INFORMATION HANDOUT

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Project ID 1213000093

MATERIALS INFORMATION

1. Aerially Deposited Lead Investigation Report
2. LED Dynamic Message Sign Sample Procurement Specification
3. Summary of Foundation Recommendation Reports

AERIALLY DEPOSITED LEAD SITE INVESTIGATION
NB SR-55/WB SR 91 CONNECTOR
ANAHEIM, CALIFORNIA
TASK ORDER NO. 12-0C5601-03
EA NO. 0C5601-3, CONTRACT NO. 12A1340

PREPARED FOR:
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Project No. 208449003

EXECUTIVE SUMMARY

The State of California Department of Transportation (Department) authorized Ninyo & Moore to conduct an aerially deposited lead (ADL) site investigation at the northbound (NB) State Route 55 (SR-55) to westbound (WB) State Route 91 (SR-91) connector in the city of Anaheim, California (Figure 1).Work was conducted in general accordance with the Department Contract No. 12A1340, Task Order No. 12-0C5601-03, dated February 14, 2012.

It is our understanding that the Department is proposing to construct an exit bypass lane on WB SR-91 from west of Tustin Ave to east of the NB SR-55/WB SR-91 connector. The project will also include reconstruction of the WB auxiliary lane from NB SR-55/WB SR-91 connector to the Tustin off-ramp (Figure 1). This investigation was performed to evaluate the presence of lead in soil resulting from the combustion of leaded fuel from nearby traffic. Data collected during this investigation were used to develop recommendations for the potential reuse or disposal of soil excavated from the site and to inform the Department of potential health and safety issues concerning the presence of lead in soil for workers at the site during construction activities.

Ninyo & Moore collected 79 soil samples from 20 borings at the site (B1 through B20). Eighteen of the 79 samples contained total lead concentrations greater than or equal to 50 milligrams per kilogram and were subsequently analyzed for soluble lead in accordance with the Waste Extraction Test (WET) using citric acid as the extractant. Eleven of those 18 sample results were greater than the Soluble Threshold Limit Concentration for California hazardous waste (Title 22 California Code of Regulations [CCR] Section 66261.24) of 5.0 milligrams per liter (mg/l) and were subsequently analyzed for soluble lead by the WET using deionized water as the extractant (WET-DI) and in accordance with the Toxicity Characteristic Leaching Procedure (TCLP). The results of the soluble lead by WET-DI were below 1.5 mg/l and the TCLP results were below 5.0 mg/l (below the threshold for federal hazardous waste under Resource Conservation and Recovery Act [Title 40 Code of Federal Regulations {CFR} 261-24]). Eight samples were analyzed for pH. The pH levels ranged from 8.2 to 9.1.

Our recommendations for soil reuse on site are based on the guidelines set forth by the Department of Toxic Substances Control (DTSC) Lead Variance issued to the Department on June 30, 2009 (DTSC Variance). Laboratory analytical results for lead were compared to the guidelines of the DTSC Variance for potential reuse of the soil as fill within the Department right-of-way.

Our recommendations for off-site disposal were based on the comparison of lead concentrations in soil samples to the California Health and Safety Code thresholds and Title 40 CFR 261.24 thresholds.

Based on the analytical results, the site was divided into two groups. Group 1 includes borings B1 through B5 (from approximate station numbers 549+00 [SR-55] to 534+00 [SR-55]) and Group 2 includes borings B6 through B20 (from approximate station numbers 534+00 [SR-55] to 484+00 [SR-91]). The on-site reuse and the off-site disposal recommendations for the two groups are summarized below.

Group 1 – Recommendations for Soil for Reuse by the Department

All scenarios: The soil in all layer combinations (surface to 4 feet below ground surface [bgs]) is suitable for on-site reuse by the Department with no restrictions based on total and soluble lead concentrations (Type X).

Group 1 – Recommendations for Soil to be Disposed Off Site

All scenarios: The soil in all layer combinations (surface to 4 feet bgs) is classified as non-hazardous and may be disposed off site with no restrictions based on total and soluble lead concentrations (Type X).

Group 2 – Recommendations for Soil for Reuse by the Department

Soil at the site can be reused on site with the following restrictions:

- Scenario A: The soil in the surface layer (surface to 0.5 feet bgs) (Type Y1) may be reused on site if it is placed a minimum of 5 feet above the maximum water table elevation and covered with at least 1 foot of non-hazardous soil. The remaining soil from the 1.5- to 4-foot layers combined (0.5 to 4 feet bgs) is suitable for on-site reuse by the Department with no restrictions based on total and soluble lead concentrations (Type X).

- Scenario B: The soil in the surface and 1.5-foot layers combined (surface to 1.5 feet bgs) (Type Y1) may be reused on site if it is placed a minimum of 5 feet above the maximum water table elevation and covered with at least 1 foot of non-hazardous soil. The remaining soil from the 3- and 4-foot layers combined (1.5 to 4 feet bgs) is suitable for on-site reuse by the Department with no restrictions based on total and soluble lead concentrations (Type X).

- Scenario C: The soil in the surface to 3-foot layers combined (surface to 3 feet bgs) (Type Y1) may be reused on site if it is placed a minimum of 5 feet above the maximum water table elevation and covered with at least 1 foot of non-hazardous soil. The remaining soil from the 4-foot layer (3 to 4 feet bgs) has no restrictions based on total and soluble lead concentrations (Type X).

- Scenario D: The soil in the layers combined (surface to 4 feet bgs) (Type Y1) may be reused on site if it is placed a minimum of 5 feet above the maximum water table elevation and covered with at least 1 foot of non-hazardous soil.

Group 2 – Recommendations for Soil to be Disposed Off Site

If the Department elects to dispose the soil off site, the following restrictions apply:

- Scenario A: The soil in the surface layer (surface to 0.5 feet bgs) is classified as California hazardous and should be disposed at a Class 1 disposal site in accordance with Title 22 CCR requirements (Type Z2). The remaining soil from the 1.5- to 4-foot layers combined (0.5 to 4 feet bgs) is classified as non-hazardous and may be disposed off site with no restrictions based on total and soluble lead concentrations (Type X).

- Scenario B: The soil in the surface and 1.5-foot layer combined (surface to 1.5 feet bgs) is classified as California hazardous and should be disposed at a Class 1 disposal site in accordance with Title 22 CCR requirements (Type Z2). The remaining soil from the 3- and 4-foot layers combined (1.5 to 4 feet bgs) is classified as non-hazardous and may be disposed off site with no restrictions based on total and soluble lead concentrations (Type X).

- Scenario C: The soil in the surface to 3-foot layers combined (surface to 3 feet bgs) and in the 4-foot layer (3 to 4 feet bgs) is classified as California hazardous and should be disposed at a Class 1 disposal site in accordance with Title 22 CCR requirements (Type Z2).

- Scenario D: The soil in the layers combined (surface to 4 feet bgs) is classified as California hazardous and should be disposed at a Class 1 disposal site in accordance with Title 22 CCR requirements (Type Z2).

The Department should notify the contractors performing the construction activities that elevated concentrations of lead are present in on-site soil. Appropriate health and safety measures should be taken to minimize the potential exposure to lead.

1. INTRODUCTION

The State of California Department of Transportation (Department) authorized Ninyo & Moore to conduct an aerially deposited lead (ADL) site investigation at the northbound (NB) State Route 55 (SR-55) to westbound (WB) State Route 91 (SR-91) connector in the city of Anaheim, California (Figure 1). Work was conducted in general accordance with the Department Contract No. 12A1340, Task Order No. 12-0C5601-03 (TO 03), dated February 14, 2012.

1.1. Project Description and Objective

It is our understanding that the Department is proposing to construct an exit bypass lane on WB SR-91 from west of Tustin Ave to east of the NB SR-55/WB SR-91 connector. The project will also include reconstruction of the WB auxiliary lane from NB SR-55/WB SR-91 connector to the Tustin off-ramp (Figure 1). This report has been prepared by Ninyo & Moore to document the results of a study to evaluate the presence of ADL along the unpaved shoulder area of the site. Twenty borings were hand augered at the site for this task order.

1.2. Scope of Work

Ninyo & Moore performed the tasks described in the following sections.

1.2.1. Pre-Field Activities

Pre-field activities included:

- Preparing a site specific health and safety plan (HSP).
- Marking boring locations at the sites.
- Notifying Underground Service Alert (USA) that Ninyo & Moore would be advancing soil borings in the area (USA ticket number A20671224).
- Preparing a project schedule and coordinating work with subcontractors.

1.2.2. Soil Sampling

Soil sampling was conducted on March 13, 2012. Twenty sampling locations (B1 through B20) were chosen, as shown on Figure 2. One boring at each sampling location was advanced and sampled using a hand auger. Four soil samples were attempted for

collection from depths of surface to ½, 1½ to 2, 2 ½ to 3, and 3 ½ to 4 feet below ground surface (bgs) at each boring location.

1.2.3. Laboratory Analysis

Ninyo & Moore submitted the soil samples under chain-of-custody (COC) protocol to Pat-Chem Laboratories of Moorpark, California; a laboratory certified by the State of California Department of Health Services Environmental Laboratory Accreditation Program.

1.2.4. Global Positioning System Surveying

Approximate latitude and longitude (North American Datum 83) of sampling locations were recorded with a handheld GPS unit (GeoXT, Trimble). The latitude and longitude data for each boring are presented on Table 1.

1.2.5. Report Preparation

This report was prepared in general accordance with Department Contract No. 12A1340 and TO 03 dated February 14, 2012.

1.3. Previous Site Investigations

Ninyo & Moore has not performed previous investigations at this site. In addition, the Department has not notified Ninyo & Moore of previous investigations performed at the site.

2. BACKGROUND

The Department obtained a variance (V09 HQSCD006) from the California Environmental Protection Agency, Department of Toxic Substances Control (DTSC), on June 30, 2009 (DTSC Variance). The DTSC Variance allows for conditional reuse of lead-impacted soil within the Department right-of-way (ROW). Background information regarding the source of ADL and the reuse or disposal of lead-impacted soil is discussed in the following sections.

2.1. Aerially Deposited Lead in Soil

Analyses for lead in soil along highways throughout the state of California have revealed that lead is commonly present along the shoulders of the highways as a result of automobile

exhaust containing lead from the combustion of leaded gasoline. Elevated concentrations of lead are commonly found in the upper 2 feet of soil. Lead concentrations in soil are dependent on many variables; but in general, are a function of the age of the highway and the volume of traffic using the highway.

