FOUNDATION REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

To: **Structure Design**
1. Design
2. R.E. Pending File
3. Specifications & Estimates
4. File

Geotechnical Services
1. GD - North ; South ; West
2 GS File Room

Date: 3/4/03

Rancho Bernardo - NB. On
Structure Name SB. Off

11 - SD - 15 - 37.3
District County Route km Post

District Project Development
District Project Engineer

11-080911 57-1108K's
E.A. Number Structure Number

Foundation Report By: H. Valencia Dated: 2/13/03

Reviewed By: S. Ohlhaver (SD) R. Price (GS)

General Plan Dated: 2/28/03 Foundation Plan Dated: 2/28/03

☑ No changes. ☐ The following changes are necessary.

FOUNDATION CHECKLIST

- ✓ Pile Types and Design Loads
- ✓ Pile Lengths
- ✓ Predrilling
- ✓ Pile Load Test
- ✓ Substitution of H Piles For Concrete Piles ☐ Yes ☐ No
- ✓ Footing Elevations, Design Loads, and Locations
- ✓ Seismic Data
- ✓ Location of Adjacent Structures and Utilities
- ✓ Stability of Cuts or Fills
- ✓ Fill Time Delay
- ✓ Effect of Fills on Abutments and Bents
- ✓ Fill Surcharge
- ✓ Approach Paving Slabs
- ✓ Scour
- ✓ Ground Water
- ✓ Tremie Seals/Type D Excavation

Yenhsi Chang for
Structure Design Bridge Design Branch No.

Geotechnical Services

Rev. 06/02

FOUNDATION REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

To: **Structure Design**
1. Design
2. R.E. Pending File
3. Specifications & Estimates
4. File

Geotechnical Services
1. GD - North ; South ; West
2 GS File Room

Date: 2/4/03

Rancho Bernardo - SB 01-Ra
Structure Name N.B. Offramp

11 - SD - 15 - 37.3
District County Route km Post

District Project Development
District Project Engineer

11-080911 52-1107 K/S
E.A. Number Structure Number

Foundation Report By: H. Valencia Dated: 2/13/03

Reviewed By: S. Phillon (SD) R. Price (GS)

General Plan Dated: 2/28/03 Foundation Plan Dated: 2/28/03

☒ No changes. ☐ The following changes are necessary.

FOUNDATION CHECKLIST

- ✓ Pile Types and Design Loads
- ✓ Pile Lengths
- ✓ Predrilling
- ✓ Pile Load Test
- ✓ Substitution of H Piles For Concrete Piles ☐ Yes ☐ No
- ✓ Footing Elevations, Design Loads, and Locations
- ✓ Seismic Data
- ✓ Location of Adjacent Structures and Utilities
- ✓ Stability of Cuts or Fills
- ✓ Fill Time Delay
- ✓ Effect of Fills on Abutments and Bents
- ✓ Fill Surcharge
- ✓ Approach Paving Slabs
- ✓ Scour
- ✓ Ground Water
- ✓ Tremie Seals/Type D Excavation

for
Structure Design Bridge Design Branch No.

Geotechnical Services

Rev. 06/02

FOUNDATION REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

To: **Structure Design**
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4. File

Geotechnical Services
1. GD - North ; South ; West
2 GS File Room

Date: 3/4/03

Rancho Bernardo Bernardo Direct Access Road
Structure Name

11 - SD - 15 - 37.3
District County Route km Post

11-080911
~~2/13/03~~ 57-1167
E.A. Number Structure Number

District Project Development
District Project Engineer

Foundation Report By: H. Valencia Dated: 2/13/03

Reviewed By: S. O'Hillan (SD) R. Price (GS)

General Plan Dated: 2/28/03 Foundation Plan Dated: 2/28/03

☒ No changes. ☐ The following changes are necessary.

FOUNDATION CHECKLIST

- ✓ Pile Types and Design Loads
- ✓ Pile Lengths
- ✓ Predrilling
- ✓ Pile Load Test
- ✓ Substitution of H Piles For Concrete Piles ☐ Yes ☒ No
- ✓ Footing Elevations, Design Loads, and Locations
- ✓ Seismic Data
- ✓ Location of Adjacent Structures and Utilities
- ✓ Stability of Cuts or Fills
- ✓ Fill Time Delay
- ✓ Effect of Fills on Abutments and Bents
- ✓ Fill Surcharge
- ✓ Approach Paving Slabs
- ✓ Scour
- ✓ Ground Water
- ✓ Tremie Seals/Type D Excavation

Structure Design Bridge Design Branch No.

Geotechnical Services

Rev. 06/02

FOUNDATION REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

To: **Structure Design**
1. Design
2. R.E. Pending File
3. Specifications & Estimates
4. File

Geotechnical Services
1. GD - North ; South ; West
2 GS File Room

Date: 3/4/03

Rancho Bernardo Rd. UC
Structure Name

11 - SD - 15 - 38.1
District County Route km Post

District Project Development
District Project Engineer

11-080911 57-0578
E.A. Number Structure Number

Foundation Report By: M. Spehn Dated: 12/11/02

Reviewed By: S. O'Hallon (SD) R. Price (GS)

General Plan Dated: 12/11/02 Foundation Plan Dated: 3/3/03

☒ No changes. ☐ The following changes are necessary.

FOUNDATION CHECKLIST

- ✓ Pile Types and Design Loads
- ✓ Pile Lengths
- ✓ Predrilling
- ✓ Pile Load Test
- ✓ Substitution of H Piles For Concrete Piles ☐ Yes ☒ No
- ✓ Footing Elevations, Design Loads, and Locations
- ✓ Seismic Data
- ✓ Location of Adjacent Structures and Utilities
- ✓ Stability of Cuts or Fills
- ✓ Fill Time Delay
- ✓ Effect of Fills on Abutments and Bents
- ✓ Fill Surcharge
- ✓ Approach Paving Slabs
- ✓ Scour
- ✓ Ground Water
- ✓ Tremie Seals/Type D Excavation

for
Structure Design Bridge Design Branch No.

Geotechnical Services

Rev. 06/02

FOUNDATION REVIEW

DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

To: **Structure Design**
1. Design
2. R.E. Pending File
3. Specifications & Estimates
4. File

Geotechnical Services
1. GD - North ; South ; West
2 GS File Room

Date: 3/5/03

Bernardo Center Dr. UC
Structure Name

11 - SD - 15 - 38.3
District County Route km Post

District Project Development
District Project Engineer

11-080911 57-1118R/L
E.A. Number Structure Number

Foundation Report By: E. Newport Dated: 12/19/02; 1/29/03; 2/10/03

Reviewed By: S. Phillan (SD) R. Price (GS)

General Plan Dated: 3/4/03 Foundation Plan Dated: 3/4/03

☒ No changes. ☐ The following changes are necessary.

