall issues may or may not arise from any near-vertical cuts in the detached bedrock, depending upon the degree of weathering.

Rockfall catchment, which basically consists of an unpaved ditch at the base of the cut slope with a backslope (towards the slope) of at least 6:1, is recommended at the base of the cut slopes. Catchment at the base of the bedrock slopes need only be 4 to 5 feet wide. Catchment at the base of the colluvial or weathered material should be widened to at least 8 feet.

Rippability

Most of the intact bedrock at this site is considered unrippable. Some of the material proposed for excavation, however, may in fact not be bedrock (specifically some of the material between stations 110+00 and 112+00), and may vary in its excavation characteristics between being easily rippable to being moderately difficult to rip. Rippability assessments were made qualitatively based on field experience and rock type; no seismic or drillhole data were available. Consequently, the rippability assessments offered above may be superceded by unknown subsurface conditions.

Blasting

Should blasting be chosen as a method of excavation for this project, it is imperative that controlled blasting techniques be employed to eliminate collateral damage to the remaining cut face and maximize the potential for strong, stable, intact cut slopes free of sliding or rockfall issues. OGDN recommends that the contractor employ cushion blasting as his primary controlled blasting technique and possibly, pre-shearing. Copies of the Department's *Standard Special Provision (SSP) 19-706 Rock Excavation (Controlled Blasting)* and *Standard Special Provision 19-705 Rock Excavation* are attached at the end of this document. SSP 19-705 has no controlled blasting provisions,

while SSP 19-706 has too many for this project. Should Management or Design wish to modify either of these SSP's into an nSSP that is more specifically tailored to the project OGDN recommends that this be done in consultation with the District Office Engineer (O.E.) and Mr. Lewis from OGDN, both of whom would be involved in approving the modified version as a non-Standard Special Provision (nSSP).

Design and Construction Considerations and Recommendations by Station

Station 110+00 to 110+50 has a proposed near-vertical cut (0.1:1) increasing to about 10 feet in height. This material is very unlikely to support this steep a slope. OGDN recommends flattening the slope to at least 1:1. This material is likely easily ripped.

Station 110+50 to 110+75 has a proposed near-vertical cut (0.1:1) increasing from about 10 feet to 14 feet in height. This material is very unlikely to support this slope its entire height, with the upper portion being the less stable colluvium and some portion of the lower part of the cut likely being in harder rock. A possible rock fall issue may be created with this near-vertical slope and limited catchment if an unstable portion of material is left at the top of the cut. This material is likely easily ripped within the outer surficial few feet, beneath which it likely grades into rock that may range from being moderately difficult to rip to unrippable.

Station 110+75 to 111+75 has a proposed near-vertical cut (0.1:1) from about 14 feet to about 19 feet in height. At least a part of this cut appears to have a significant chance of undercutting and thereby instigating a slough (about 5 to 10 feet thick) of any unsupported colluvium that appears to mantle the slope in this location. While the underlying rock is probably capable of supporting a 0.1:1 cut face, the colluvium should be cut at 1:1 or else stripped completely off the slope above the new cut face.

Station 112+00 to 113+00 has a proposed near-vertical cut that reaches a height of about 25 feet before tapering down to nothing. The rock is likely good to the surface, based on surface inspection. This cut is likely to be stable.

Station 113+00 to end of project. Slopes here are capable of supporting stable near-vertical cuts. The exception is the area (shown as area 2 in Plate 2) on this slope where it pulls away from the roadway slightly and has a soil mantle. This area should probably not need cutting due to its already recessed topography, but, should the designer's cut go into this area, consideration must be made for the soil mantle, which will not remain stable at any slope ratio greater than 1:1.

We recommend that our office be consulted during the construction phase when the cuts between stations 110+00 to 112+75 are performed. We believe that geotechnical involvement during the construction phase here is warranted due to the lack of any real subsurface data and the uncertainty of the nature and strength of the material, combined with the surface geologic evidence (rock outcrop orientation and condition, slope orientation and condition...) that indicate at least a moderate possibility that conditions inappropriate for near-vertical cuts will be unearthed during excavation and that unstable masses of rock and/or soil may be left perched, high on a cut, susceptible to rockfall or sliding. In addition, OGDN can provide oversight and review blasting plans to assure compliance and that the objective of protecting the remaining slopes (through proper controlled blasting) is achieved.