2.2. Hazardous Waste Classification Criteria

Soil that exceeds the following limitations may be classified as hazardous waste with respect to lead concentrations:

- The soil contains more than 1,000 milligrams per kilogram (mg/kg) total lead, exceeding the Total Threshold Limit Concentration (TTLC) for California hazardous waste (Title 22 California Code of Regulations [CCR], Section 66261.24);

- The soil contains more than 5.0 milligrams per liter (mg/l) citric acid-extractable lead, exceeding the Soluble Threshold Limit Concentration (STLC) for California hazardous waste (Title 22 CCR, Section 66261.24);

- The soil contains more than 5.0 mg/l leachable lead using the Toxicity Characteristic Leaching Procedure (TCLP), exceeding the maximum concentration for the toxicity characteristic of the Resource Conservation and Recovery Act (RCRA; Title 40 Code of Federal Regulations [CFR] 261.24); or

- The soil pH is less than or equal to 2.0 or greater than or equal to 12.5, which exceeds the limits for the corrosivity characteristic of RCRA hazardous waste (40 CFR 261.22) and California hazardous waste (Title 22 CCR, Section 66261.22).

2.3. DTSC Variance

In accordance with the DTSC Variance, soil that is subject to the guidelines presented below may be reused within the Department ROW. A chart presenting the different ADL soil type classifications is included in Appendix A.

2.3.1. Reuse – Condition 1

Soil containing less than 1.5 mg/l extractable lead by the Waste Extraction Test (WET) using de-ionized water as the extractant (WET-DI) and less than or equal to 1,411 mg/kg total lead (United States Environmental Protection Agency [EPA] Method 6010B) may be used as fill in the Department ROW provided the soil is placed a mini-

mum of 5 feet above the maximum level of the water table and covered with at least 1 foot of non-hazardous soil.

2.3.2. Reuse – Condition 2

Soil containing greater than or equal to 1.5 mg/l, but less than 150 mg/l, extractable lead by WET-DI method, or more than 1,411 mg/kg total lead but less than 3,397 mg/kg total lead, may be used as fill in the Department ROW provided the soil is placed a minimum of 5 feet above the maximum level of the water table and protected from infiltration by a paved structure that will be maintained by the Department.

2.3.3. Reuse – Condition 3

Lead-contaminated soil with a pH less than 5.5 but greater than 5.0 shall only be used as fill material under the paved portion of the roadway. Lead-contaminated soil with a pH at or less than 5.0 shall be managed as a hazardous waste.

2.4. Criteria for Disposal of Soil Not Intended for Reuse On Site

If the Department elects to dispose soil within the Department ROW that has been excavated during construction activities, the soil may be classified either as hazardous waste or non-hazardous waste. The distinction is based on the total and soluble lead concentrations compared to the TTLC and STLC criteria. As mentioned in Section 2.2, the TTLC for total lead is 1,000 mg/kg and the STLC for citric acid extractable lead is 5.0 mg/l. Waste containing lead concentrations in excess of or equal to those listed must be disposed at a Class I hazardous waste disposal facility pursuant to State of California regulations.

3. INVESTIGATION METHODS

The investigation activities are described in the following subsections and were conducted in general accordance with the TO that was approved by the Department prior to beginning the field activities.

3.1. Health and Safety Plan (HSP)

A site-specific HSP dated February 28, 2012, was prepared by Ninyo & Moore and submitted to the Department for approval prior to commencing field work.

3.2. Utility Clearance

The boring locations were described to USA during the notification at least 2 working days prior to conducting the soil sampling. USA marked the member utilities known to be in the vicinity of the boring locations.

3.3. Hand-Auger Sampling

The field work was conducted on March 13, 2012. The boring locations were approved by the Department Task Order Manager and are shown on the attached Figures 2 through 8. Four samples were attempted for collection from each of the five boreholes at depths of ½, 1½ to 2, 2 ½ to 3, and 3 ½ to 4 feet bgs unless refusal was encountered. The depths reached for each boring are presented on Table 1.

Samples were placed into new, 4-ounce, glass jars; capped with Teflon-coated plastic lids; labeled; placed in a resealable plastic bag; and stored in a cooler. The sampling equipment was decontaminated between each boring. Soil samples were transferred under COC protocol to Pat-Chem Laboratories within 24 hours of collection. In accordance with the TO, soil sample homogenization was performed in the laboratory.

Hand augering was conducted by Ninyo & Moore personnel.

3.4. Investigation-Derived Wastes

Soil cuttings generated by hand-auger drilling were returned to their corresponding boreholes after collection of soil samples. Decontamination water was transported to Ninyo & Moore's Irvine office and placed in a drum pending chemical characterization. Based on the analytical result of the decontamination water sample, the decontamination water was subsequently disposed in the sanitary sewer.

3.5. Laboratory Analyses

Once the samples were received by Pat-Chem Laboratories the samples were homogenized and analyzed for the following:

- Seventy-nine soil samples were analyzed for total lead using EPA Method 6010B;
- Eighteen soil samples were analyzed for soluble lead by the WET using a citric acid extraction (WET-citric);
- Eleven soil samples was analyzed for soluble lead by the WET-DI and soluble lead by TCLP;
- Eight soil samples were analyzed for pH using EPA Method 9045;
- One decontamination water sample was analyzed for total lead using EPA Method 6010B.

4. ANALYTICAL RESULTS

The results of this investigation are described in the following subsections. The analytical results of lead and pH are summarized in Table 1, and the sampling locations with their corresponding data are shown on Figures 3 through 8. Laboratory reports and COC records are included in Appendix B.

4.1. Total Lead

Seventy-nine soil samples were analyzed for total lead. The maximum total lead concentration was 1,100 mg/kg. The minimum total lead concentration was less than the laboratory practical quantitation limit of 1.0 mg/kg (Table 1).

The decontamination water sample contained 0.54 mg/l of lead.

4.2. Soluble Lead – Citric Acid

Eighteen of the 80 samples contained total lead at a concentration of greater than or equal to 50 mg/kg and were subsequently analyzed for soluble lead by WET-citric. The maximum soluble lead concentration was 71 mg/l. The minimum soluble lead concentration was 0.31 mg/l (Table 1).

4.3. Soluble Lead – Deionized Water

Eleven of the samples analyzed using the WET-citric contained soluble lead at a concentration greater than or equal to 5.0 mg/l and were subsequently analyzed for soluble lead using the WET-DI. The maximum soluble lead concentration using the WET-DI was 0.48 mg/l. The minimum soluble lead concentration using the WET-DI was the laboratory practical quantization limit of 0.20 mg/l.

4.4. Soluble Lead – TCLP

Eleven of the samples analyzed using the WET-citric contained soluble lead at a concentration greater than or equal to 5.0 mg/l and were subsequently analyzed for soluble lead by the TCLP. The maximum soluble lead concentration using the TCLP was 1.2 mg/l. The minimum soluble lead concentration using the TCLP was 0.08 mg/l.

4.5. pH

Eight of the samples collected were analyzed for pH. The maximum pH level was 9.1 and the minimum pH level was 8.2.

5. STATISTICAL EVALUATION

The following subsections describe the statistical methods used to evaluate the lead data set for the site.

Based on the analytical results, the site was divided into two groups. Group 1 includes borings B1 through B5 (from approximate station numbers 549+00 [SR-55] to 534+00 [SR-55]) and Group 2 includes borings B6 through B20 (from approximate station numbers 534+00 [SR-55] to 484+00 [SR-91]).

In order to evaluate four of the possible soil excavation depth scenarios, the following depth combinations were evaluated:

- **Scenario A** – surface soil (0 to ½ foot) and underlying subsurface soil (½ foot to 4 feet bgs)
- **Scenario B** – the upper 1½ feet (0 to 1½ feet) and the underlying subsurface soil (1½ to 4 feet)

- **Scenario C** – the upper 3 feet (0 to 3 feet) and the underlying subsurface soil (3 to 4 feet)
- **Scenario D** – the entire 4-foot soil column

5.1. Statistical Evaluation Methods

The analytical results were evaluated statistically to recommend the appropriate method of on-site reuse or off-site disposal of excavated soil. Prior to performing statistical calculations, concentrations below the laboratory reporting limit were assigned values equal to half the reporting limit. Statistical methods were applied to the data set to evaluate:

- The total lead data population distribution;
- The one-sided upper confidence limits (UCLs) of the means of the total lead concentrations; and
- If there is an acceptable correlation between total and soluble lead concentrations that would allow prediction of soluble lead concentrations based on calculated UCLs.

5.2. Population Distribution

A test for population distribution is necessary in order to apply the appropriate evaluation methods when estimating the UCLs on the total lead means. When evaluating the distribution of total lead concentrations, total lead data are treated as one data set. Distribution was evaluated in accordance with EPA SW-846, Chapter Nine (1986) by comparing the mean to the variance of the total lead data sets. If the mean is greater than the variance, the data set is normally distributed and no transformation is performed. If the mean is less than the variance, the data set is transformed using an arcsine conversion. If the mean is approximately equal to the variance, the data set is transformed using a square-root conversion. A histogram of the data is presented in Appendix D.

5.3. Upper Confidence Limits

The UCLs are used to address the uncertainty associated with estimating the true mean concentration of a population. As more data become available for a given site, the uncertainty of the estimate of a true statistical mean decreases and the UCLs move closer to the true mean of the population.

For this project, a 90 percent UCL is calculated for soil to be reused on site, while a 95 percent UCL is calculated for soil to be disposed off site. As described in Section 2.3.2, the maximum 90 percent UCL allowed for soil reuse on site is 3,397 mg/kg. A total lead concentration above 1,000 mg/kg is classified as hazardous for soil not reused on site, corresponding to a 95 percent UCL greater than or equal to 1,000 mg/kg.

One-sided 90 and 95 percent UCLs of the true mean are defined as values that, when calculated repeated for randomly drawn subsets of data, equal or exceed the true mean 90 and 95 percent of the time, respectively. The following equation (EPA, 1986) was used to calculate the UCLs:

$$UCL = x + t_p \frac{S}{sqrt(n)}$$

Where:

x = sample mean
t_p = student's t for a one-tailed confidence interval and a probability of p
S = standard deviation
N = number of samples

The samples in this study were collected using a systematic random sampling approach. SW-846 Chapter Nine indicates that statistical transformation should be used if the data set is not normally distributed and that statistical evaluations should be performed on the transformed scale. The data for this project are not normally distributed and therefore must be transformed using the arcsine function.

Transformation using the arcsine function is accomplished by calculating the arcsine of the concentration normalized to the maximum concentration in the population. That is:

$$y_i = \text{arcsine } \frac{x_i}{x_{max}}$$

Where:

y_i = transformed value sample mean
x_i = reported concentration
x_{max} = maximum concentration reported for the data set

The final result is transformed back to a concentration by multiplying the sine of the transformed number by the maximum concentration:

$z_i = x_{max} \sin y_i$

Results of this exercise are presented in Appendix C and are shown graphically on the block diagrams presented in Appendix F.