FOUNDATION CHECKLIST

- ✓ Pile Types and Design Loads
- ✓ Pile Lengths
- ✓ Predrilling
- ✓ Pile Load Test
- ✓ Substitution of H Piles For Concrete Piles ☐ Yes ☐ No
- ✓ Footing Elevations, Design Loads, and Locations
- ✓ Seismic Data
- ✓ Location of Adjacent Structures and Utilities
- ✓ Stability of Cuts or Fills
- ✓ Fill Time Delay
- ✓ Effect of Fills on Abutments and Bents
- ✓ Fill Surcharge
- ✓ Approach Paving Slabs
- ✓ Scour
- ✓ Ground Water
- ✓ Tremie Seals/Type D Excavation

for

Structure Design Bridge Design Branch No. Geotechnical Services

Rev. 06/02

State of California

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: SURJIT DHILLON, SENIOR
Structures Design
Office of Bridge Design South
Bridge Design Branch 15
MS - 9 - 3/3G

Date: April 3, 2003

File: 11-SD-15-KP 31.3
11-080911
Rancho Bernardo Main Access
Ramp & Direct Access Ramps
Br. No. 57-1107,
Br. No. 57-1107 K&S,
Br. No. 57-1108 K&S

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 2 (MS #5)

Subject: Revised Foundation Recommendations

Introduction

The following revised foundation recommendations are in response to a memorandum from the Office of Bridge Design South (OBDS) dated February 26, 2003, requesting "revised" foundation recommendations to prior foundation recommendations for the Rancho Bernardo Main Access Ramp (Br. No. 57-1107) and its connecting Direct Access Ramps (Br. No. 57-1107 K&S and 57-1108 K&S). This report supercedes the "original" foundation recommendations for the above mentioned structures (dated February 13, 2003) and was prepared in order to address increased load demands at all support locations with the exception of Abutment 1 of the Main Access Ramp (57-1107). In order to avoid confusion, the pile data tables given below will cover all support locations. The sole purpose for this "revised" foundation report is to provide new specified pile tip elevations for the above mentioned structures.

Foundation Recommendations

The following recommendations are for the proposed Rancho Bernardo Main Access Ramp (Br. No. 57-1107) and its connecting Direct Access Ramps, Northbound Off and On-Ramp (Br. No. 57-1107S & 57-1108S) and Southbound Off and On Ramps (Br. No. 57-1108K & 57-1107K). At all bent locations, Cast-In-Drilled Hole (CIDH) piles are recommended for support. At all abutment locations, driven steel piles are recommended for support. At Abutment 5 for the Southbound Off-Ramp (Br. No. 57-1108K) and Abutment 4 for the Northbound On-Ramp (Bridge No. 57-1108S), spread footings may also be used for support as an alternate foundation type (see "original" foundation recommendations for details). The foundation loads and pile cut-off elevations given in this report are based on the information included in the request memorandum (dated February 26, 2003) mentioned above.

Rancho Bernardo Main Access Ramp (Br. No. 57-1107)

At the Abutment 1 location for the Main Access Ramp, driven Modified "Class 900", Alternative "W" closed-end, steel pipe piles are recommended for support. All abutment pipe piles are to be driven with steel plates welded to the base of the pile in order to be considered closed-end. At all bent locations, it is possible to utilize 610mm, Cast-In-Drilled-Hole (CIDH) piles for support. The specified pile tip elevations, listed below in Table 1, were developed using the Rancho Berndardo Main Access Ramp, General Plan No. 1 (dated 12-10-02). The ultimate geotechnical pile capacity for the piles will meet or exceed the required nominal resistance in compression listed below in Table 1.

Table 1: Pile Data: Rancho Bernardo Main Access Ramp (Br. No. 57-1107)

Support Location	Pile Type	Design Loading	Nominal Resistance		Bottom of Pile Cap Elevation (m)	Design Tip Elevation (m)	Specified Tip Elevation (m)
			Compression	Tension			
Abutment 1	Modified Class 900, Alt "W" *	900 kN	1800 kN	0 kN	183.6	170.8 (1)	170.8
Bent 2	610 mm CIDH	N/A	2350 kN	450 kN	176.8	174.3 (2) 165.5 (1)	165.5
Bent 3	610 mm CIDH	N/A	2350 kN	450 kN	175.1	171.0 (2) 161.9 (1)	161.9

Note: Design tip elevation is controlled by the following demands: (1) Compression, (2) Tension.
* Modified "Class 900", Alternative "W" closed-end, steel pipes piles must have a steel plate welded to the base of the pile. The Design Tip Elevation for compression at the abutment location is based on the pile being closed ended.

Direct Access Ramp – Southbound On-Ramp (Br. No. 57-1107K)

At the Abutment 1 location for the Southbound On-Ramp, driven Modified "Class 900", Alternative "W" closed-end, steel pipe piles are recommended for support. All abutment pipe piles are to be driven with steel plates welded to the base of the pile in order to be considered closed-end. At all bent locations, it is possible to utilize 610mm, Cast-In-Drilled-Hole (CIDH) piles for support. The specified pile tip elevations, listed below in Table 2, were developed using the Southbound On-Ramp, General Plan (dated 10-7-02). The ultimate geotechnical pile capacity for the piles will meet or exceed the required nominal resistance in compression listed below in Table 2.

Table 2: Pile Data: Direct Access Ramp – Southbound On-Ramp (Br. No. 57-1107K)

Support Location	Pile Type	Design Loading	Nominal Resistance		Bottom of Pile Cap Elevation (m)	Design Tip Elevation (m)	Specified Tip Elevation (m)
			Compression	Tension			
Abutment 1	Modified Class 900, Alt "W" *	900 kN	1800 kN	0 kN	180.1	167.9 (1)	167.9
Bent 2	610 mm CIDH	N/A	2850 kN	900 kN	175.1	169.6 (2) 162.3 (1)	162.3
Bent 3	610 mm CIDH	N/A	2850 kN	900 kN	176.2	167.9 (2) 161.8 (1)	161.8
Bent 4	610 mm CIDH	N/A	2850 kN	900 kN	176.9	171.0 (2) 163.6 (1)	163.6

Note: Design tip elevation is controlled by the following demands: (1) Compression, (2) Tension.
* Modified "Class 900", Alternative "W" closed-end, steel pipes piles must have a steel plate welded to the base of the pile. The Design Tip Elevation for compression at the abutment location is based on the pile being closed ended.

Direct Access Ramp – Northbound Off-Ramp (Br. No. 57-1107S)

At the Abutment 1 location for the Northbound Off-Ramp, driven Modified "Class 900", Alternative "W" closed-end, steel pipe piles are recommended for support. All abutment pipe piles are to be driven with steel plates welded to the base of the pile in order to be considered closed-end. At all bent locations, it is possible to utilize 610-mm Cast-In-Drilled-Hole (CIDH) piles for support. The specified pile tip elevations, listed below in Table 3, were developed using the Northbound Off-Ramp, General Plan (dated 10-7-02). The ultimate geotechnical pile capacity for the piles will meet or exceed the required nominal resistance in compression listed below in Table 3.