If you have any questions or comments, please call Mr. Scott Lewis at (530) 225-3516.

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Associate Engineering Geologist
Office of Geotechnical Design - North

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Attachments:

Appendix A. 19-705 Rock Excavation SSP
Appendix B. 19-706 Rock Excavation (Controlled Blasting) SSP

Plate 1. Aerial Photo With Design Plan View Layout & Primary Area of Geotechnical Investigation
Plate 2. Slope Areas 1, 2, & 3
Plate 3. Photos of Slope Faces at Turn

REFERENCES

Strand, R.G., 1962, Geologic Map of California, Redding Sheet, California Division of Mines and Geology, scale 1:250,000

10-1.__ ROCK EXCAVATION

GENERAL

Summary

This work includes using hydraulic splitters, pneumatic hammers, blasting, or other roadway excavation techniques approved by the Engineer to fracture rock and construct stable final rock cut faces.

This work includes using hydraulic splitters, pneumatic hammers, or other roadway excavation techniques approved by the Engineer to fracture rock and construct stable final rock cut faces. Blasting is not allowed.

Comply with Sections 12, "Construction Area Traffic Control Devices," and 19, "Earthwork," of the Standard Specifications and "Traffic Control" of these special provisions.

Geotechnical reports are available as specified in "Project Information" of these special provisions.

If you choose to use blasting, comply with Federal, State, and local blasting regulations. Regulations containing specific Cal-OSHA requirements for blasting activities include 8 CA Code of Regs, Ch 4, Subchapter 7, Group 18, "Explosive Materials."

Do not perform any drilling or other preparation work for blasting before the Engineer approves the blasting safety plan and personnel assignments. Comply with Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. If, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engieer's delay in completing the submittal review within the specified time, you will be compensated for resulting losses and an extension of time will be granted in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

You are liable for damages resulting from blasting activities.

Submittal

Blasting Safety Plan

Submit 3 copies of a blasting safety plan for review. The plan must include:

1. References to applicable Federal, State, and local codes and regulations
2. Copies of permits required for blasting activities
3. Business name, contractor license number, address, and telephone number of the blasting subcontractor
4. Proof of current liability insurance and bonding
5. Name, address, telephone number, copies of applicable licenses, and resume of:

    5.1. Blaster-in-charge
    5.2. Personnel responsible for blast design, loading, and conducting blasting operations
    5.3. Safety officer for blasting subcontractor

6. Name, address, and telephone number of the local fire station and law enforcement agencies
7. Detailed description of:

    7.1. Location where explosives will be stored
    7.2. Security measures to protect and limit access to the explosives
    7.3. Transportation means for explosives

7.4. List of personnel permitted to handle the explosives

8. Exclusion zone and limited entry zone for nonblast related operations and personnel surrounding loading and blasting operations
9. Details of warning signals used to alert employees on the job site of an impending blast and to indicate the blast is completed and the area is safe to enter
10. How blasting operations will be conducted
11. Measures to protect blasting operations and personnel from lightning
12. Emergency evacuation procedures for areas where explosives may be present
13. How misfires will be recognized, handled, and resolved including:

    13.1. Who will be notified
    13.2. How blast zone will be secured until misfire is resolved
    13.3. Identification of equipment that may be needed to resolve misfires

14. Details of signs to be used around blasting zones including:

    14.1. Timing of when signs will be posted relative to a specific blast
    14.2. Name and telephone number of person responsible for placing signs
    14.3 Roadway signs for compliance with Chapter 6, Typical Application 2, of the California MUTCD.

15. Traffic control details for:

    15.1 Loading and blasting operations
    15.2 Misfire event or other blast related phenomenon that causes a transportation corridor to remain closed to the public

16. Description of possible noxious gas generation and details of safeguards to be used to protect employees, work zones adjacent to the shot, private property, and the public
17. Procedure to report and resolve complaints for blast related accidents
18. Copies of the Material Safety Data Sheets and manufacturer data sheets of explosives, caps, primers, initiators, and other compounds

The Engineer reviews each blasting safety plan submittal within 15 days of receipt. If revisions are needed, you must revise and resubmit the plan. After the plan has been approved by the Engineer, submit 3 additional copies of the approved plan.