5.4. Regression Analysis

A linear regression analysis is used to create a soluble lead prediction model for use with the 90 and 95 percent UCLs. A line fit to the data using the equation:

$y = mx + b$

Where:

y = soluble lead by WET-citric acid, mg/l
x = total lead concentration, mg/kg
b = y-intercept
m = slope

$$\text{slope} = \frac{r \times s_t}{s_s}$$

Where:

r = correlation coefficient
s_t = standard deviation of the total lead concentrations
s_s = standard deviation of the soluble lead concentrations

The linear equation from the regression is used to predict soluble lead concentrations for the statistical total lead UCLs. The integrity of the equation is directly related to 'r,' the correlation coefficient, which should be greater than or equal to 0.8.

A regression analysis was performed for this data set and the correlation coefficient was 0.94. The regression analysis is included as Appendix E.

6. CONCLUSIONS

The analyses of the data indicate that the surface layers tend to have the highest concentrations of total lead, followed by the 1½-, 3-, and 4-foot layers. Assuming the soil has not been disturbed since construction of the routes in the site vicinities, concentrations of total lead would be expected to decrease with depth.

7. RECOMMENDATIONS

Based on the findings of this study, recommendations are summarized on block diagrams in Appendix C and discussed below.

7.1. Group 1 – Recommendations for Soil for Reuse by the Department

All scenarios: The soil in all layer combinations (surface to 4 feet bgs) is suitable for on-site reuse by the Department with no restrictions based on total and soluble lead concentrations (Type X).

7.2. Group 1 – Recommendations for Soil to be Disposed Off Site

All scenarios: The soil in all layer combinations (surface to 4 feet bgs) is classified as non-hazardous and may be disposed off site with no restrictions based on total and soluble lead concentrations (Type X).

7.3. Group 2 – Recommendations for Soil for Reuse by the Department

Soil at the site can be reused on site with the following restrictions:

- Scenario A: The soil in the surface layer (surface to 0.5 feet bgs) (Type Y1) may be reused on site if it is placed a minimum of 5 feet above the maximum water table elevation and covered with at least 1 foot of non-hazardous soil. The remaining soil from the 1.5- to 4-foot layers combined (0.5 to 4 feet bgs) is suitable for on-site reuse by the Department with no restrictions based on total and soluble lead concentrations (Type X).

- Scenario B: The soil in the surface and 1.5-foot layers combined (surface to 1.5 feet bgs) (Type Y1) may be reused on site if it is placed a minimum of 5 feet above the maximum water table elevation and covered with at least 1 foot of non-hazardous soil. The remaining soil from the 3- and 4-foot layers combined (1.5 to 4 feet bgs) is suitable for on-site reuse by the Department with no restrictions based on total and soluble lead concentrations (Type X).

- Scenario C: The soil in the surface to 3-foot layers combined (surface to 3 feet bgs) (Type Y1) may be reused on site if it is placed a minimum of 5 feet above the maximum water table elevation and covered with at least 1 foot of non-hazardous soil. The remaining soil from the 4-foot layer (3 to 4 feet bgs) has no restrictions based on total and soluble lead concentrations (Type X).

- Scenario D: The soil in the layers combined (surface to 4 feet bgs) (Type Y1) may be reused on site if it is placed a minimum of 5 feet above the maximum water table elevation and covered with at least 1 foot of non-hazardous soil.

7.4. Group 2 – Recommendations for Soil to be Disposed Off Site

If the Department elects to dispose the soil off site, the following restrictions apply:

- Scenario A: The soil in the surface layer (surface to 0.5 feet bgs) is classified as California hazardous and should be disposed at a Class 1 disposal site in accordance with Title 22 CCR requirements (Type Z2). The remaining soil from the 1.5- to 4-foot layers combined (0.5 to 4 feet bgs) is classified as non-hazardous and may be disposed off site with no restrictions based on total and soluble lead concentrations (Type X).

- Scenario B: The soil in the surface and 1.5-foot layer combined (surface to 1.5 feet bgs) is classified as California hazardous and should be disposed at a Class 1 disposal site in accordance with Title 22 CCR requirements (Type Z2). The remaining soil from the 3- and 4-foot layers combined (1.5 to 4 feet bgs) is classified as non-hazardous and may be disposed off site with no restrictions based on total and soluble lead concentrations (Type X).

- Scenario C: The soil in the surface to 3-foot layers combined (surface to 3 feet bgs) and in the 4-foot layer (3 to 4 feet bgs) is classified as California hazardous and should be disposed at a Class 1 disposal site in accordance with Title 22 CCR requirements (Type Z2).

- Scenario D: The soil in the layers combined (surface to 4 feet bgs) is classified as California hazardous and should be disposed at a Class 1 disposal site in accordance with Title 22 CCR requirements (Type Z2).

The Department should notify the contractors performing the construction activities that elevated concentrations of lead are present in on-site soil. Appropriate health and safety measures should be taken to minimize the potential exposure to lead.

8. HEALTH EFFECTS OF LEAD

Concentrations of lead in soil at the site represent a potential threat to the health of site workers performing earthwork activities.

Lead in its element form is a heavy, ductile, soft, gray metal. The permissible exposure limit for lead is 0.05 milligrams per cubic meter (mg/m^3) in air based on an eight-hour time-weighted average. The immediately dangerous to life and health exposure limit is 100 mg/m^3 as established by the National Institute of Occupational Safety and Health. Exposure may produce several symptoms including weakness, eye irritation, facial pallor, pale eyes, lassitude, insomnia, anemia, tremors, malnutrition, constipation, paralysis of the wrists and ankles, abdominal pain, colic, nephropathy, encephalopathy, gingival lead line, hypertension, anorexia, and weight loss. Target organs are the central nervous system, kidneys, eyes, blood, gingival tissue, and the gastrointestinal tract.

Because of the potential hazard from exposure to lead-contaminated soil, a lead HSP should be prepared by a Certified Industrial Hygienist (CIH). In addition, all site workers (earthwork) should have completed a training program meeting the requirements of 29 CFR 1910.120 and 8 CCR 1532.1. The plan developed by the CIH should include a hazard analysis, dust control measures, air monitoring, signage, work practices, emergency response plans, personal protective equipment, decontamination, and documentation.

9. LIMITATIONS

The services outlined in this report have been conducted in a manner generally consistent with current regulatory guidelines. No warranty, expressed or implied, is made regarding the professional opinions presented in this report. Ninyo & Moore's opinions are based on an analysis of observed conditions and on information obtained from third parties. It is likely that variations in soil conditions may exist.

The samples collected and chemically analyzed and the observations made are believed to be representative of the general area evaluated; however, conditions can vary significantly between sampling locations. The interpretations and opinions contained in this report are based on the re-

sults of laboratory tests and analyses intended to detect the presence and measure the concentration of selected chemical or physical constituents in samples collected from the site. The analyses have been conducted by an independent laboratory certified by the State of California to conduct such analyses. Ninyo & Moore has no involvement in, or control over, such analyses and has no means of confirming the accuracy of laboratory results. Ninyo & Moore, therefore, disclaims any responsibility for inaccuracy in such laboratory results.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader wants any additional information, or has questions regarding content, interpretations presented, or completeness of this document. Opinions and judgments expressed herein, which are based on our understanding and interpretation of current regulatory standards, should not be construed as legal opinions.

For individuals with sensory disabilities, this document is available in alternate formats upon request. For any questions regarding this document, please call or write David Yaghoubi, Environmental Engineering, 3347 Michelson Drive, Suite 100, Irvine, California 92612-1692. Phone Number (949) 724-2221.

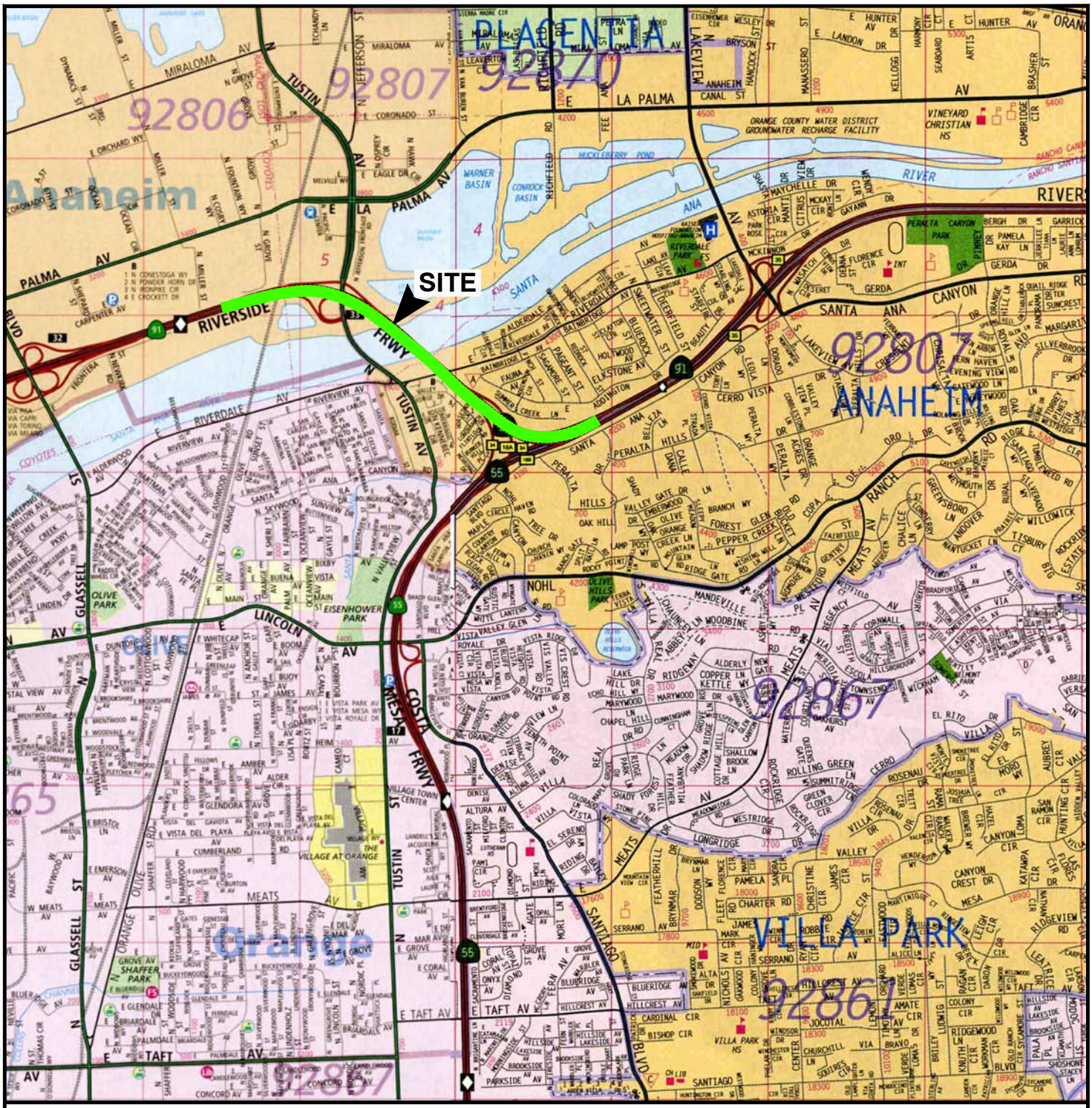
TABLE 1 – SOIL ANALYTICAL RESULTS – AERIALLY DEPOSITED LEAD, pH, AND GPS COORDINATES

Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH	Latitude	Longitude
GROUP 1									
B1-0.5	0.5	3/13/2012	17	--	--	--	--	33.845311	-117.824547
B1-1.5	1.5	3/13/2012	22	--	--	--	--		
B1-3.0	3	3/13/2012	ND<1.0	--	--	--	--		
B1-4.0	4	3/13/2012	ND<1.0	--	--	--	--		
B2-0.5	0.5	3/13/2012	5.2	--	--	--	8.8	33.845061	-117.825329
B2-1.5	1.5	3/13/2012	ND<1.0	--	--	--	--		
B2-3.0	3.0	3/13/2012	3.8	--	--	--	--		
B2-4.0	4.0	3/13/2012	28	--	--	--	--		
B3-0.5	0.5	3/13/2012	14	--	--	--	--	33.844797	-117.826096
B3-1.5	1.5	3/13/2012	3.1	--	--	--	--		
B3-3.0	3.0	3/13/2012	20	--	--	--	--		
B3-4.0	4.0	3/13/2012	1.1	--	--	--	--		
B4-0.5	0.5	3/13/2012	4.2	--	--	--	--	33.844641	-117.826940
B4-1.5	1.5	3/13/2012	1.5	--	--	--	--		
B4-3.0	3	3/13/2012	ND<1.0	--	--	--	8.5		
B4-4.0	4	3/13/2012	ND<1.0	--	--	--	--		
B5-0.5	0.5	3/13/2012	4.4	--	--	--	--	33.844712	-117.827840
B5-1.5	1.5	3/13/2012	ND<1.0	--	--	--	--		
B5-3.0	3.0	3/13/2012	2.4	--	--	--	--		
B5-4.0	4.0	3/13/2012	ND<1.0	--	--	--	--		
GROUP 2									
B6-0.5	0.5	3/13/2012	13	--	--	--	--	33.845277	-117.828769
B6-1.5	1.5	3/13/2012	130	8.6	ND<0.20	0.08	--		
B6-3.0	3.0	3/13/2012	1.7	--	--	--	--		
B6-4.0	4.0	3/13/2012	ND<1.0	--	--	--	--		
B7-0.5	0.5	3/13/2012	600	16	ND<0.20	0.33	--	33.845798	-117.829404
B7-1.5	1.5	3/13/2012	23	--	--	--	--		
B7-3.0	3.0	3/13/2012	ND<1.0	--	--	--	--		
B7-4.0	4.0	3/13/2012	ND<1.0	--	--	--	--		
B8-0.5	0.5	3/13/2012	1,100	71	0.45	1.2	--	33.846172	-117.829907
B8-1.5	1.5	3/13/2012	13	--	--	--	--		
B8-3.0	3.0	3/13/2012	1.4	--	--	--	--		
B8-4.0	4.0	3/13/2012	20	--	--	--	8.8		
B9-0.5	0.5	3/13/2012	42	--	--	--	--	33.846643	-117.830737
B9-1.5	1.5	3/13/2012	14	--	--	--	--		
B9-3.0	3.0	3/13/2012	ND<1.0	--	--	--	--		
B9-4.0	4.0	3/13/2012	11	--	--	--	--		
B10-0.5	0.5	3/13/2012	140	7.7	ND<0.20	0.17	8.5	33.847063	-117.831383
B10-1.5	1.5	3/13/2012	12	--	--	--	--		
B10-3.0	3.0	3/13/2012	170	9.3	ND<0.20	0.13	--		
B10-4.0	4.0	3/13/2012	4.7	--	--	--	--		
B11-0.5	0.5	3/13/2012	76	4.2	--	--	--	33.847604	-117.832139
B11-1.5	1.5	3/13/2012	120	9.0	ND<0.20	0.3	--		
B11-3.0	3.0	3/13/2012	270	21	ND<0.20	0.53	--		
B11-4.0	4.0	3/13/2012	310	22	0.32	0.62	--		
B12-0.5	0.5	3/13/2012	14	--	--	--	--	33.848006	-117.832705
B12-1.5	1.5	3/13/2012	6.4	--	--	--	--		
B12-3.0	3.0	3/13/2012	22	--	--	--	--		
B12-4.0	4.0	3/13/2012	56	2.8	--	--	--		
B13-0.5	0.5	3/13/2012	17	--	--	--	9.0	33.849898	-117.835266
B13-1.5	1.5	3/13/2012	29	--	--	--	--		
B13-3.0	3.0	3/13/2012	32	--	--	--	--		

TABLE 1 – SOIL ANALYTICAL RESULTS – AERIALLY DEPOSITED LEAD, pH, AND GPS COORDINATES

Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH	Latitude	Longitude
B13-4.0	4.0	3/13/2012	45	--	--	--	--		
B14-0.5	0.5	3/13/2012	110	7.1	ND<0.20	0.16	--	33.850530	-117.836097
B14-1.5	1.5	3/13/2012	160	4.4	--	--	--		
B14-3.0	3.0	3/13/2012	ND<1.0	--	--	--	--		
B14-4.0	4.0	3/13/2012	15	--	--	--	--		
B15-0.5	0.5	3/13/2012	2.7	--	--	--	--	33.850891	-117.836553
B15-1.5	1.5	3/13/2012	ND<1.0	--	--	--	8.2		
B15-3.0	3.0	3/13/2012	8.6	--	--	--	--		
B16-0.5	0.5	3/13/2012	60	3.9	--	--	--	33.851593	-117.837445
B16-1.5	1.5	3/13/2012	41	--	--	--	--		
B16-3.0	3.0	3/13/2012	81	5.5	ND<0.20	0.09	--		
B16-4.0	4.0	3/13/2012	24	--	--	--	--		
B17-0.5	0.5	3/13/2012	56	0.31	--	--	--	33.851767	-117.839191
B17-1.5	1.5	3/13/2012	54	0.37	--	--	--		
B17-3.0	3.0	3/13/2012	7.4	--	--	--	--		
B17-4.0	4.0	3/13/2012	ND<1.0	--	--	--	9.0		
B18-0.5	0.5	3/13/2012	18	--	--	--	--	33.851757	-117.840136
B18-1.5	1.5	3/13/2012	18	--	--	--	--		
B18-3.0	3.0	3/13/2012	1.0	--	--	--	--		
B18-4.0	4.0	3/13/2012	2.7	--	--	--	--		
B19-0.5	0.5	3/13/2012	310	20	0.48	0.37	--	33.851692	-117.841332
B19-1.5	1.5	3/13/2012	ND>1.0	--	--	--	--		
B19-3.0	3.0	3/13/2012	ND>1.0	--	--	--	9.1		
B19-4.0	4.0	3/13/2012	4.3	--	--	--	--		
B20-0.5	0.5	3/13/2012	68	4.0	--	--	--	33.851570	-117.841820
B20-1.5	1.5	3/13/2012	ND<1.0	--	--	--	--		
B20-3.0	3.0	3/13/2012	ND<1.0	--	--	--	--		
B20-4.0	4.0	3/13/2012	ND<1.0	--	--	--	--		
Maximum			1100	71	0.48	1.2	9.1		
Average			56.6	12.1	0.19	0.36	8.7		
Minimum			ND<1.0	0.31	ND<0.20	0.08	8.2		
Regulatory Limits			1,411[(1)]	5[(2)]	1.5[(3)]	5[(4)]	5[(5)]		
Decontamination Water (mg/l)									
EB-1	--	3/13/2012	0.54	--	--	--			

Notes:
TTLC – total lead for comparison to the Total Threshold Limit Concentration
mg/kg – milligrams per kilogram
WET – Waste Extraction Test
WET-citric – soluble lead by WET using citric acid for comparison to the Soluble Threshold Limit Concentration
mg/l – milligrams per liter
WET-DI – soluble lead by WET using deionized water for comparison to the Soluble Threshold Limit Concentration
TCLP – soluble lead by the Toxicity Characteristic Leaching Procedure
ND − not detected above reporting limits presented in Appendix B
1 − Limit specified in addendum to Variance issued by the Department of Toxic Substance Control to Caltrans (DTSC) Variance, September 22, 2000; Addendum, December 2002; Addendum June 2008)
2 − Soluble Threshold Limit Concentration for California Hazardous Waste (California Code of Regulations [CCR] Title 22, Section 66261.24)
3 − Limit Specified by DTSC Variance
4 − Maximum concentration for the TCLP of Resource, Conservation, and Recovery Act (RCRA) hazardous waste (CCR Title 22, Section 66216.24)
5 − Minimum value specified by DTSC variance
* Borings sampled as part of Task Order 31 and were identified as B1 and B2, respectively



208449_A2.DWG.....GK

REFERENCE: 2007 THOMAS GUIDE FOR LOS ANGELES/ORANGE COUNTIES, STREET GUIDE AND DIRECTORY

N

APPROXIMATE SCALE

0 2400 4800

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

Ninyo & Moore	□□□□□□□□□□N	FIGURE
PROJECT NO.	DATE	NORTHBOUND SR-55/WESTBOUND SR-91 CONNECTOR ANAHEIM, CALIFORNIA	□
208449003	4/12		

REFERENCE: GOOGLE EARTH AERIAL PHOTO, 2012.