Table 3: Pile Data: Direct Access Ramp – Northbound Off-Ramp (Br. No. 57-1107S)

Support Location	Pile Type	Design Loading	Nominal Resistance		Bottom of Pile Cap Elevation (m)	Design Tip Elevation (m)	Specified Tip Elevation (m)
			Compression	Tension			
Abutment 1	Modified Class 900, Alt "W" *	900 kN	1800 kN	0 kN	177.9	164.6 (1)	164.6
Bent 2	610 mm CIDH	N/A	2850 kN	900 kN	173.8	168.6 (2) 161.0 (1)	161.0
Bent 3	610 mm CIDH	N/A	2850 kN	900 kN	174.6	169.0 (2) 161.5 (1)	161.5
Bent 4	610 mm CIDH	N/A	2850 kN	900 kN	175.5	171.0 (2) 162.5 (1)	162.5
Bent 5	610 mm CIDH	N/A	2850 kN	900 kN	175.5	170.7 (2) 162.5 (1)	162.5

Note: Design tip elevation is controlled by the following demands: (1) Compression, (2) Tension.

* Modified "Class 900", Alternative "W" closed-end, steel pipes piles must have a steel plate welded to the base of the pile. The Design Tip Elevation for compression at the abutment location is based on the pile being closed ended.

Direct Access Ramp – Southbound Off-Ramp (Br. No. 57-1108K)

At all bent locations for the Southbound Off-Ramp, it is possible to utilize 610-mm Cast-In-Drilled-Hole (CIDH) piles for support. At the Abutment 5 location for the Southbound Off-Ramp, driven HP 356X174 steel "H" piles are recommended for support. The specified pile tip elevations, listed below in Table 4, were developed using the Southbound Off-Ramp, General Plan No. 1 (dated 12-17-02). The ultimate geotechnical pile capacity for the piles will meet or exceed the required nominal resistance in compression listed below in Table 4.

Table 4: Pile Data: Direct Access Ramp – Southbound Off-Ramp (Br. No. 57-1108K)

Support Location	Pile Type	Design Loading	Nominal Resistance		Bottom of Pile Cap Elevation (m)	Design Tip Elevation (m)	Specified Tip Elevation (m)
			Compression	Tension			
Bent 1	610 mm CIDH	N/A	2850 kN	900 kN	176.8	173.0 (2) 165.2 (1)	165.2
Bent 2	610 mm CIDH	N/A	2850 kN	900 kN	176.2	166.3 (2) 160.2 (1)	160.2
Bent 3	610 mm CIDH	N/A	2850 kN	900 kN	174.8	164.3 (2) 158.5 (1)	158.5
Bent 4	610 mm CIDH	N/A	2850 kN	900 kN	172.6	160.9 (2) 155.4 (1)	155.4
Abut 5	HP 356X174 "H" Piles	900 kN	1800 kN	0 kN	176.3	163.1 (1)	163.1

Note: Design tip elevation is controlled by the following demands: (1) Compression, (2) Tension.

Direct Access Ramp – Northbound On-Ramp (Br. No. 57-1108S)

At all bent locations for the Northbound On-Ramp, it is possible to utilize 610-mm Cast-In-Drilled-Hole (CIDH) piles for support. At the Abutment 4 location for the Northbound On-Ramp, driven HP 356X174 steel "H" piles are recommended for support. The specified pile tip elevations, listed below in Table 5, were developed using the Northbound On-Ramp, General Plan No. 1 (12-17-02). The ultimate geotechnical pile capacity for the piles will meet or exceed the required nominal resistance in compression listed below in Table 5.

Table 5: Pile Data: Direct Access Ramp – Northbound On-Ramp (Br. No. 57-1108S)

Support Location	Pile Type	Design Loading	Nominal Resistance		Bottom of Pile Cap Elevation (m)	Design Tip Elevation (m)	Specified Tip Elevation (m)
			Compression	Tension			
Bent 1	610 mm CIDH	N/A	2850 kN	900 kN	175.3	169.2 (2) 160.0 (1)	160.0
Bent 2	610 mm CIDH	N/A	2850 kN	900 kN	174.5	165.4 (2) 159.6 (1)	159.6
Bent 3	610 mm CIDH	N/A	2850 kN	900 kN	172.1	164.2 (2) 159.3 (1)	159.3
Abut 4	HP 356X174 "H" Piles	725 kN	1800 kN	0 kN	174.6	160.3 (1)	160.3

Note: Design tip elevation is controlled by the following demands: (1) Compression, (2) Tension.

The recommendations contained in this report are based on specific project information regarding design loads and structure locations that has been provided by OBDS. The "General Notes" and "Construction Considerations" detailed in the "original" Foundation Recommendations for the proposed Rancho Bernardo Main Access Ramp (Br. No. 57-1107) and its connecting Direct Access Ramps, Northbound Off and On-Ramp (Br. No. 57-1107S & 57-1108S) and Southbound Off and On Ramps (Br. No. 57-1108K & 57-1107K) are still applicable and shall be followed with regards to the above mentioned revised foundation recommendations. If any conceptual changes are made during final project design, the Office of Geotechnical Design South 2, Design Branch B should review those changes to determine if the foundation recommendations provided in this report are still applicable. Any questions regarding the above recommendations should be directed to the attention of Hector Valencia (916) 227-4555 (CALNET 498-4555) or Mark DeSalvatore (916) 227-5391 (CALNET 498-5391), Office of Geotechnical Design South 2, Branch B.

Prepared by: Date:

Not Available to Sign

Hector Valencia
Associate Engineering Geologist
Office of Geotechnical Design – South 2
Branch B

Supervised by: Date: 4/7/03

Mark DeSalvatore, RCE# C 39499
Senior Materials and Research Engineer
Office of Geotechnical Design – South 2
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REGISTERED PROFESSIONAL ENGINEER
MARK DeSALVATORE
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CIVIL
STATE OF CALIFORNIA

cc: R.E. Pending File
John Stayton – Specs & Estimates
Tony Marquez – Project Mgmt
Dave Pajouhesh – PCE
Lawrence Carr – District 11, Project Manager
Marcelo Peinado – District 11, Design Project Manager
Abbas Abghari – OGDS2
Project File
Project File - South

State of California

Business, Transportation and Housing Agency

Memorandum

Flex your power!
Be energy efficient!

To: SURJIT DHILLON, SENIOR
Structures Design
Office of Bridge Design South
Bridge Design Branch 15
MS - 9 - 3/3G

Date: February 13, 2003

File: 11-SD-15-KP 31.3
11-080911
Rancho Bernardo Main Access Ramp & Direct Access Ramps
Br. No. 57-1107,
Br. No. 57-1107 K&S,
Br. No. 57-1108 K&S

From: **DEPARTMENT OF TRANSPORTATION**
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES
OFFICE OF GEOTECHNICAL DESIGN – SOUTH 2 (MS #5)

Subject: Foundation Recommendations

Introduction

This report presents the foundation recommendations for the proposed Rancho Bernardo Main Access Ramp (Br. No. 57-1107) and its connecting Direct Access Ramps (Br. No. 57-1107 K&S and 57-1108 K&S). The Office of Geotechnical Design South 2, Branch B (OGDS2B) completed a foundation investigation pursuant to the October 9, 2001 request by the Office of Bridge Design South (OBDS) for a foundation investigation and recommendations for the proposed structure.