MEASUREMENT AND PAYMENT

Rock excavation is measured and paid for by the cubic yard in the same manner as specified for roadway excavation in Sections 19-2.08, "Measurement," and 19-2.09, "Payment," of the Standard Specifications.

Full compensation for preparing and submitting the blasting safety plan is included in the contract price paid per cubic yard for rock excavation and no additional compensation will be allowed therefor.

10-1.__ ROCK EXCAVATION (CONTROLLED BLASTING)

GENERAL

Summary

This work includes using hydraulic splitters, pneumatic hammers, controlled blasting, or other roadway excavation techniques approved by the Engineer to fracture rock and construct stable final rock cut faces.

Comply with Section 19, "Earthwork," of the Standard Specifications and "Traffic Control" of these special provisions.

Geotechnical reports are available as specified in "Project Information" of these special provisions.

Blasting to perform rock excavation must be controlled blasting. Comply with Federal, State, and local blasting regulations. Regulations containing specific Cal-OSHA requirements for blasting activities include 8 CA Code of Regs, Ch 4, Subchapter 7, Group 18, "Explosive Materials." Regulations for explosives containing percholate materials include 22 CA Code of Regs, Division 4.5, Ch 33, "Best Management Practices for Percholate Materials."

Do not perform any drilling or other preparation work for blasting before the Engineer approves all submittals and personnel assignments. Comply with Section 5-1.02, "Plans and Working Drawings," of the Standard Specifications. If, in the opinion of the Engineer, completion of the work is delayed or interfered with by reason of the Engineer's delay in completing the submittal review within the specified time, you will be compensated for resulting losses and an extension of time will be granted in the same manner as provided for in Section 8-1.09, "Right of Way Delays," of the Standard Specifications.

You are liable for damages resulting from blasting activities.

Definitions

controlled blasting: The use of explosives and blasting accessories in predetermined spaced and aligned drill holes to limit blast vibrations, noise (airblast overpressure), and flyrock.

flyrock: Rock that becomes airborne due to blasting.

near field blasting: Blasting within 30 feet of a critical structure.

Submittals

Blasting Safety Plan

Submit 3 copies of a blasting safety plan for review. The plan must include:

1. References to applicable Federal, State, and local codes and regulations
2. Copies of permits required for blasting activities
3. Business name, contractor license number, address, and telephone number of the blasting subcontractor
4. Proof of current liability insurance and bonding
5. Name, address, telephone number, copies of applicable licenses, and resume of:

    5.1. Blaster-in-charge
    5.2. Personnel responsible for controlled blast design, loading, and conducting the blasting operation
    5.3. Safety officer for blasting subcontractor
    5.4. Blast monitoring consultant
    5.5 Blasting consultant

6. Name, address, and telephone number of the local fire station and law enforcement agencies
7. Detailed description of:

    7.1. Location where explosives will be stored
    7.2. Security measures to protect and limit access to the explosives
    7.3. Transportation means for explosives
    7.4. List of personnel permitted to handle the explosives

8. Exclusion zone and limited entry zone for nonblast related operations and personnel surrounding loading and blasting operations
9. Details of warning signals used to alert employees on the job site of an impending blast and to indicate the blast is completed and the area is safe to enter
10. How blasting operations will be conducted
11. Measures to protect blasting operations and personnel from lightning
12. Emergency evacuation procedures for areas where explosives may be present
13. How misfires will be recognized, handled, and resolved including:

    13.1. Who will be notified
    13.2. How blast zone will be secured until misfire is resolved
    13.3. Identification of equipment that may be needed to resolve misfires

14. Details of signs to be used around blasting zones including:

    14.1. Timing of when signs will be posted relative to a specific blast
    14.2. Name and telephone number of person responsible for placing signs
    14.3 Roadway signs for compliance with Chapter 6, Typical Application 2, of the California MUTCD.