LEGEND	
B1 - B5	GROUP 1 BORINGS
B6 - B20	GROUP 2 BORINGS

N

SCALE IN FEET

0 600 1,200

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

Ninyo & Moore

PROJECT NO.	DATE
208449003	4/12

NORTHBOUND SR-55/WESTBOUND SR-91 CONNECTOR
ANAHEIM, CALIFORNIA

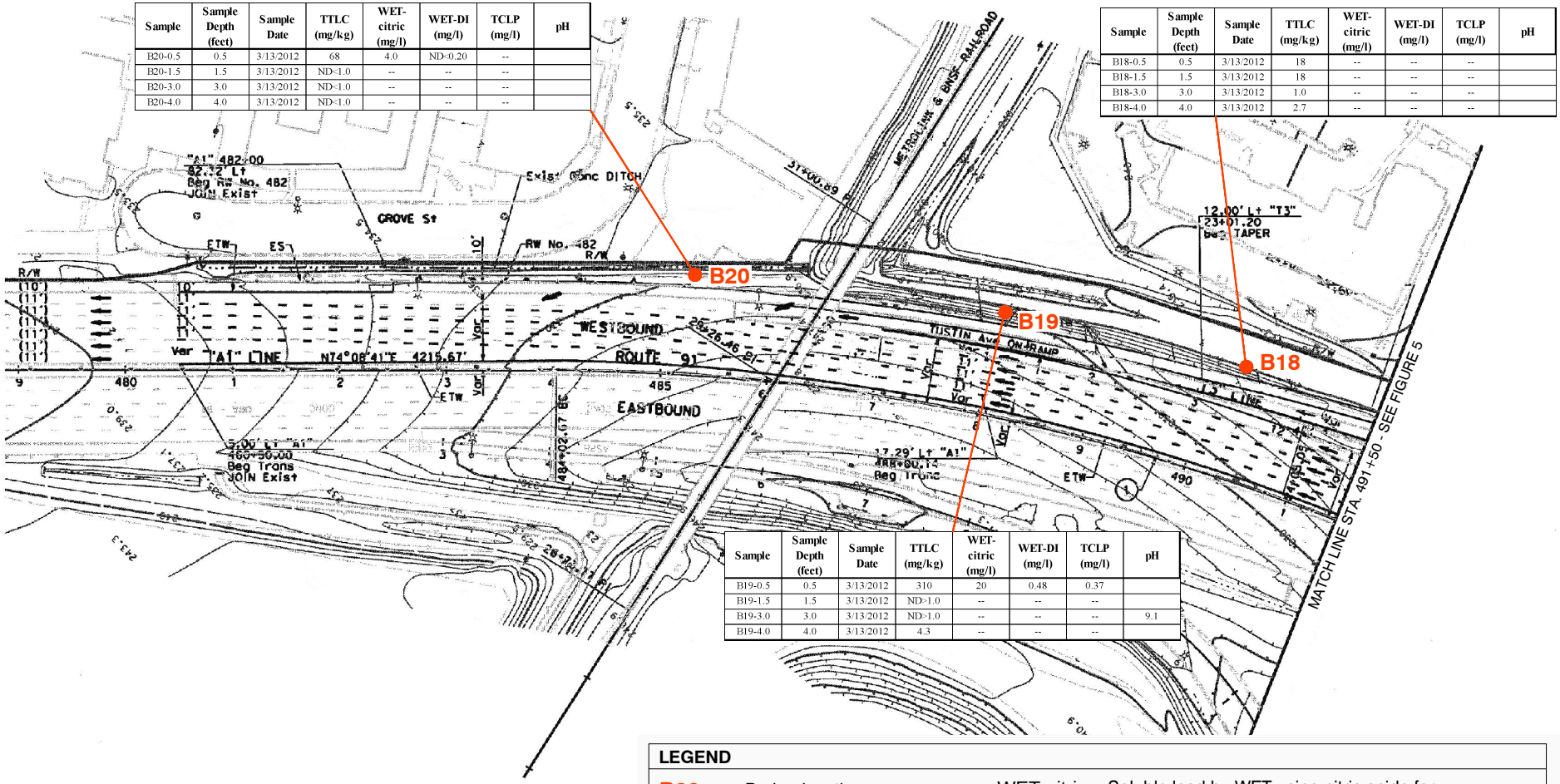
FIGURE

208449_A3.DWG..... – G.K.

Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B20-0.5	0.5	3/13/2012	68	4.0	ND<0.20	--	
B20-1.5	1.5	3/13/2012	ND<1.0	--	--	--	
B20-3.0	3.0	3/13/2012	ND<1.0	--	--	--	
B20-4.0	4.0	3/13/2012	ND<1.0	--	--	--	

Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B18-0.5	0.5	3/13/2012	18	--	--	--	
B18-1.5	1.5	3/13/2012	18	--	--	--	
B18-3.0	3.0	3/13/2012	1.0	--	--	--	
B18-4.0	4.0	3/13/2012	2.7	--	--	--	

Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B19-0.5	0.5	3/13/2012	310	20	0.48	0.37	
B19-1.5	1.5	3/13/2012	ND<1.0	--	--	--	
B19-3.0	3.0	3/13/2012	ND<1.0	--	--	--	9.1
B19-4.0	4.0	3/13/2012	4.3	--	--	--	



LEGEND			
B20 ●	Boring location	WET-citric	Soluble lead by WET using citric acide for comparision to Soluble Threshold Limit Concentration
TTLC	Total lead for comparison to the Total Threshold Limit Concentration	WET-DI	Soluble lead by WET using deionized water for comparison to Soluble Threshold Limit Concentration
mg/kg	milligrams per kilogram	mg/l	milligrams per liter
WET	Waste Extraction Test	TCLP	Soluble lead by Toxicity Characteristic Leaching Procedure

REFERENCE: CALTRANS

N

SCALE IN FEET

0 150 300

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

208449_A4.DWG.....-G.K.

Ninyo & Moore

□□□N□□□□□

FIGURE

□

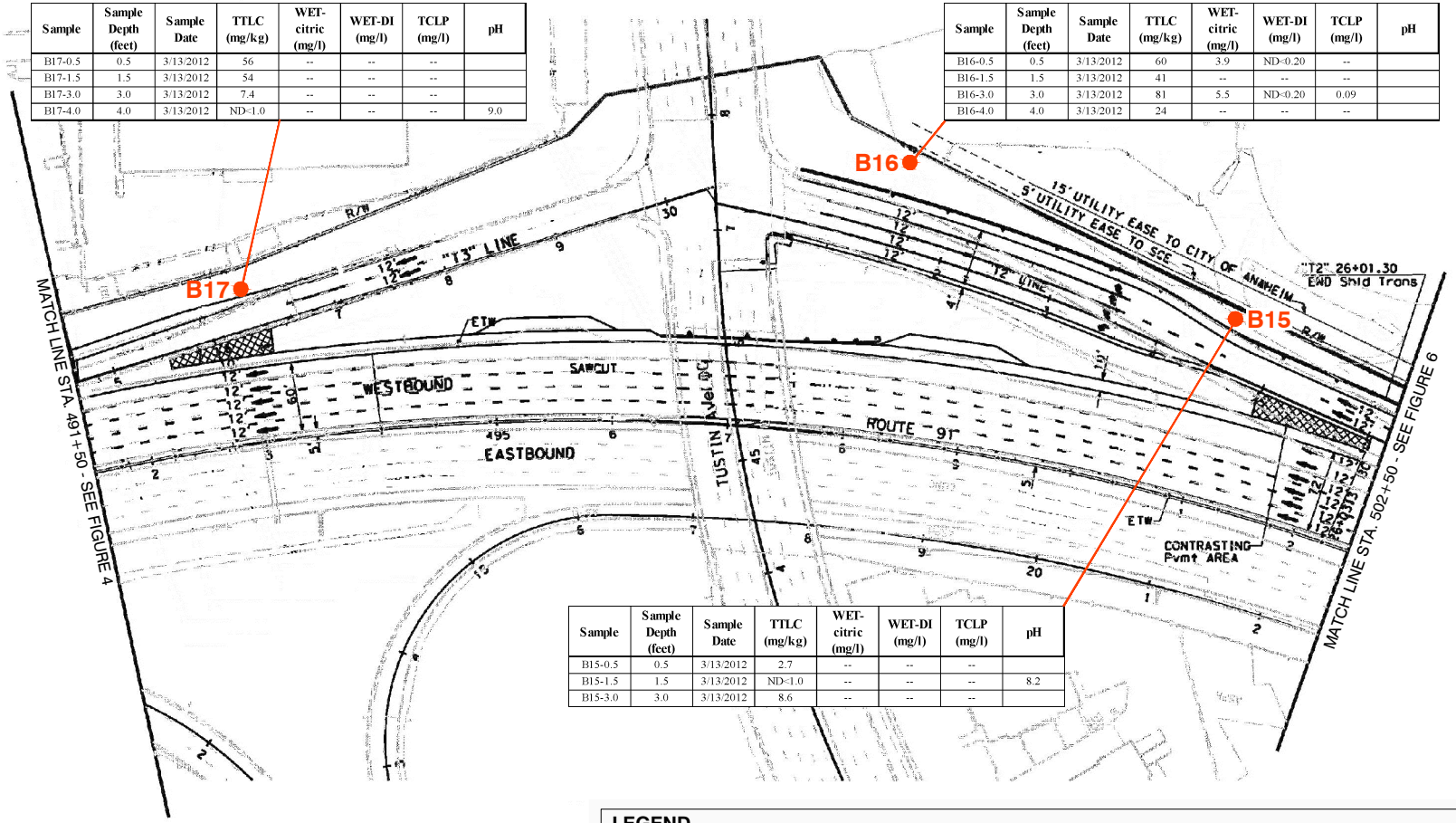
PROJECT NO.	DATE
208449003	4/12

NORTHBOUND SR-55/WESTBOUND SR-91 CONNECTOR
ANAHEIM, CALIFORNIA

Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B17-0.5	0.5	3/13/2012	56	--	--	--	
B17-1.5	1.5	3/13/2012	54	--	--	--	
B17-3.0	3.0	3/13/2012	7.4	--	--	--	
B17-4.0	4.0	3/13/2012	ND<1.0	--	--	--	9.0

Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B16-0.5	0.5	3/13/2012	60	3.9	ND<0.20	--	
B16-1.5	1.5	3/13/2012	41	--	--	--	
B16-3.0	3.0	3/13/2012	81	5.5	ND<0.20	0.09	
B16-4.0	4.0	3/13/2012	24	--	--	--	

Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B15-0.5	0.5	3/13/2012	2.7	--	--	--	
B15-1.5	1.5	3/13/2012	ND<1.0	--	--	--	8.2
B15-3.0	3.0	3/13/2012	8.6	--	--	--	



LEGEND			
B17 ●	Boring location	WET-citric	Soluble lead by WET using citric acide for comparision to Soluble Threshold Limit Concentration
TTLC	Total lead for comparison to the Total Threshold Limit Concentration	WET-DI	Soluble lead by WET using deionized water for comparison to Soluble Threshold Limit Concentration
mg/kg	milligrams per kilogram	mg/l	milligrams per liter
WET	Waste Extraction Test	TCLP	Soluble lead by Toxicity Characteristic Leaching Procedure