The following foundation recommendations are based on the subsurface information gathered during a recent foundation investigation (December 2001 to August 2002) along with a review of subsurface information for nearby bridge structures. With regards to the current foundation recommendations given in this report, elevations are based on NAVD 88 vertical datum and horizontal coordinates are based on CCS 83 horizontal datum.

Project / Site Description

The bridge site for the 5 proposed structures described above is located in the Rancho Bernardo area between Bernardo Center Drive Undercrossing (Br. No. 57-0577) and Rancho Bernardo Road Undercrossing (Br. No. 57-0578) on Route 15. These structures are part of the I-15 Managed Lanes Project aimed at improving traffic mobility on Route 15 between the Escondido area and San Diego. The proposed structures will allow managed lane commuters access to and from the proposed Rancho Bernardo Transit Center, which will be located immediately west of this project site. Currently at this location, Route 15 consists of an 8-lane divided highway.

The proposed Rancho Bernardo Main Access Ramp (Bridge No. 57-1107), which measures approximately 74.3 m in length and approximately 28 m in width, will be the main structure which provides commuters, using the proposed managed lanes, access (via the Direct Access Ramps) to

and from the proposed Transit Center located west of this structure. The Rancho Bernardo Main Access Ramp will consist of a two span, cast-in-place, pre-stressed concrete box girder type structure, which will span the proposed Route 15 managed lanes and southbound lanes. The layout of the proposed structure is shown on the Rancho Bernardo Main Access Ramp, General Plan No. 1, provided by OBDS and dated December 10, 2002.

The proposed Rancho Bernardo Direct Access Ramps, Northbound and Southbound Off-Ramp structures (Bridge No. 57-1107S & 57-1108K), which measure between 143.4 m and 147.9 m in length and approximately 8.1 m in width, will provide commuters, using proposed managed lanes, access to the Rancho Bernado Main Access Ramp and the proposed Transit Center. The proposed Rancho Bernardo Direct Access Ramps, Northbound and Southbound Off-Ramp structures will consist of a four span, cast-in-place, pre-stressed concrete box girder type structure, which will connect to the proposed Rancho Bernardo Main Access Ramp. The layout of the proposed structures are shown on the General Plan sheets for the proposed Rancho Bernardo Direct Access Ramps, Northbound and Southbound Off-Ramp structures, provided by OBDS and dated October 7, 2002 & December 17, 2002, respectively.

The proposed Rancho Bernardo Direct Access Ramps, Northbound and Southbound On-Ramp structures (Bridge No. 57-1108S & 57-1107K), which measure between 112.7 m and 105.5 m in length and approximately 8.1 m in width, will provide commuters, using the proposed Transit Center, access to proposed managed lanes. The proposed Rancho Bernardo Direct Access Ramps, Northbound and Southbound On-Ramp structures will consist of a three span, cast-in-place, pre-stressed concrete box girder type structure, which will connect to the proposed Rancho Bernardo Main Access Ramp. The layout of the proposed structures are shown on the General Plan sheets for the proposed Rancho Bernardo Direct Access Ramps, Northbound and Southbound On-Ramp structures, provided by OBDS and dated December 17, 2002 & October 7, 2002, respectively.

Geology

The recent foundation investigation performed for the proposed widening consisted of eighteen mud-rotary, sampled borings advanced with wireline-diamond coring methods extending down to a maximum depth of 32.0 m (105.0 ft) and four supplemental 64-mm diameter dynamic-displacement (hydraulically driven) soil soundings that were also done to aid in characterizing the subsurface conditions at the site. The foundation investigation was started in December 2001 and was completed in August 2002. The foundation investigation revealed that the regional geology across the site is variable and can be separated into three generalized profiles for the purposes of this report.

- Profile 1 (Northbound Off-Ramp, Southbound On-Ramp, & Main Access Ramp)

In Profile 1 area (approximately Sta. 382+80 to 384+60 "SD-15M" Line), the geology consists of a thin layer of fill over poorly cemented (soil-like) sedimentary rock interpreted to be Eocene in age and part of the La Jolla Group (Friars Formation). The foundation investigation revealed that earth materials encountered within the Profile 1 area can be generally separated into two units.

The upper unit is a thin layer of fill consisting of medium dense to dense clayey and silty sand with scattered gravel and cobbles. The fill soils are underlain by moderately to weakly cemented (soil-like) sedimentary (formational) rock that consists typically of moderately soft to soft, sandstone, siltstone and claystone with localized well cemented, cobble to boulder sized blocks of hard sedimentary rock. In this unit, the sedimentary (formational) rock was typically more competent and equivalent to a very hard cohesive soil or a very dense granular soil with localized hard and very soft zones. Localized very soft (less competent) zones included sheared zones up to 2.5 m thick. This sedimentary rock was encountered at depths varying from 0.5 to 4.3 m below the existing ground surface (elevation 176.9 m in Boring B-18-02 to elevation 177.8 m in Boring B-20-02, respectively). In the Profile 1 area, this lower unit extended down to the maximum explored depth of 30.5 m (elevation 146.9 m in Boring B-18-02).

- Profile 2 (N.B. On-Ramp Bent 1, Bent 2 & S.B. Off-Ramp Bent 1 and Bent 2)

In Profile 2 area (approximately Sta. 384+60 to 385+10 "SD-15M" Line), the geology is a transitional area between Profile 1 and Profile 3 (discussed later). The geology at the site consists of a thin layer of fill and alluvial soil over sedimentary (formational) rock described above in Profile 1. Below this sedimentary rock, igneous (granitic) rock was encountered and interpreted to be Mesozoic in age and part of Southern California Batholith. The foundation investigation revealed that earth materials encountered within the Profile 2 area can be generally separated into four units.

The upper unit is a thin layer of fill consisting of medium dense to dense, silty & clayey sand and well graded sand with scattered gravel, cobbles and boulders. The fill soils are underlain by a thin layer of alluvial soil consisting of firm to stiff clay and medium dense and dense sand with silt and gravel. This unit was encountered at depths varying from 2.4 to 5.8 m below the existing ground surface (elevation 174.1 m in Boring B-17-02 to elevation 170.6 m in Boring B-16-02, respectively). The alluvial soils are underlain by sedimentary (formational) rock described above and consisting of typically soft to moderately soft, siltstone and claystone with localized very soft and well-cemented, moderately hard zones. In this unit, the sedimentary (formational) rock was typically more competent and equivalent to a very hard cohesive soil or a very dense granular soil with localized moderately hard and very soft zones. Localized very soft (less competent) zone included sheared zones up to 1.6 m thick. This unit was encountered at depths varying from 3.7 m to 8.7 m below the existing ground surface (elevation 172.8 m in Boring B-17-02 to elevation 170.7 m in Boring B-19-02, respectively). The lowest unit consists of granitic rock, which varies from decomposed, soft rock to slightly weathered, very hard rock. This unit was encountered at depths varying from 11.0 to 25.0 m below the existing ground surface (elevation 165.4 m in Boring B-16-02 to elevation 151.5 m in Boring B-17-02, respectively). In the Profile 2 area, this lower unit extended down to the maximum explored depth of 30.0 m (elevation 146.5 m in Boring B-17-02).