15. Traffic control details for:

    15.1 Loading and blasting operations
    15.2 Misfire event or other blast related phenomenon that causes a transportation corridor to remain closed to the public

16. Description of possible noxious gas generation and details of safeguards to be used to protect employees, work zones adjacent to the shot, private property, and the public
17. Procedure to report and resolve complaints for blast related accidents
18. Copies of the Material Safety Data Sheets and manufacturer data sheets of explosives, caps, primers, initiators, and other compounds

The Engineer reviews the blasting safety plan submittal within 15 days of receipt. If revisions are needed, you must revise and resubmit the plan. After the plan has been approved by the Engineer, submit 3 additional copies of the plan.

Controlled Blasting Plan

For each blast submit 3 copies of a controlled blasting plan for review. Each plan must include details on how each blast will be controlled and the following:

1. Blast identification by numerical and chronological sequence
2. Location, referenced to stationing, offset distance, date, and time of blast
3. Drawings showing drill hole pattern, spacing, burden, and initiation sequence
4. Typical cross-sections through zone to be blasted
5. Groundwater level if present within the prism to be blasted
5. Initiation-sequence diagram showing the actual firing time of each delay
6. Type of material to be blasted
7. Number of drill holes
8. Diameter, depth, and spacing of holes
9. Height or length of stemming
10. Types and characteristics of explosives used, including explosive's density, relative strength, and date of manufacture
11. Type of caps and delay periods used and their date of manufacture
12. Total amount of explosives used
13. The total amount of explosives detonating within any 8 millisecond period
14. Powder factor (pounds of explosive per cubic yard of material blasted)
15. Method of firing
16. Direction and distance to nearest building or structure
17. Type and method of instrumentation
18. Location and placement of instruments
19. Measures to limit air noise and flyrock
20. Measures to limit overbreak
21. Name of blasting subcontractor
22. Name and signature of blaster-in-charge
23. Drawings showing spacing and proximity of shot guards to blast location

The Engineer reviews the controlled blasting plan within 15 days of receipt. If revisions are needed, revise and resubmit the plan. After the plan has been approved by the Engineer, submit 3 additional copies of the approved plan.

If changes to the controlled blasting plan are made to adjust for site conditions, these must be submitted for review before implementing.

Quality Control and Assurance

Blaster-In-Charge

Assign a blaster-in-charge responsible for supervising all blasting activities. The blaster-in-charge must have 10 years of experience in performing or supervising similar blasting activities and must be a licensed blaster.

Blast Monitoring Consultant

Assign a blast monitoring consultant to monitor blasting generated vibrations and noise near buildings and structures that may be subject to damage. The monitoring consultant will be responsible for collecting and interpreting vibration and noise data. The blast monitoring consultant must:

1. Not be employed by the blasting contractor or other subcontractor on this project
2. Have a minimum of a 2-year Associate's Degree in science or engineering

3. Have at least 5 years of documented experience in collecting and interpreting ground vibration~~s~~ and noise data

Blasting Consultant

Assign a blasting consultant to oversee near field blasting activities. The blasting consultant must:

1. Be a licensed engineer or geologist
2. Have 10 years experience providing specialized blasting services in near field blasting
3. Not be employed by the blasting contractor, explosive manufacturer, or explosive distributor
4. Submit a resume of credentials and a list of projects worked on

Preblast Surveys

At least 15 days before starting blasting activities, prepare a preblast survey of all buildings and structures within 330 feet of blasting activities and submit it to the Engineer with the controlled blasting plan. The preblast survey must include a written report, sketches, and photos or a videotape with date and time displayed on the image. The preblast survey must include:

1. Name of the person making the inspection
2. Name of property owner and occupants
3. Property address
4. Date and time of the inspection
5. Description of the structure or other improvement including culverts and bridges
6. Detailed description of existing condition of walls, ceiling, and floor of each interior room including attic and basement
7. Detailed description of existing condition of foundations, exterior walls, roofs, doors, windows, and porches
8. Detailed description of existing condition of garages, outbuildings, sidewalks, driveways and swimming pools
9. Detailed listing of highway sign posts, light fixtures, and overhead power lines
10. Survey of wells or other private water supplies including total depth and existing water surface levels
11. Identification of sites conducting procedures, processes, or operations that may be sensitive to blasting activities
12. Scaled map or aerial photo showing the location of structures and properties surveyed and location of all proposed blasting sites

If blasting activities are suspended for a period of 45 days or more, perform another preblast survey and submit it at least 15 days before resuming blasting activities.