REFERENCE: CALTRANS

N

SCALE IN FEET

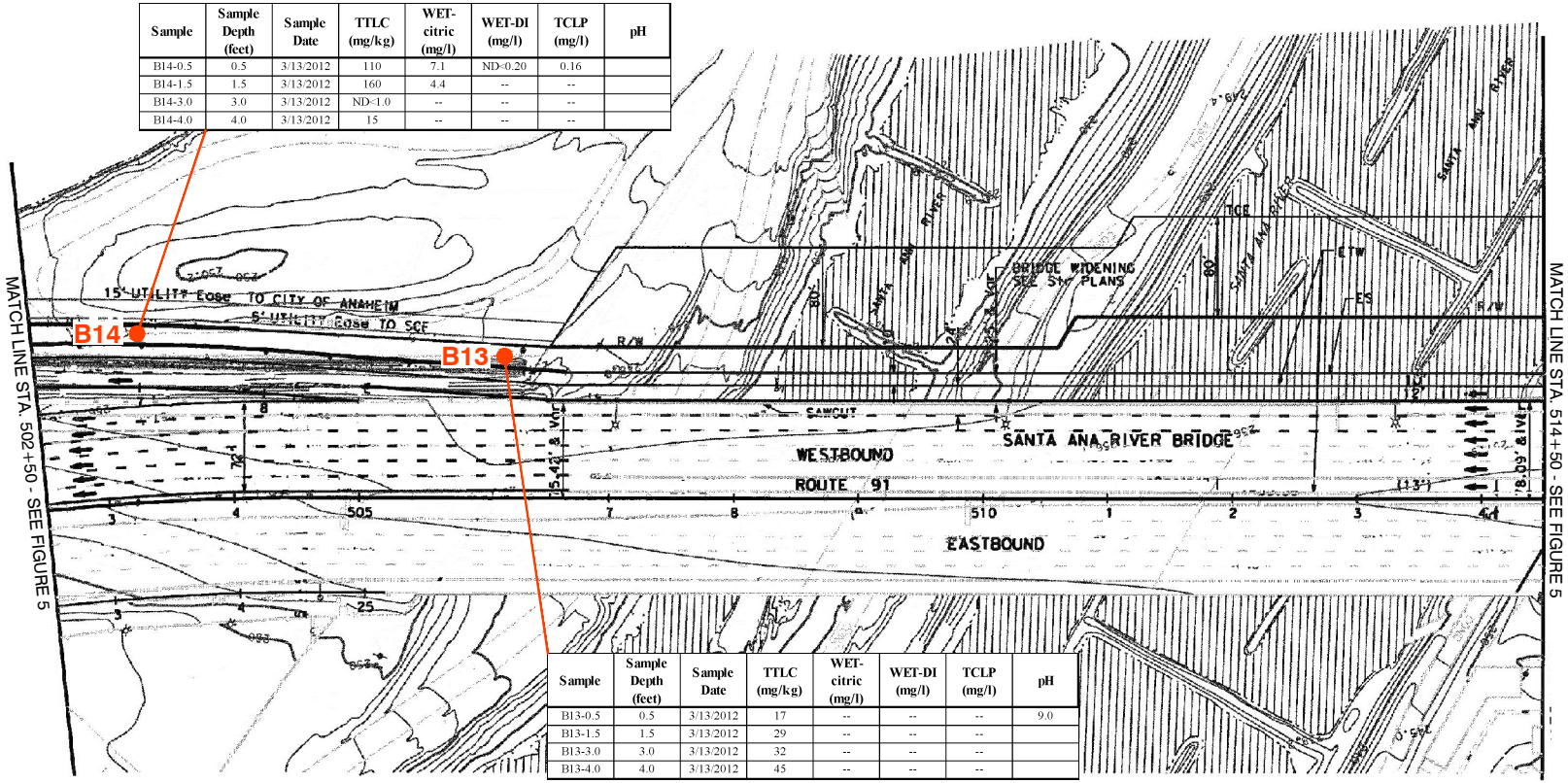
0 150 300

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

208449_A5.DWG..... -G.K.

Ninyo & Moore		FIGURE
PROJECT NO.	DATE	NORTHBOUND SR-55/WESTBOUND SR-91 CONNECTOR ANAHEIM, CALIFORNIA
208449003	4/12	

Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B14-0.5	0.5	3/13/2012	110	7.1	ND<0.20	0.16	
B14-1.5	1.5	3/13/2012	160	4.4	--	--	
B14-3.0	3.0	3/13/2012	ND<1.0	--	--	--	
B14-4.0	4.0	3/13/2012	15	--	--	--	



Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B13-0.5	0.5	3/13/2012	17	--	--	--	9.0
B13-1.5	1.5	3/13/2012	29	--	--	--	
B13-3.0	3.0	3/13/2012	32	--	--	--	
B13-4.0	4.0	3/13/2012	45	--	--	--	

LEGEND

B14 ●	Boring location	WET-citric	Soluble lead by WET using citric acide for comparision to Soluble Threshold Limit Concentration
TTLC	Total lead for comparison to the Total Threshold Limit Concentration	WET-DI	Soluble lead by WET using deionized water for comparison to Soluble Threshold Limit Concentration
mg/kg	milligrams per kilogram	mg/l	milligrams per liter
WET	Waste Extraction Test	TCLP	Soluble lead by Toxicity Characteristic Leaching Procedure

REFERENCE: CALTRANS

N

SCALE IN FEET

0 150 300

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

208449_A6.DWG..... -G.K.

Ninyo & Moore

□□□N□□□□□

PROJECT NO.	DATE
208449003	4/12

NORTHBOUND SR-55/WESTBOUND SR-91 CONNECTOR
ANAHEIM, CALIFORNIA

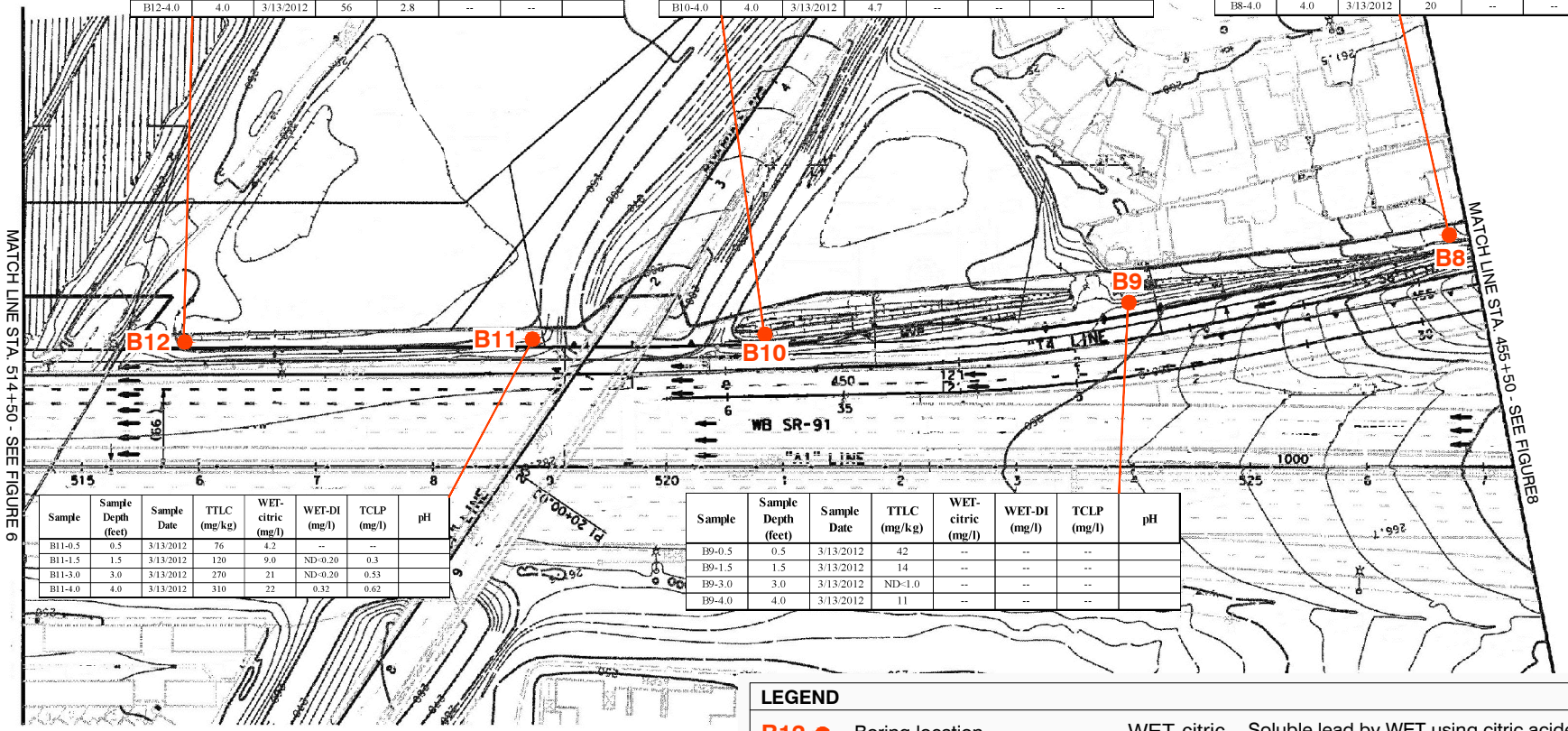
FIGURE

□

Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B12-0.5	0.5	3/13/2012	14	--	--	--	
B12-1.5	1.5	3/13/2012	6.4	--	--	--	
B12-3.0	3.0	3/13/2012	22	--	--	--	
B12-4.0	4.0	3/13/2012	56	2.8	--	--	

Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B10-0.5	0.5	3/13/2012	140	7.7	ND<0.20	0.17	8.5
B10-1.5	1.5	3/13/2012	12	--	--	--	
B10-3.0	3.0	3/13/2012	170	9.3	ND<0.20	0.13	
B10-4.0	4.0	3/13/2012	4.7	--	--	--	

Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B8-0.5	0.5	3/13/2012	1100	71	0.45	1.20	
B8-1.5	1.5	3/13/2012	13	--	--	--	
B8-3.0	3.0	3/13/2012	1.4	--	--	--	
B8-4.0	4.0	3/13/2012	20	--	--	--	8.8



Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B11-0.5	0.5	3/13/2012	76	4.2	--	--	
B11-1.5	1.5	3/13/2012	120	9.0	ND<0.20	0.3	
B11-3.0	3.0	3/13/2012	270	21	ND<0.20	0.53	
B11-4.0	4.0	3/13/2012	310	22	0.32	0.62	

Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B9-0.5	0.5	3/13/2012	42	--	--	--	
B9-1.5	1.5	3/13/2012	14	--	--	--	
B9-3.0	3.0	3/13/2012	ND<1.0	--	--	--	
B9-4.0	4.0	3/13/2012	11	--	--	--	

LEGEND

B12 ●	Boring location	WET-citric	Soluble lead by WET using citric acide for comparision to Soluble Threshold Limit Concentration
TTLC	Total lead for comparison to the Total Threshold Limit Concentration	WET-DI	Soluble lead by WET using deionized water for comparison to Soluble Threshold Limit Concentration
mg/kg	milligrams per kilogram	mg/l	milligrams per liter
WET	Waste Extraction Test	TCLP	Soluble lead by Toxicity Characteristic Leaching Procedure

REFERENCE: CALTRANS

N

SCALE IN FEET

0 150 300

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

208449_A7.DWG..... -G.K.