- Profile 3 (N.B. On-Ramp Bent 3 and Abut 4 & S.B. Off-Ramp Bent 3, Bent 4 and Abut 5)

In Profile 3 area (approximately Sta. 385+10 to 386+00 "SD-15M" Line), the geology consists of a layer of fill and alluvial soil over igneous (granitic) rock described above in Profile 2. The foundation investigation revealed that earth materials encountered within the Profile 3 area can be generally separated into three units.

The upper unit is a layer of fill consisting of medium dense to dense silty and clayey sand and well graded sand with scattered gravel and boulders. This fill soil was encountered at depths extending down to 7.8 m below the existing ground surface (elevation 170.0 m in Boring B-3-02). The fill soils are underlain by an alluvial soil consisting of firm to stiff clay, loose silt and medium dense to very dense silty sand with scattered gravel, cobbles and boulders. The lowest unit consists of igneous (granitic) rock, which varies from decomposed, soft rock to slightly weathered, very hard rock. This unit was encountered at depths varying from 10.1 to 16.9 m below the existing ground surface (elevation 165.9 m in Boring B-14-02 to elevation 161.4 m in Boring B-15-02, respectively). In the Profile 3 area, this lower unit extended down to the maximum explored depth of 32.0 m (elevation 146.3 m in Boring B-15-02).

-Structural Geology

Some structural geologic features were identified in the borings drilled across the bridge site and are summarized below. In profile 1, the sedimentary (formational) rock was locally sheared with well-developed slickensides. These zones were up to 2.5m in thickness. This formational unit consisted of thickly interbedded siltstone, sandstone and claystone units (as described in the geology section).

Within the Profile 2 (transitional) area, abrupt thinning of the sedimentary (formational) rock unit over granitic rock was identified in the drilled borings. Evidence of localized sheared and well-developed slickenside zones (up to 1.6 m thick) within the sedimentary (formational) rock were also identified. Within the Profile 2 area, the abrupt changes in stratigraphy over relatively short distances and abrupt changes in the groundwater elevation indicate potential discontinuity in this area.

In Profile 3, the absence of the sedimentary rock was noted in all borings. In this area, fill and alluvial soils were deposited on granitic rock (as described in the geology section).

The geologic features listed above may indicate some ancient tectonic or ancient slide movements have occurred in the area since deposition of the Eocene sedimentary rock unit described above. At the time this report was written, there is insufficient subsurface data to make any conclusions or evaluate potential discontinuities within the structure site. Structural evaluation of the geology to determine the origins of any historic movements within the rock units is beyond the scope of this report.

Landslide Potential of Adjacent Private Property just West of Site

At the time of the field investigation, a geologic evaluation was completed by Mr. Jeff Tesar of the Office Geotechnical Design South 2, Branch D. He was requested by Metropolitan Transit Developed Board to review subsurface information drilled by consultants adjacent to and within the project area in order to evaluate a potential landslide mapped on the Landslide Hazard Identification Map No. 35 (California Divisions of Mines, OFR 95-04, Plate 35). In a report (dated May 16, 2002), Mr. Tesar concluded (based on subsurface information available at that time) that the mapped slide was not currently active. However, his geological review of the area indicates that the potential to re-activate an ancient, (currently) inactive slide due to the seismic loading or alteration of the topography for the construction of the proposed transit center does exist.

Mr. Tesar's conclusions were based on reviewing nearby subsurface information, consultant borings and 4-bucket auger borings, which were visually, inspected (April/May 2002) and spot logged for the specific purpose of identifying potential shear zones and slip planes. Hand drawn x-sections and field logs were look over by OGDS2B, but were not used for the geotechnical design of the foundations of the proposed structures in this report.

At the time this report was written, some preliminary plans were provided to our office from OBDS (received 10-21-02) to inform our office of proposed mitigation measures to remediate potential landslide of the western adjacent property. The preliminary plans show design of a grade beam wall with tieback tendons. The consultant design for the proposed tieback wall was developed by TerraCosta Consulting Group. The plans were provided to our office in order to identify any potential conflicts between the proposed wall and the foundations designed for the proposed bridge structures. OGDS2B did not evaluate the structural or geotechnical design for the proposed tieback wall.

Groundwater

Ground water was measured in nine of the eighteen rotary borings drilled during the Caltrans subsurface investigation at various depths across the site. In the other nine rotary borings, groundwater was not measured and the borings were immediately backfilled due to varying logistical reasons but primarily due to borings being located in existing highway lanes. Groundwater levels varied from elev. 175.1 m (Boring B-1-01) to elevation 158.9 m (Boring B-13-02). Groundwater surface elevation are subject to seasonal fluctuations and may occur higher or lower depending on the conditions and time of construction. For more details, please refer to the LOTB sheets.

Corrosion

Composite soil samples collected from 8 borings during the 2001-2002 foundation investigation were tested for corrosive potential by the Office of Testing and Technology Services, Corrosive Technology Branch (CTB). The results of the laboratory tests determined that the composite

samples were not corrosive in Profile 1 area but were corrosive in Profile 2 and Profile 3 areas (Profile 1, 2 & 3 are described in the geology section). For specific test results, please refer to Table 1.

Table 1: Corrosion Test Summary-Composite Samples

Support Location/ Corrosion Number	Sample Depth (m)	pH	Minimum Resistivity (Ohm-Cm)	Sulfate Content (PPM)*	Chloride Content (PPM)*	Years To Perforation 18 ga. Galv. Steel Culvert
Abut 1 –Main Access Ramp / 02-0011	0 - 12.9	7.7	420	137	242	17
Bent 2 – Main Access Ramp / 02-0172	0 – 3.51	7.7	670	43	<30	21
Bent 2 – Main Access Ramp / 02-0173	3.51 – 12.19	8.7	825	57	<30	23
Abut 4 – SOF / 02-0174	0 – 3.51	8.5	2400	44	<30	36
Abut 4 – SOF / 02-0175	8.08 – 11.13	7.5	345	320	530	16
Abut 4 – SOF / 02-0176	3.51 – 7.74	8.4	3000	75	34	39
Abut 1 – SON / 02-0189	0 - 4.57	8.4	660	N/A	N/A	21
Bent 3 - SON / 02-0190	0 – 3.51	8.8	1550	N/A	N/A	30
Bent 3 - NOF / 02-0212	0 – 1.52	7.42	570	98	290	20
Abut 4 – NON / 02-0366	0 – 7.68	7.62	3250	N/A	N/A	40
Bent 3 - NON / 02-0361	0 – 3.51	8.44	1250	N/A	N/A	27
Bent 3 - NON / 02-0362	3.51 – 10.06	7.94	3200	N/A	N/A	40

*The Corrosion Technology Branch policy states that if the minimum resistivity is greater than 1000 ohm-cm the sample is considered to be non-corrosive and testing to determine sulfate and chloride contents are not typically performed by the Corrosion Laboratory.