After blasting activities are completed, prepare and submit a postblast survey of the same buildings and structures as in the preblast survey. The postblast survey must include all items included in the preblast survey.

Vibration and Noise (Airblast Overpressure) Monitoring

Vibration levels must be kept below peak particle velocity of 2 inches per second at the nearest building or structure.

Noise (airblast overpressure) levels must be kept below 128 Decibels (C-network or Linear network) at the nearest building

Ground vibrations and noise created from blasting shall be controlled by using properly designed delay sequencing and charge weights for shots.

Provide 3 seismographs to be available for deployment. The seismographs must be:

1. Appropriate for controlled blasting activities
2. Capable of:

    2.1. Recording particle velocities for 3 mutually perpendicular components of vibration and instantaneous resultant peak vector sum in the range generally found with controlled blasting
    2.2. Continuously measuring, recording, and reporting vibrations along 3 primary axes
    2.3. Measuring and recording vibration frequencies ranging from 2 to 300 Hz
    2.4. Providing a printed record of each event showing a plot of peak particle velocity versus vibration frequencies
    2.5. Measuring and recording airblast noise levels. The noise transducer must be detachable from main unit to allow placing at elevations with a clear line of sight between transducer and blast

Record each blast shot using approved seismographs and prepare a vibration and noise monitoring report. The report must include:

1. Identification of instruments used
2. Name of blast monitoring consultant
3. Distance and direction of recording stations from blast area
4. Type of ground at recording station and material on which instrument sits
5. Maximum particle velocity in each component and resultant peak particle velocity of each shot
6. Copy of seismograph readings with date and signature of blast monitoring consultant
7. Noise levels recorded in Decibels (C-network or Linear network) units

Video Recording of Blasts

Video-record each blast. The video-recording must be taken from a safe location with a clear view of the blast area, activities, and progression. Identify each video or section of video with an index to properly identify each blast. Submit a copy of each video in DVD-Video format to the Engineer.

Blasting Complaints

Accurately document complaints. Notify the Engineer immediately of complaints received or at the start of the next day's work shift. Complaint documentation must include:

1. Name and address of complainant
2. Date, time, and nature of complaint
3. Dated photo or videotape of physical damage
4. Name of person receiving complaint
5. Record of complaint investigation conducted
6. Resolution of complaint

Postblast Reports

Document each shot in a postblast report. The postblast report must include all data required in the controlled blasting plan for that shot and the following:

1. Description of site conditions, loading, and time of blast
2. Description of weather conditions at time of blast including wind direction and cloud cover
3. Drillers boring record
4. Copy of vibration and noise monitoring report
5. Copy of document complaints arising from blast

Submit the postblast report within 48 hours of the blast.

CONSTRUCTION

At least 7 days before starting or resuming blasting activities, notify in writing occupants of the local buildings within 330 feet of the blasting area. Also, verbally notify occupants of pending blasting activities on the day of blasting.

Do not perform blasts within 1200 feet of concrete that has been placed within 72 hours.

Before firing any blast, confirm that groundwater conditions are consistent with shot design and explosive type to be used.

Before firing any blast in areas where flyrock may result in personal injury or damage to property or the work, cover the rock to be blasted with blasting mats, soil, or other equally serviceable material to prevent flyrock.

