

**BART Agreement Number:** 6M8145

**Approval Date:** 03/22/2021

**Work Plan:** No. B.07-02 – Geotechnical and Retaining Wall Design Services to support C75

**Scope:**

## 2. SCOPE OF SERVICES

### 2.1 Geotechnical Field Surveys and Testing

The primary geotechnical concerns to be addressed in this investigation are as follows:

- Retaining wall along BART/Caltrans ROW limits;
- Retaining wall along entry/exit roadway to the site; and
- Pavement Structural Section.

#### Soil Investigation

The scope of work will involve drilling and sampling of the subsurface at multiple locations of the Project Site. The field investigation will include 4 mud-rotary soil borings and 3 Cone Penetration Testing (CPT) borings, as summarized in Table 1. Figure 1 shows the approximate locations of these borings, are subject to change based on accessibility and other site constraints. We assume that site access to the investigation points will be provided by BART and/or Caltrans prior to mobilization.

**TABLE 1**  
Proposed Soil Borings and CPT Soundings

Borehole ID	Maximum Depth (ft)
R-1	60
R-2	60
R-3	60
CPT-4	100
CPT-5	100
R-6	60
CPT-7	100

#### Soil Borings

Soil borings will be drilled at 4 locations along the proposed retaining wall alignments to a maximum depth of about 60 feet below the existing ground surface. The mud-rotary borings will be drilled with a truck-mounted drill rig. Geotechnical soil samples and Standard Penetration Test (SPT) blow counts will be collected at about 5-foot intervals to the total depth of the hole. The SPT blow counts will be recorded by driving a 2.0-inch diameter (OD) SPT sampler using a 140-pound hammer falling 30-inches for a penetration of 18 to 24 inches or refusal, in accordance with ASTM D1586 – 08 Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils. When appropriate, cohesive soil samples may also be collected using a 3-inch Shelby tube sampler.

The soil drilling and sampling will be conducted under the direct supervision of a registered geologist or geotechnical engineer. He/she will log the borings, record blowcounts from SPT tests, visually classify the soils, and determine samples for laboratory tests.

The soil samples will be properly packaged and submitted for shipment, under chain-of-custody, to a geotechnical laboratory testing facility. U.S. Department of Transportation regulations will be followed for packaging and shipping.

After the borings are completed, the holes will be filled with bentonite chips or a bentonite-cement mixture, in accordance with applicable BART standards.

#### *CPT Soundings*

CPT soundings will be performed at 3 locations along the proposed retaining wall alignments to a maximum depth of about 100 feet below existing ground surface. The CPT soundings will be performed with a truck-mounted CPT rig.

After the CPT soundings are completed, the holes will be filled with bentonite chips or a bentonite-cement mixture, in accordance with applicable BART standards.

#### *Utility Clearance*

We assume that BART will identify their existing utilities at the site prior to Jacobs team's utility clearance. The locations of utilities within the investigation area will be identified and the initial borehole locations will be cleared. The proposed boring locations may be modified based on site physical constraints.

#### *Investigation Derived Waste*

All soil spoils and wastewater generated from the field investigation will be placed in watertight drums and temporarily stored at the Project Site. Drummed soils will be removed from the site at the end of field investigation and disposed of at an approved disposal facility. We assume that the soils and groundwater are not contaminated and can be disposed as non-hazardous waste.

### **Laboratory Tests**

Soil laboratory tests will be conducted in accordance with the applicable ASTM and/or CTM procedures.

#### *Proposed Tests*

Table 2 summarizes the proposed testing types. The selection of the soil samples for the various tests will be based on the actual soil conditions encountered during the field investigation. Laboratory tests were chosen to provide data for geotechnical analyses.

**TABLE 2**  
Proposed Laboratory  
Tests

Laboratory Test	ASTM / CTM Number	ASTM / CTM Title
Atterberg Limits	ASTM D4318	<i>Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils</i>
Consolidation	ASTM D2435	Standard Test Methods for One-Dimensional Consolidation Properties of Soils Using Incremental Loading
Corrosivity	CTM 643	<i>Method for Determining Field and Laboratory Resistivity and pH Measurements for Soil and Water</i>
	CTM 417	<i>Method of Testing Soils and Waters for Sulfate Content</i>
	CTM 422	<i>Method of Testing Soils and Waters for Chloride Content</i>
Direct Shear	ASTM D3080	<i>Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions</i>
Expansion Index	ASTM D4829	<i>Standard Test Method for Expansion Index of Soils</i>
Moisture / Density	ASTM D2937	<i>Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method</i>
Particle Size Analysis #200 Wash	ASTM D1140	<i>Standard Test Methods for Determining the Amount of Material Finer than 75-<math>\mu</math>m (No. 200) Sieve in Soils by Washing</i>
Particle Size Analysis Sieve Analysis	ASTM D6913	<i>Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis</i>
Sand Equivalent	ASTM D2419 / CT 217	<i>Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate / Method of Test for Sand Equivalent</i>
R-Value	ASTM D2844 / CTM 301	<i>Standard Test Method for Resistance R-Value and Expansion Pressure of Compacted Soils / Method of Test for Determining the Resistance "R" Value of Treated and Untreated Bases, Subbases, and Basement Soils by the Stabilometer</i>

#### *Sample Handling*

The soil samples will be properly handled during test sample preparation and testing. We assume that the soils and groundwater are not contaminated and can be disposed as non-hazardous waste.