For site specific corrosion recommendations for the proposed Rancho Bernardo Main Access and Direct Access Ramps, please refer to the memorandum (dated November 14, 2002) prepared by Mike Piepoli (916-227-7068) with the Corrosion Technology Branch.

Seismic Data

The site is potentially subject to strong ground motions from nearby earthquake sources during the design life of the new structure. The Newport-Inglewood Rose Canyon Fault/E (NIE, Strike-Slip)

fault located approximately 22 km southwest from the site is the controlling fault for this site with a maximum credible earthquake of Mw=7. At all structure locations, the Peak Bedrock Acceleration at this site, based on the Caltrans California Seismic Hazard Map, is estimated to be 0.3g. At all structure locations, the liquefaction potential is considered to be minimal.

For site specific seismic data and design recommendations, refer to the memorandums concerning final seismic design recommendations, by Hossain Salimi (916-227-7147) of the former Office of Geotechnical Earthquake Engineering.

Foundation Recommendations

The following recommendations are for the proposed Rancho Bernardo Main Access Ramp (Br. No. 57-1107) and its connecting Direct Access Ramps, Northbound Off and On-Ramp (Br. No. 57-1107S & 57-1108S) and Southbound Off and On Ramps (Br. No. 57-1108K & 57-1107K). At all bent locations, Cast-In-Drilled Hole (CIDH) piles are recommended for support. At all abutment locations, driven steel piles are recommended for support. At Abutment 5 for the Southbound Off-Ramp (Br. No. 57-1108K) and Abutment 4 for the Northbound On-Ramp (Bridge No. 57-1108S), spread footings may also be used for support as an alternate foundation type.

Rancho Bernardo Main Access Ramp (Br. No. 57-1107)

At the Abutment 1 location for the Main Access Ramp, driven Modified "Class 900", Alternative "W" closed-end, steel pipe piles are recommended for support. These driven piles must have a steel plate be welded to the base of the pile in order to be considered closed-end. At all bent locations, it is possible to utilize 610mm, Cast-In-Drilled-Hole (CIDH) piles for support. The specified pile tip elevations, listed below in Table 2, were developed using the Rancho Berndardo Main Access Ramp, General Plan No. 1 (dated 12-10-02) and information received via email (dated 12-12-02) from OBDS regarding loads and pile cut off elevation. The ultimate geotechnical pile capacity for the piles will meet or exceed the required nominal resistance in compression listed below in Table 2.

Table 2: Pile Data: Rancho Bernardo Main Access Ramp (Br. No. 57-1107)

Support Location	Pile Type	Design Loading	Nominal Resistance		Bottom of Pile Cap Elevation (m)	Design Tip Elevation (m)	Specified Tip Elevation (m)
			Compression	Tension			
Abutment 1	Modified Class 900, Alt "W" *	900 kN	1800 kN	0 kN	183.3	170.8 m (1)	170.8 m
Bent 2	610 mm CIDH	N/A	2150 kN	0 kN	176.8	166.8 m (1)	166.8 m
Bent 3	610 mm CIDH	N/A	2150 kN	0 kN	175.1	163.7 m (1)	163.7 m

Note: Design tip elevation is controlled by the following demands: (1) Compression
* Modified "Class 900", Alternative "W" closed-end, steel pipes piles must have a steel plate welded to the base of the pile. The Design Tip Elevation for compression at the abutment location is based on the pile being closed ended.

Direct Access Ramp – Southbound On-Ramp (Br. No. 57-1107K)

At the Abutment 1 location for the Southbound On-Ramp, driven Modified "Class 900", Alternative "W" closed-end, steel pipe piles are recommended for support. These driven piles must have a steel plate be welded to the base of the pile in order to be considered closed-end. At all bent locations, it is possible to utilize 610mm, Cast-In-Drilled-Hole (CIDH) piles for support. The specified pile tip elevations, listed below in Table 3, were developed using the Southbound On-Ramp, General Plan (dated 10-7-02) and information received via email (dated 12-12-02) from OBDS regarding loads and pile cut off elevation. The ultimate geotechnical pile capacity for the piles will meet or exceed the required nominal resistance in compression listed below in Table 3.

Table 3: Pile Data: Direct Access Ramp – Southbound On-Ramp (Br. No. 57-1107K)

Support Location	Pile Type	Design Loading	Nominal Resistance		Bottom of Pile Cap Elevation (m)	Design Tip Elevation (m)	Specified Tip Elevation (m)
			Compression	Tension			
Abutment 1	Modified Class 900, Alt "W" *	725 kN	1450 kN	0 kN	180.1	169.8 (1)	169.8
Bent 2	610 mm CIDH	N/A	2700 kN	0 kN	175.1	162.9 (1)	162.9
Bent 3	610 mm CIDH	N/A	2700 kN	0 kN	176.2	162.4 (1)	162.4
Bent 4	610 mm CIDH	N/A	2700 kN	0 kN	176.9	164.6 (1)	164.6

Note: Design tip elevation is controlled by the following demands: (1) Compression
* Modified "Class 900", Alternative "W" closed-end, steel pipes piles must have a steel plate welded to the base of the pile. The Design Tip Elevation for compression at the abutment location is based on the pile being closed ended.

Direct Access Ramp – Northbound Off-Ramp (Br. No. 57-1107S)

At the Abutment 1 location for the Northbound Off-Ramp, driven Modified "Class 900", Alternative "W" closed-end, steel pipe piles are recommended for support. These driven piles must have a steel plate be welded to the base of the pile in order to be considered closed-end. At all bent locations, it is possible to utilize 610-mm Cast-In-Drilled-Hole (CIDH) piles for support. The specified pile tip elevations, listed below in Table 4, were developed using the Northbound Off-Ramp, General Plan (dated 10-7-02) and information received via email (dated 12-12-02) from OBDS regarding loads and pile cut off elevation. The ultimate geotechnical pile capacity for the piles will meet or exceed the required nominal resistance in compression listed below in Table 4.

Table 4: Pile Data: Direct Access Ramp – Northbound Off-Ramp (Br. No. 57-1107S)

Support Location	Pile Type	Design Loading	Nominal Resistance		Bottom of Pile Cap Elevation (m)	Design Tip Elevation (m)	Specified Tip Elevation (m)
			Compression	Tension			
Abutment 1	Modified Class 900, Alt "W" *	725 kN	1450 kN	0 kN	177.9	166.4 (1)	166.4
Bent 2	610 mm CIDH	N/A	2700 kN	0 kN	173.8	161.6 (1)	161.6
Bent 3	610 mm CIDH	N/A	2700 kN	0 kN	174.6	162.2 (1)	162.2
Bent 4	610 mm CIDH	N/A	2700 kN	0 kN	175.5	163.1 (1)	163.1
Bent 5	610 mm CIDH	N/A	2700 kN	0 kN	175.5	162.8 (1)	162.8

Note: Design tip elevation is controlled by the following demands: (1) Compression
* Modified "Class 900", Alternative "W" closed-end, steel pipes piles must have a steel plate welded to the base of the pile. The Design Tip Elevation for compression at the abutment location is based on the pile being closed ended.