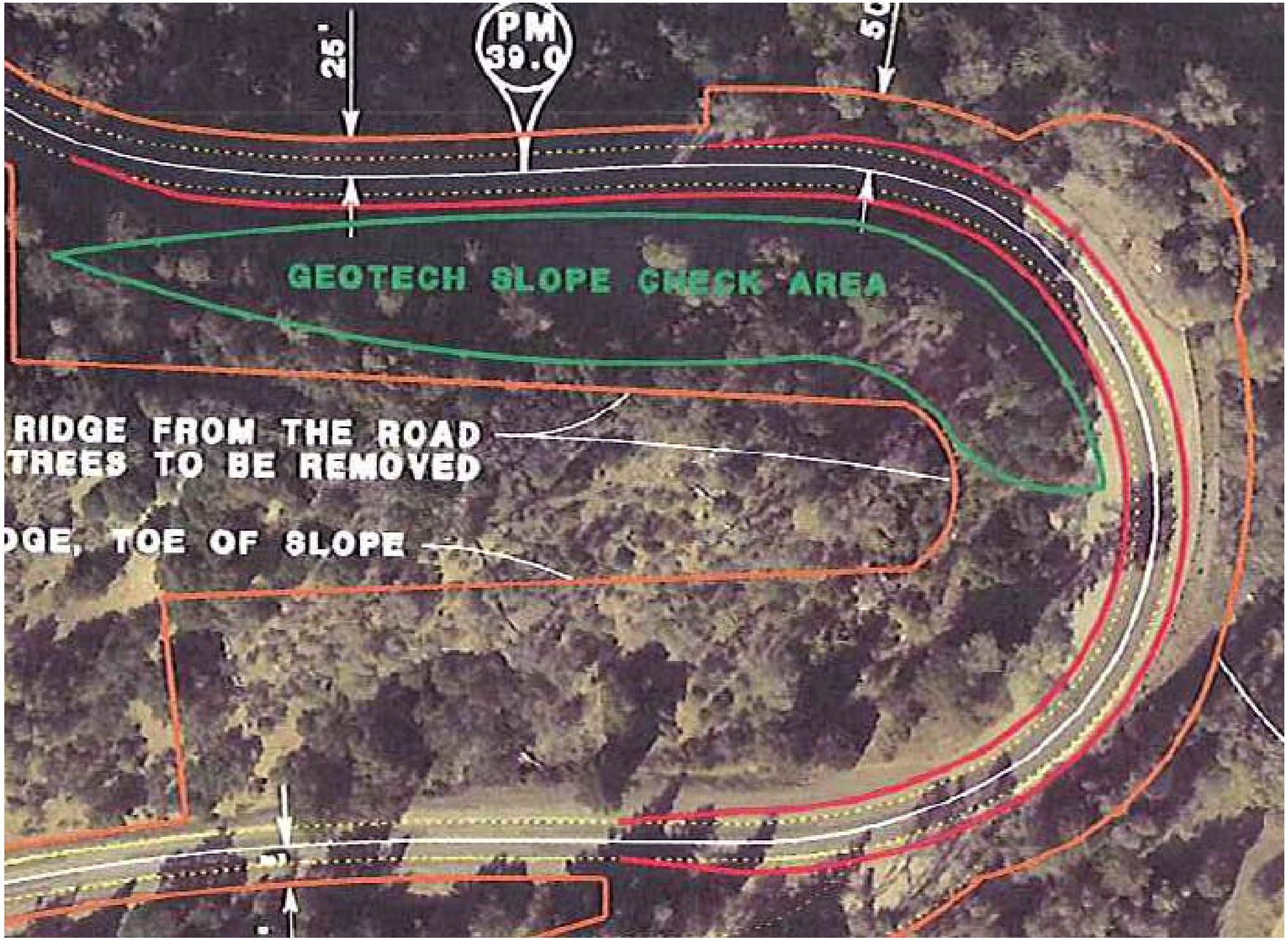
If blasting causes flyrock, suspend blasting activities. The blasting consultant must review the site to determine the cause of the flyrock problem and provide an amendment to the controlled blasting plan that prevents flyrock.

Do not use drill cuttings as stemming in controlled blasting operations.

MEASUREMENT AND PAYMENT

Rock excavation (controlled blasting) is measured and paid for by the cubic yard in the same manner as specified for roadway excavation in Sections 19-2.08, "Measurement," and 19-2.09, "Payment," of the Standard Specifications.

Full compensation for preparing and submitting blasting safety plan and controlled blasting plan is included in the contract price paid per cubic yard for rock excavation (controlled blasting) and no additional compensation will be allowed therefor.