## 2.2 Geotechnical Recommendations

The scope for geotechnical recommendations will include:

- Evaluation and interpretation of field data for bearing capacity and other soil parameters to inform the design of cantilever retaining walls consistent with BFS design criteria.
- Interpreting field data and developing recommendations for both a flexible (Hot Mix Asphalt) pavement, as well as Portland Cement Concrete slabs to accommodate portable electrical equipment.

### Deliverables:

- Draft and Final Geotechnical Evaluation and Report, including recommendations for retaining wall design, and rigid and non-rigid pavement structural sections.

## 2.3 Engineering Design Services for Retaining Walls

During the site investigation it was determined that inclusion of a retaining wall parallel to the northern property line with Caltrans would increase the useable laydown area of the site. Original concepts included using either Mechanically Stabilized Embankment (MSE) technology, or a reinforced concrete cantilever wall. During the presentation of the 35% conceptual plans and Basis of Design, BART requested that we eliminate the MSE alternative for the more rigid cantilever type. Subsequently, the northern limit of the wall has been extended to further increase the usable area of the site. Reference is made to the attachment "Proposed Boreholes/ CPT Locations".

After sharing the preliminary concept with Caltrans, they stipulated that no improvements could be made within their jurisdictional limits, specifically the driveway widening, due to the restricted access status of their ROW and proximity to the on-ramp to State Route 4. As such, the driveway will need to be redesigned to the south outside of Caltrans Right of Way, which requires an additional wall be designed and constructed to create a relatively flat area to allow access and egress of large trucks from the BART site.

### *Structural Design- Scope of Work*

Jacobs will perform the following scope of work:

- 1) Design calculations for proposed retaining walls for wall heights of 6', 8', 10', 12', 14' and 16'.
- 2) Provide drawings for 65% submittal.
- 3) Respond to BART comments on 65% submittal.
- 4) Provide drawings and calculations for 95% submittal.
- 5) Respond to BART comments on 95% submittal.
- 6) Provide drawings and calculations for 100% submittal.
- 7) Respond to BART comments on 100% submittal.
- 8) Provide drawings and calculations for IFB submittal.

- 9) Develop structural specifications.
- 10) QAQC of all drawings, calculations and specifications prior to final submittal.
- 11) Inter-discipline reviews prior to each submittal (4 total).
- 12) Two (2) site visits.
- 13) Coordination meetings.

#### *Clarifications and Assumptions*

- 1) Design will follow BFS R3.1.3.
- 2) Retaining walls will be reinforced concrete cantilevered retaining walls.
- 3) Retaining wall designs will be for 6 different heights at 2' intervals: 6', 8', 10', 12', 14' and 16'.
- 4) Expected live loads on soil surface supported by retaining walls will be provided by BART.
- 5) Drainage details for the retaining walls will be per BART Standard Drawings.
- 6) In the interest of expediency, 35% drawings will not be prepared. The approximate alignment and elevation of the wall has been discussed with BART, and they have requested that the wall be a rigid reinforced concrete cantilever wall, as opposed to an MSE alternative that was one of the earlier concepts.

#### **Deliverables:**

- 65% Plans, quantities, structural calculations, and Specifications submittal and response to comments.
- 95% Plans, quantities, structural calculations, and Specifications submittal and response to comments.
- IFB Plans, quantities, structural calculations, and Specifications submittal.

#### 2.4 Electrical Design Services for Communications Conduit

Provide design for conduit from the train control room located at North Concord/ Martinez Station to the project site. Existing underground raceways are all filled with no spares, thereby requiring a new raceway to the project site. New comm raceway will route overhead out of the train control room at North Concord/Martinez Station then continue exposed exterior in a routing to be as inconspicuous as possible such as along edges and corners in areas where patrons can visibly see conduit. Comm raceway will continue overhead outside of patron's visibility and cross the tracks and run parallel along the existing west retaining wall. Once the comm raceway reaches the far north end of the retaining wall, the comm raceway will continue around the bend of the same retaining wall to cross the drainage ditch to avoid the need for a raceway bridge and continue up the slope, and underground to the proposed office point of connection.

#### 2.5 Associated Design Services During Construction (DSDC)

Jacobs will perform various Design Services During Construction (DSDC) tasks related to geotechnical recommendations and retaining wall design, including but not limited to the following:

- Review Contractors schedule and submittals
- Address and review RFI's from Contractor
- Provide Engineering Support for contract change orders

**Prime:** Jacobs

<b>Subconsultant</b>	<b>Amount</b>	<b>DBE (Y/N)</b>	<b>SBE (Y/N)</b>
Rail Surveyors Engineering, Inc.	\$ 33,159	N	Y
YEI	\$19,947	Y	Y

**Total Work Plan Value:** \$ 315,608