Direct Access Ramp – Southbound Off-Ramp (Br. No. 57-1108K)

At all bent locations for the Southbound Off-Ramp, it is possible to utilize 610-mm Cast-In-Drilled-Hole (CIDH) piles for support. At the Abutment 5 location for the Southbound Off-Ramp, driven HP 356X174 steel "H" piles are recommended for support. The specified pile tip elevations, listed below in Table 5, were developed using the Southbound Off-Ramp, General Plan No. 1 (dated 12-17-02) and information received via email (dated 12-12-02) from OBDS regarding loads and pile cut off elevation. The ultimate geotechnical pile capacity for the piles will meet or exceed the required nominal resistance in compression listed below in Table 5.

Table 5: Pile Data: Direct Access Ramp – Southbound Off-Ramp (Br. No. 57-1108K)

Support Location	Pile Type	Design Loading	Nominal Resistance		Bottom of Pile Cap Elevation (m)	Design Tip Elevation (m)	Specified Tip Elevation (m)
			Compression	Tension			
Bent 1	610 mm CIDH	N/A	2700 kN	0 kN	176.8	165.2 (1)	165.2
Bent 2	610 mm CIDH	N/A	2700 kN	0 kN	176.2	160.8 (1)	160.8
Bent 3	610 mm CIDH	N/A	2700 kN	0 kN	174.8	159.1 (1)	159.1
Bent 4	610 mm CIDH	N/A	2700 kN	0 kN	172.6	155.7 (1)	155.7
Abut 5	HP 356X174 "H" Piles	725 kN	1450 kN	0 kN	176.3	163.7 (1)	163.7

Note: Design tip elevation is controlled by the following demands: (1) Compression

Direct Access Ramp – Northbound On-Ramp (Br. No. 57-1108S)

At all bent locations for the Northbound On-Ramp, it is possible to utilize 610-mm Cast-In-Drilled-Hole (CIDH) piles for support. At the Abutment 4 location for the Northbound On-Ramp, driven HP 356X174 steel "H" piles are recommended for support. The specified pile tip elevations, listed below in Table 6, were developed using the Northbound On-Ramp, General Plan No. 1 (12-17-02) and information received via email (dated 12-12-02) from OBDS regarding loads and pile cut off elevation. The ultimate geotechnical pile capacity for the piles will meet or exceed the required nominal resistance in compression listed below in Table 6.

Table 6: Pile Data: Direct Access Ramp – Northbound On-Ramp (Br. No. 57-1108S)

Support Location	Pile Type	Design Loading	Nominal Resistance		Bottom of Pile Cap Elevation (m)	Design Tip Elevation (m)	Specified Tip Elevation (m)
			Compression	Tension			
Bent 1	610 mm CIDH	N/A	2700 kN	0 kN	175.3	160.9 (1)	160.9
Bent 2	610 mm CIDH	N/A	2700 kN	0 kN	174.5	160.2 (1)	160.2
Bent 3	610 mm CIDH	N/A	2700 kN	0 kN	172.1	159.3 (1)	1593
Abut 4	HP 356X174 "H" Piles	725 kN	1450 kN	0 kN	174.6	160.3 (1)	160.3

Note: Design tip elevation is controlled by the following demands: (1) Compression

Alternate spread footing option at Abutment 5 of the Southbound Off-Ramp (Br. No. 57-1108K) & Abutment 4 of the Northbound On-Ramp (Br. No. 57-1108S)

At Abutment 5 of the Southbound Off-Ramp (Br. No. 57-1108K) and at the Abutment 4 of the Northbound On-Ramp (Br. No. 57-1108S), an alternate foundation type of spread footings are also recommended for support. The bottom of spread footing foundations shall be located on undisturbed, earth materials, as described earlier in the geology section. The recommended Soil Bearing Pressures to be used for design are listed below in Table 7.

Table 7: Spread Footing Data: Southbound Off-Ramp & Northbound On-Ramp (Br. # 57-1108K&S)

Support Location	Minimum Footing Width (m)	Bottom of Footing Elevation (m)	Recommended Soil Bearing Pressures	
			ASD[1]	LFD[2]
			Gross Allowable Soil Bearing Pressure (q_{all})	Ultimate Soil Bearing Pressure (q_{ult}^*)
Abutment 5 (Br. No. 57-1108K)	5.49	176.80	192 kPa (4.0 ksf)	N/A
Abutment 4 (Br. No. 57-1108S)	5.49	174.55	192 kPa (4.0 ksf)	N/A

Notes: 1) Allowable Stress Design, (ASD). The Maximum Contact Pressure, (q_{max}), is not to exceed the recommended Gross Allowable Soil Bearing Pressure, (q_{all}). The Ultimate Soil Bearing Capacity, (q_{ult}), will equal or exceed 3 times the recommended Gross Allowable Soil Bearing Pressure, (q_{all}).
2) Load Factor Design, (LFD). The Maximum Contact Pressure, (q_{max}), divided by the Strength Reduction Factor, (ϕ), is not to exceed the recommended Ultimate Soil Bearing Pressure, (q_{ult}^*). The Ultimate Soil Bearing Capacity, (q_{ult}), will equal or exceed the recommended Ultimate Soil Bearing Pressure, (q_{ult}^*).

The recommended gross allowable soil bearing pressures to be used for design, listed above in Table 7, are based upon the following design criteria:

(1) All footings shall have a minimum footing width of 5.49 meters for the abutments.
(2) All footings shall be constructed at the bottom of footing elevations, not to exceed more than 1 meter below the recommended bottom of footing elevation.
(3) All footings were designed using a minimum embedment depth (d) of 1.22 m, which extends from the finished grade to the bottom of the footing elevation.

If any of the above minimum footing widths or minimum embedment depths are reduced, then OGDS2B is to be contacted immediately for reevaluation.

General Notes

1. All support locations are to be plotted on the Log of Test Borings, in plan view, as stated in "Memos to Designers" 4-2. The plotting of the support locations should be made prior to the foundation review.

2. The structure engineer shall show on the plans, in the pile data table, the minimum pile tip elevation required to meet the lateral load demands. If the specified pile tip elevation required to meet lateral load demands exceed the specified pile tip elevation given within this report, the Office of Geotechnical Design South 2, Branch B should be contacted for further recommendations.

Construction Considerations

1. Groundwater was encountered during the 2001-2002 field investigation and it is anticipated that groundwater will be encountered during CIDH pile construction. Groundwater surface elevation is subject to seasonal fluctuations and may occur higher or lower depending on the conditions and time of construction.