Ninyo & Moore

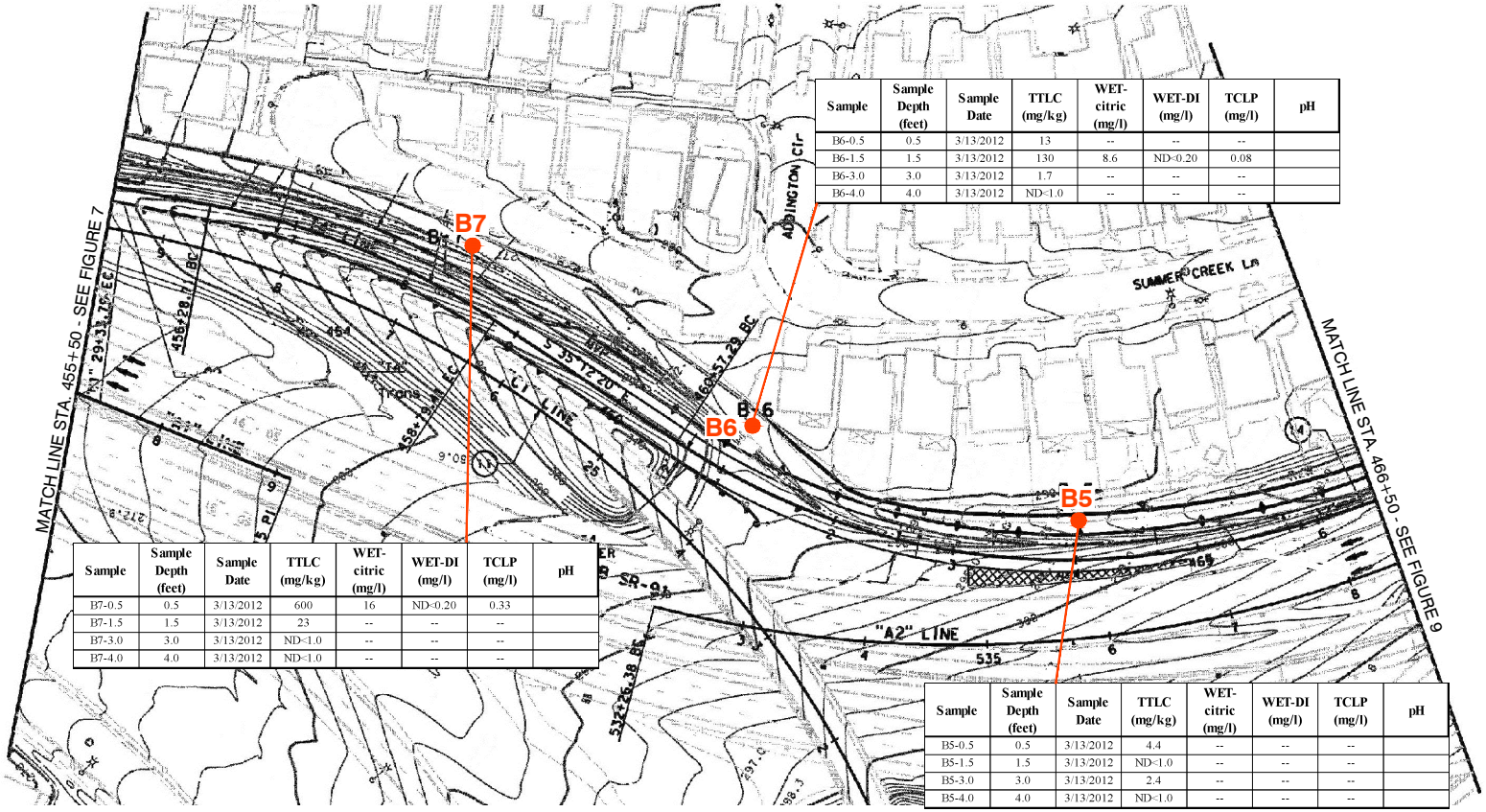
□□□N□□□□□

FIGURE

□

PROJECT NO.	DATE
208449003	4/12

NORTHBOUND SR-55/WESTBOUND SR-91 CONNECTOR
ANAHEIM, CALIFORNIA



Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B6-0.5	0.5	3/13/2012	13	--	--	--	
B6-1.5	1.5	3/13/2012	130	8.6	ND<0.20	0.08	
B6-3.0	3.0	3/13/2012	1.7	--	--	--	
B6-4.0	4.0	3/13/2012	ND<1.0	--	--	--	

Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B7-0.5	0.5	3/13/2012	600	16	ND<0.20	0.33	
B7-1.5	1.5	3/13/2012	23	--	--	--	
B7-3.0	3.0	3/13/2012	ND<1.0	--	--	--	
B7-4.0	4.0	3/13/2012	ND<1.0	--	--	--	

Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B5-0.5	0.5	3/13/2012	4.4	--	--	--	
B5-1.5	1.5	3/13/2012	ND<1.0	--	--	--	
B5-3.0	3.0	3/13/2012	2.4	--	--	--	
B5-4.0	4.0	3/13/2012	ND<1.0	--	--	--	

LEGEND

B7 ●	Boring location	WET-citric	Soluble lead by WET using citric acide for comparision to Soluble Threshold Limit Concentration
TTLC	Total lead for comparison to the Total Threshold Limit Concentration	WET-DI	Soluble lead by WET using deionized water for comparison to Soluble Threshold Limit Concentration
mg/kg	milligrams per kilogram	mg/l	milligrams per liter
WET	Waste Extraction Test	TCLP	Soluble lead by Toxicity Characteristic Leaching Procedure

REFERENCE: CALTRANS

N

SCALE IN FEET

0 150 300

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

208449_A8.DWG..... -G.K.

Ninyo & Moore

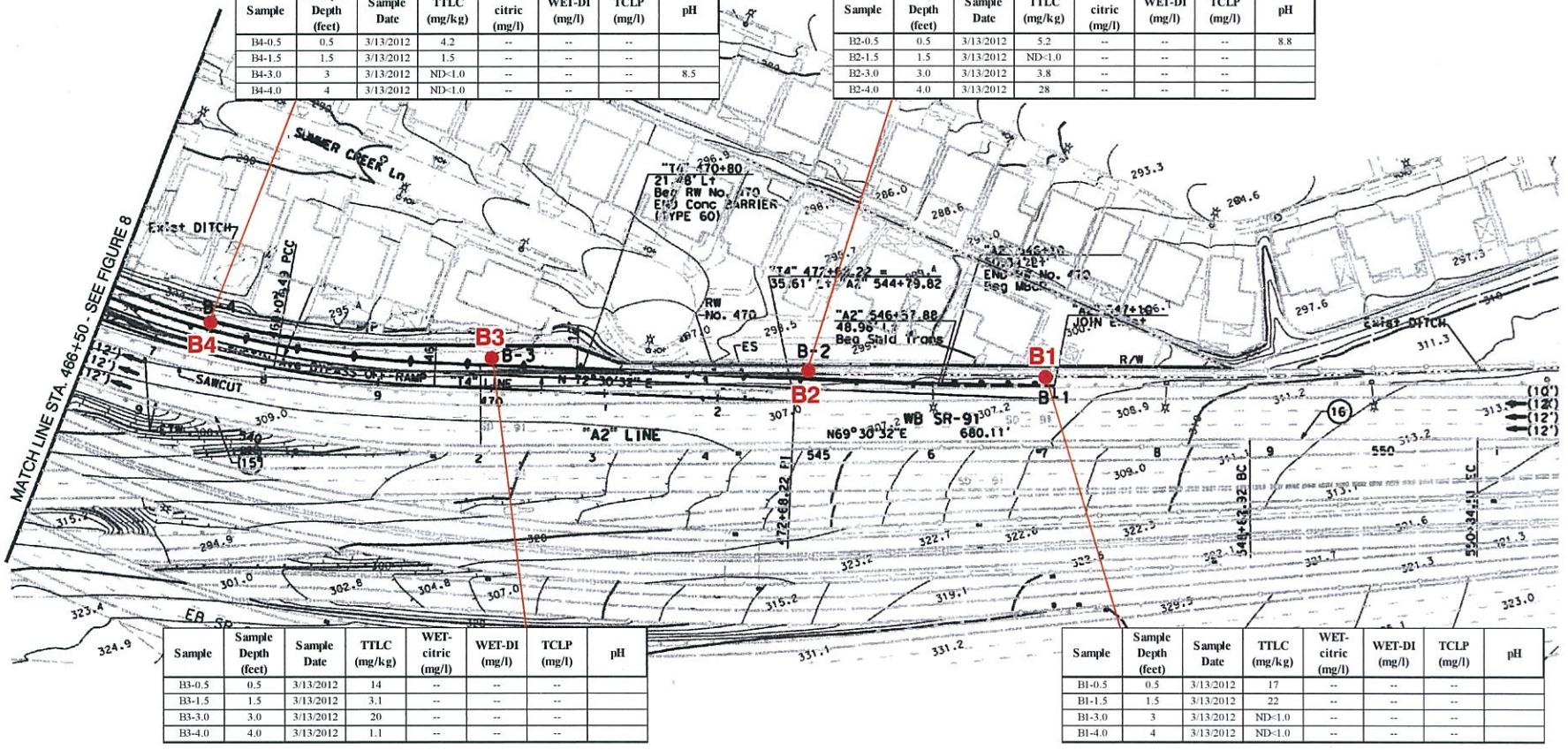
□□□N□□□□□

FIGURE

□

PROJECT NO.	DATE
208449003	4/12

NORTHBOUND SR-55/WESTBOUND SR-91 CONNECTOR
ANAHEIM, CALIFORNIA



Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B4-0.5	0.5	3/13/2012	4.2	--	--	--	
B4-1.5	1.5	3/13/2012	1.5	--	--	--	
B4-3.0	3	3/13/2012	ND<1.0	--	--	--	8.5
B4-4.0	4	3/13/2012	ND<1.0	--	--	--	

Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B2-0.5	0.5	3/13/2012	5.2	--	--	--	8.8
B2-1.5	1.5	3/13/2012	ND<1.0	--	--	--	
B2-3.0	3.0	3/13/2012	3.8	--	--	--	
B2-4.0	4.0	3/13/2012	28	--	--	--	

Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B3-0.5	0.5	3/13/2012	14	--	--	--	
B3-1.5	1.5	3/13/2012	3.1	--	--	--	
B3-3.0	3.0	3/13/2012	20	--	--	--	
B3-4.0	4.0	3/13/2012	1.1	--	--	--	

Sample	Sample Depth (feet)	Sample Date	TTLC (mg/kg)	WET-citric (mg/l)	WET-DI (mg/l)	TCLP (mg/l)	pH
B1-0.5	0.5	3/13/2012	17	--	--	--	
B1-1.5	1.5	3/13/2012	22	--	--	--	
B1-3.0	3	3/13/2012	ND<1.0	--	--	--	
B1-4.0	4	3/13/2012	ND<1.0	--	--	--	

LEGEND

B7 ●	Boring location	WET-citric	Soluble lead by WET using citric acide for comparision to Soluble Threshold Limit Concentration
TTLC	Total lead for comparison to the Total Threshold Limit Concentration	WET-DI	Soluble lead by WET using deionized water for comparison to Soluble Threshold Limit Concentration
mg/kg	milligrams per kilogram	mg/l	milligrams per liter
WET	Waste Extraction Test	TCLP	Soluble lead by Toxicity Characteristic Leaching Procedure

REFERENCE: CALTRANS

N

SCALE IN FEET

0 150 300

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

208449_A9.DWG.....-G.K.