CALTRANS
Division of Engineering Services
Geotechnical Services
Office of Geotechnical Design-
North

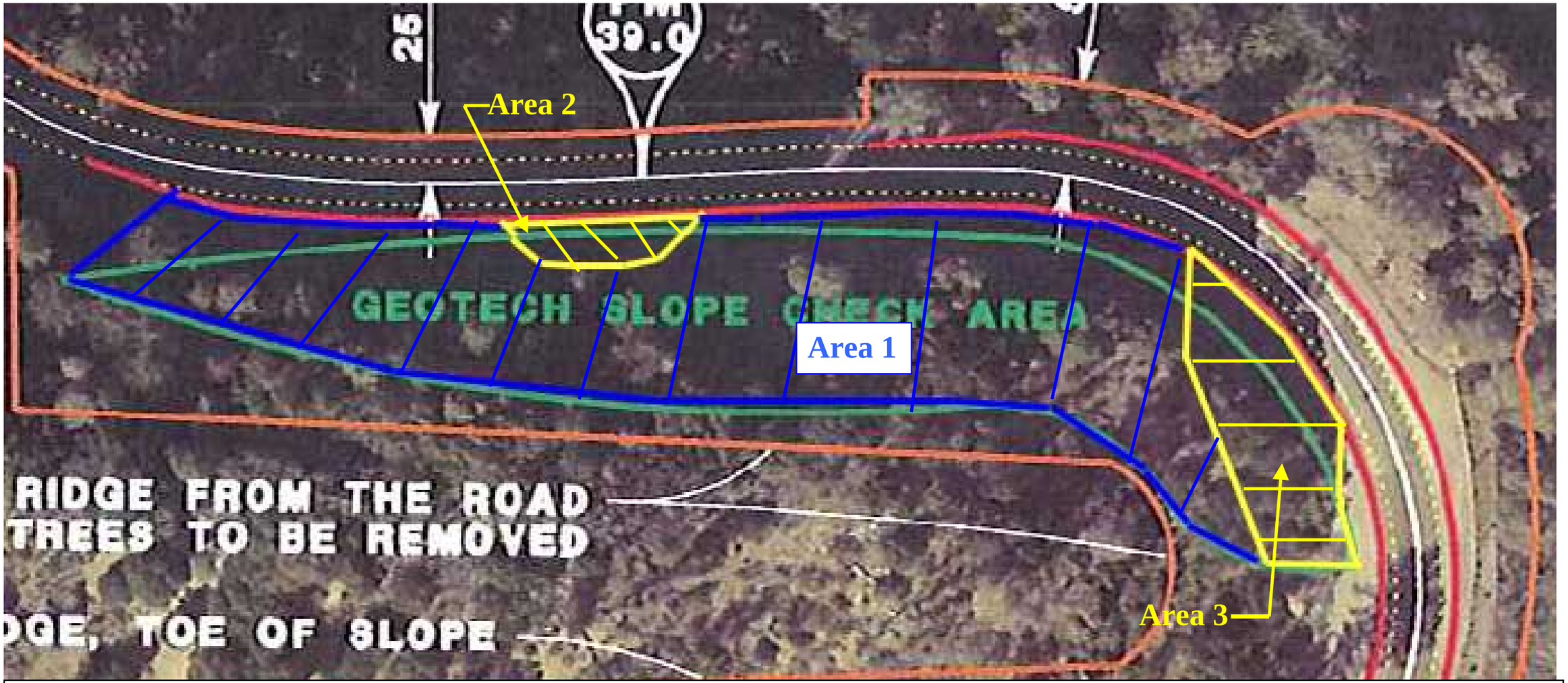
EA: 02-1E2100

Date: October 2009

AERIAL PHOTO WITH DESIGN PLAN VIEW LAYOUT & PRIMARY AREA OF GEOTECHNICAL INVESTIGATION

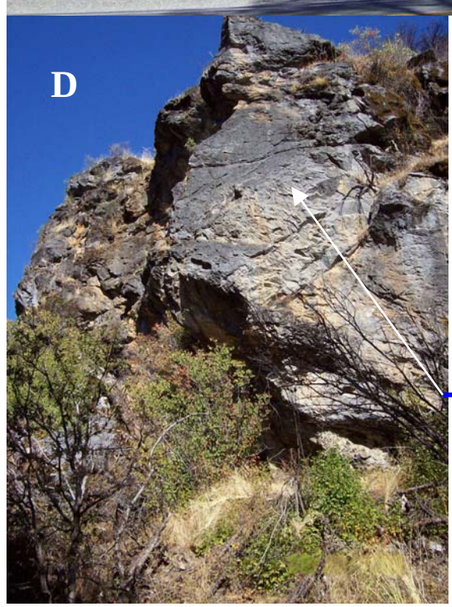
02-TRI-299 PM 38.8/39.0
DISTRICT PRELIMINARY GEOTECHNICAL REPORT

Plate
No. 1



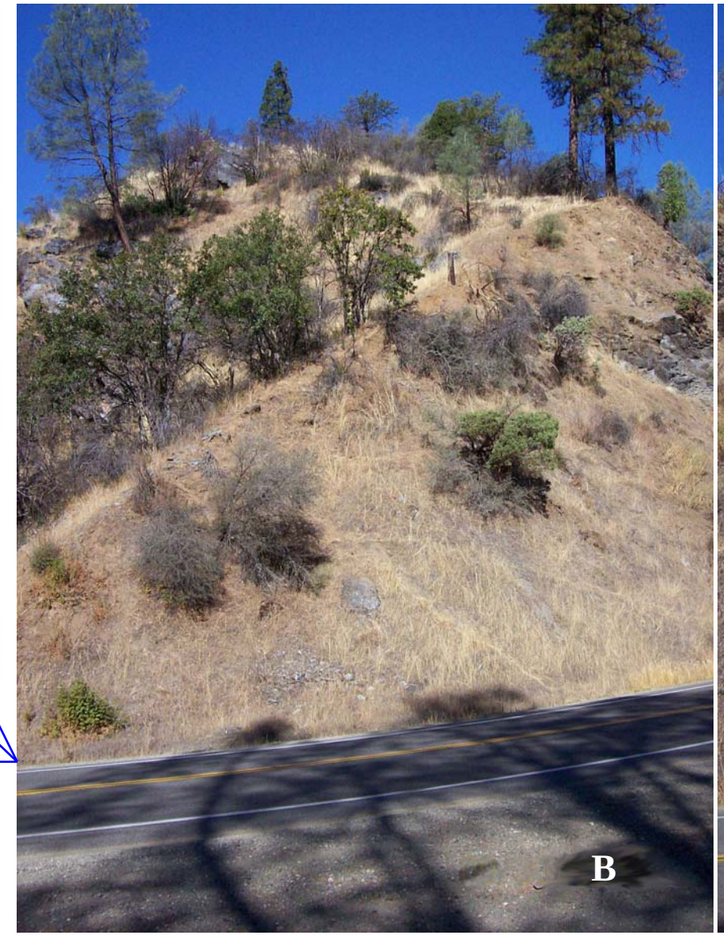
Slope Areas 1, 2, & 3. Slope areas demarcated from field reconnaissance efforts. These areas demonstrate different properties and capacities to handle steep cuts. **Area 1** (Blue outline with blue hachure lines) is predominantly massive mildly metamorphosed limestone or carbonate rock capable of handling stable near-vertical (0.1:1) cuts. **Area 2** (yellow outline with diagonal hachure lines) is a localized area where the slope contours pull away from the roadway due to a slight draw in the slope topography. This area will not support near-vertical cuts because of the soil (which must be laid back no steeper than 1:1). **Area 3** (yellow outline with horizontal hachure lines) is the complex structural and engineering geology area. Though much of the material may in fact be hard competent rock that is stable, some may in fact be weathered and/or situated in a potentially unstable position for cutting steeply. In addition, colluvial bodies are observed here with unknown thicknesses.

Caltrans	CALTRANS Division of Engineering Services Geotechnical Services Office of Geotechnical Design-North	EA: 02-1E2100 Date: October 2009	**SLOPE AREAS 1, 2, & 3**
		02-TRI-299 PM 38.8/39.0 **DISTRICT PRELIMINARY GEOTECHNICAL REPORT**	Plate No. 2



Steep colluvium veneers or wedges

Massive rock structure



CALTRANS Division of Engineering Services Geotechnical Services Office of Geotechnical Design-North	EA: 02-1E2100 Date: October 2009	**PHOTOS OF SLOPE FACES AT TURN**	
	02-TRI-299 PM 38.8/39.0 **DISTRICT PRELIMINARY GEOTECHNICAL REPORT**		Plate No. 3