2. De-watering of drilled pile excavations will be required at the Southbound On-Ramp (Br. No. 57-1107K), the Northbound Off-Ramp (Br. No. 57-1107S), the Main Access Ramp (Br. No. 57-1107) and Bent 1 of the Northbound On-Ramp (Br. No. 57-1108S).

3. The contractor is to be required to keep drilled excavations dry, where groundwater is encountered, immediately after the boring has reached specified tip elevation until the time concrete is placed for construction of the pile. No CIDH pile excavations are to be left open overnight.

4. At all bent locations, the calculated geotechnical capacity of the CIDH piles is based upon Skin Friction only. The geotechnical capacity of the CIDH piles was calculated from one pile diameter below the pile cap elevation extending down to one diameter above the specified pile tip elevation (SPTE). No end bearing was considered.

5. At the Southbound On-Ramp (Br. No. 57-1107K), the Northbound Off-Ramp (Br. No. 57-1107S) the Main Access Ramp (Br. No. 57-1107) and Bent 1 of the Northbound On-Ramp (Br. No. 57-1108S), difficult pile installation is anticipated due to the presence of soft to stiff clays overlying variably very soft to hard sedimentary (formational) rock. The rock has a sedimentary structure, which results in discontinuous, cobble to boulder sized blocks of more competent, well-cemented (hard) formational rock within a poorly indurated, weakly cemented (soil-like) earth material. Both soft and hard rock drilling should be anticipated to advance the shaft excavations to the specified pile tip elevations at these locations. For further details refer to the LOTB sheets.

6. At the Southbound Off-Ramp (Br. No. 57-1108K) and the Northbound On-Ramp except Bent 1 (Br. No. 57-1108S), difficulties encountered during the 2001-2002 drilling operations of the borings included loss of drill fluid in fractured rock, difficulty in advancing the boring due to the presence of cobbles, boulders and alternating zones of decomposed soft igneous rock and hard to very hard igneous rock with near vertical dipping fractures. The contractor should anticipate difficult pile installation and drilling due to the presence of alluvial/embankment fill soils with hard cobbles and boulders overlying variably weathered rock conditions ranging from decomposed igneous rock to fresh, hard to very hard igneous rock. Both soft and hard rock drilling should be anticipated while drilling to the specified pile tip elevations at these locations. For further details refer to the LOTB sheets.

7. At all bent locations, caving conditions may be encountered during CIDH pile construction. Temporary steel casing may be necessary to control caving during construction. All temporary steel casing is to be removed during concrete placement.

8. Pile acceptance criteria for all driven pile types will be based on the ENR equation (Standard Specifications in Section 49-1.08).

9. At the Abutment 1 locations for the Main Access Ramp (Br. No. 57-1107), Southbound On-Ramp (Br. No. 57-1107K) and the Northbound Off-Ramp (Br. No. 57-1107S), the calculated geotechnical capacity of all driven Modified "Class 900" closed-end pipe piles are predominantly based on End Bearing.

10. All Class 900 Alternative "W" steel pipe piles are to be driven closed ended. Modification of the steel piles must be achieved by welding flat, steel plates on the end of the pipe piles in order to be considered closed ended. The steel plates are to have a minimum thickness of 20mm.

11. At the Abutment 5 locations for Southbound Off-Ramp (Br. No. 57-1108K) and the Abutment 4 location for the Northbound On-Ramp (Br. No. 57-1108S), the calculated geotechnical capacity of all driven steel "H" piles is based on both Skin Friction & End Bearing.

12. At the Abutment locations for the Main Access Ramp (Br. No. 57-1107), Southbound On-Ramp & Off-Ramp (Br. No. 57-1107K & 57-1108K) and the Northbound Off-Ramp & On-Ramp (Br. No. 57-1107S & 57-1108S), any driven steel pile achieving two times (2x) the design loading within 1.5 meter of specified pile tip elevations may be considered good and cut off with the Engineer's written approval. Two times (2x) the required design loading is shown below in Table 8.

Table 8: Supplemental Information for Driven Piles

Structure No.	Support Location	(2 x) Design Loading (kN)
Br. No. 57-1107	Abutment 1 Main Access Ramp	1800
Br. No. 57-1107K	Abutment 1 Southbound On-Ramp	1450
Br. No. 57-1107S	Abutment 1 Northbound Off-Ramp	1450
Br. No. 57-1108K	Abutment 5 Southbound Off-Ramp	1450
Br. No. 57-1108S	Abutment 4 Northbound On-Ramp	1450

13. The contractor should anticipate hard and erratic driving of the steel "H" piles. Field cutting and splicing of all "H" piles should be anticipated due to the presence of cobbles, boulders and due to the variations in the top of igneous rock elevation along with variations of igneous rock weathering across the support location. See the LOTB sheets for details.

14. Hard driving tips shall be required on all driven steel "H" piles to ensure pile integrity and limit damage to piles during hard driving.

15. Prior to driving each Closed-End Pipe Pile (Modified "Class 900"), drilling to assist driving (Standard Specifications in Section 49-1.05) will be required to obtain the specified penetration. Any drilling to assist driving, shall not extend beyond the recommended elevation stated in Table 9. Equipment or methods used for advancing holes shall not cause quick soil conditions or cause scouring or caving of the hole.

Table 9: Drilling to Assist Elevation

Location	Drilling to Assist Elevation (m)
Abutment 1 Main Access Ramp (Br. No. 57-1107)	173.1 m
Abutment 1 Southbound On-Ramp (Br. No. 57-1107K)	171.3 m
Abutment 1 Northbound Off-Ramp (Br. No. 57-1107S)	168.0 m

Alternative Spread Footing Option

16. At Abutment 5 for the Southbound Off-Ramp (Br. No. 57-1108K) and Abutment 4 for the Northbound On-Ramp (Bridge No. 57-1108S), concrete for the proposed footing shall be placed neat against the undisturbed earth materials on the bottom of the footing excavation. Should the bottom of the footing excavation be disturbed, then the disturbed soils shall be recompacted to 95% relative compaction prior to placement of concrete for the structure support footings.

17. At the spread footing locations, all excavations are to be inspected and approved by a representative of the Office of Geotechnical Design-South 2, Design Branch B prior to placing any steel or concrete. The contractor is to allow five (5) working days for the inspection of the excavation to be completed. The structures representative is to provide the Office of Geotechnical Design–South 2, Design Branch B a one-week notification prior to beginning the five-day contractor waiting period.

The recommendations contained in this report are based on specific project information regarding design loads and structure locations that has been provided by OBDS. If any conceptual changes are made during final project design, the Office of Geotechnical Design South 2, Structure Branch B should review those changes to determine if the foundation recommendations provided in this report are still applicable. Any questions regarding the above recommendations should be directed to the attention of Hector Valencia (916) 227-4555 (CALNET 498-4555) or Mark DeSalvatore (916) 227-5391 (CALNET 498-5391), Office of Geotechnical Design South 2, Branch B.

Prepared by: Date: 2-13-03

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