Ninyo & Moore

BORING DATA

FIGURE 8

PROJECT NO.	DATE
208449003	4/12

NORTHBOUND SR-55/WESTBOUND SR-91 CONNECTOR
ANAHEIM, CALIFORNIA

TABLE C1
LEAD ANALYSES – GROUP 1 - SURFACE LAYER

Sample ID	Depth (feet bgs)	Total Lead (mg/kg)	Total Lead % of Maximum	Transformed Data Arcsine
B1-0.5	0.5	17	1.0000	1.570796327
B2-0.5	0.5	5.2	0.3059	0.310865065
B3-0.5	0.5	14	0.8235	0.967604921
B4-0.5	0.5	4.2	0.2471	0.249643807
B5-0.5	0.5	4.4	0.2588	0.261804030

Total Lead	Max TTLC:	17	**Transformed Data**		**Soluble Data**	
Number of Samples:	5		5			
Sample Mean:	9		0.672			
Delta = RT - mean	991					
Appropriate Number of Samples:	0.00					
Standard Deviation of Sample:	6		0.586			
Standard Deviation of Mean:	3		0.262			
Sample Variance:	37		0.343			
t-value for 90%:	1.533	Need to Transform Data	1.533			
Upper Confidence Limit for 90%:			1.074			
Reverse Transformation for 90%			15	mg/kg	0.3	mg/l
t-value for 95%:	2.132		2.132			
Upper Confidence Limit for 95%:			1.231			
Reverse Transformation for 95%			16	mg/kg	0.4	mg/l

TABLE C2
LEAD ANALYSES – GROUP 1 - 1½ TO 4 FOOT LAYER

Sample ID	Depth (feet bgs)	Total Lead (mg/kg)	Total Lead % of Maximum	Transformed Data Arcsine
B1-1.5	1.5	22	0.7857	0.903849982
B1-3.0	3	0.5	0.0179	0.017858092
B1-4.0	4	0.5	0.0179	0.017858092
B2-1.5	1.5	0.5	0.0179	0.017858092
B2-3.0	3.0	3.8	0.1357	0.136134383
B2-4.0	4.0	28	1.0000	1.570796327
B3-1.5	1.5	3.1	0.1107	0.110941725
B3-3.0	3.0	20	0.7143	0.795602953
B3-4.0	4.0	1.1	0.0393	0.039295827
B4-1.5	1.5	1.5	0.0536	0.053597086
B4-3.0	3	0.5	0.0179	0.017858092
B4-4.0	4	0.5	0.0179	0.017858092
B5-1.5	1.5	0.5	0.0179	0.017858092
B5-3.0	3.0	2.4	0.0857	0.085819591
B5-4.0	4.0	0.5	0.0179	0.017858092

Total Lead	Max TTLC:	28	**Transformed Data**		**Soluble Data**
Number of Samples:	15		15		
Sample Mean:	6		0.255		
Delta = RT - mean	994				
Appropriate Number of Samples:	0.00				
Standard Deviation of Sample:	9		0.462		
Standard Deviation of Mean:	2		0.119		
Sample Variance:	87		0.213		
t-value for 90%:	1.345	Need to Transform Data	1.345		
Upper Confidence Limit for 90%:			0.415		
Reverse Transformation for 90%			11	mg/kg	0.1 mg/l
t-value for 95%:	1.761		1.761		
Upper Confidence Limit for 95%:			0.465		
Reverse Transformation for 95%			13	mg/kg	0.2 mg/l

TABLE C3
LEAD ANALYSES – GROUP 1 - SURFACE TO $1^{1}/_{2}$ FOOT LAYER

Sample ID	Depth (feet bgs)	Total Lead (mg/kg)	Total Lead % of Maximum	Transformed Data Arcsine
B1-0.5	0.5	17	0.7727	0.883126675
B1-1.5	1.5	22	1.0000	1.570796327
B2-0.5	0.5	5.2	0.2364	0.238621731
B2-1.5	1.5	0.5	0.0227	0.022729230
B3-0.5	0.5	14	0.6364	0.689775001
B3-1.5	1.5	3.1	0.1409	0.141379608
B4-0.5	0.5	4.2	0.1909	0.192088188
B4-1.5	1.5	1.5	0.0682	0.068234756
B5-0.5	0.5	4.4	0.2000	0.201357921
B5-1.5	1.5	0.5	0.0227	0.022729230

Total Lead	Max TTLC:	22	**Transformed Data**		**Soluble Data**
Number of Samples:	10		10		
Sample Mean:	7		0.403		
Delta = RT - mean	993				
Appropriate Number of Samples:	0.00				
Standard Deviation of Sample:	8		0.501		
Standard Deviation of Mean:	2		0.158		
Sample Variance:	58		0.251		
t-value for 90%:	1.383	Need to Transform Data	1.383		
Upper Confidence Limit for 90%:			0.622		
Reverse Transformation for 90%			13	mg/kg	0.2 mg/l
t-value for 95%:	1.833		1.833		
Upper Confidence Limit for 95%:			0.693		
Reverse Transformation for 95%			14	mg/kg	0.3 mg/l

TABLE C4
LEAD ANALYSES – GROUP 1 - 3 TO 4 FOOT LAYER

Sample ID	Depth (feet bgs)	Total Lead (mg/kg)	Total Lead % of Maximum	Transformed Data Arcsine
B1-3.0	3	0.5	0.0179	0.017858092
B1-4.0	4	0.5	0.0179	0.017858092
B2-3.0	3.0	3.8	0.1357	0.136134383
B2-4.0	4.0	28	1.0000	1.570796327
B3-3.0	3.0	20	0.7143	0.795602953
B3-4.0	4.0	1.1	0.0393	0.039295827
B4-3.0	3	0.5	0.0179	0.017858092
B4-4.0	4	0.5	0.0179	0.017858092
B5-3.0	3.0	2.4	0.0857	0.085819591
B5-4.0	4.0	0.5	0.0179	0.017858092

Total Lead	Max TTLC:	28	**Transformed Data**		**Soluble Data**
Number of Samples:	10		10		
Sample Mean:	6		0.272		
Delta = RT - mean	994				
Appropriate Number of Samples:	0.00				
Standard Deviation of Sample:	10		0.515		
Standard Deviation of Mean:	3		0.163		
Sample Variance:	97		0.266		
t-value for 90%:	1.383	Need to Transform Data	1.383		
Upper Confidence Limit for 90%:			0.497		
Reverse Transformation for 90%			13	mg/kg	0.2 mg/l
t-value for 95%:	1.833		1.833		
Upper Confidence Limit for 95%:			0.570		
Reverse Transformation for 95%			15	mg/kg	0.3 mg/l

TABLE C5
LEAD ANALYSES – GROUP 1 - SURFACE TO 3 FOOT LAYER

Sample ID	Depth (feet bgs)	Total Lead (mg/kg)	Total Lead % of Maximum	Transformed Data Arcsine
B1-0.5	0.5	17	0.7727	0.883126675
B1-1.5	1.5	22	1.0000	1.570796327
B1-3.0	3	0.5	0.0227	0.022729230
B2-0.5	0.5	5.2	0.2364	0.238621731
B2-1.5	1.5	0.5	0.0227	0.022729230
B2-3.0	3.0	3.8	0.1727	0.173597891
B3-0.5	0.5	14	0.6364	0.689775001
B3-1.5	1.5	3.1	0.1409	0.141379608
B3-3.0	3.0	20	0.9091	1.141096661
B4-0.5	0.5	4.2	0.1909	0.192088188
B4-1.5	1.5	1.5	0.0682	0.068234756
B4-3.0	3	0.5	0.0227	0.022729230
B5-0.5	0.5	4.4	0.2000	0.201357921
B5-1.5	1.5	0.5	0.0227	0.022729230
B5-3.0	3.0	2.4	0.1091	0.109308455

Total Lead	Max TTLC:	22	**Transformed Data**	**Soluble Data**
Number of Samples:	15		15	
Sample Mean:	7		0.367	
Delta = RT - mean	993			
Appropriate Number of Samples:	0.00			
Standard Deviation of Sample:	8		0.479	
Standard Deviation of Mean:	2		0.124	
Sample Variance:	57		0.229	
t-value for 90%:	1.345	Need to Transform Data	1.345	
Upper Confidence Limit for 90%:			0.533	
Reverse Transformation for 90%			11	mg/kg 0.1 mg/l
t-value for 95%:	1.761		1.761	
Upper Confidence Limit for 95%:			0.584	
Reverse Transformation for 95%			12	mg/kg 0.2 mg/l

TABLE C6
LEAD ANALYSES – GROUP 1 - 4 FOOT LAYER

Sample ID	Depth (feet bgs)	Total Lead (mg/kg)	Total Lead % of Maximum	Transformed Data Arcsine
B1-4.0	4.0	0.5	0.0179	0.017858092
B2-4.0	4.0	28	1.0000	1.570796327
B3-4.0	4.0	1.1	0.0393	0.039295827
B4-4.0	4.0	0.5	0.0179	0.017858092
B5-4.0	4.0	0.5	0.0179	0.017858092

Total Lead	Max TTLC:	28	**Transformed Data**		**Soluble Data**
Number of Samples:	5		5		
Sample Mean:	6		0.333		
Delta = RT - mean	994				
Appropriate Number of Samples:	0.00				
Standard Deviation of Sample:	12		0.692		
Standard Deviation of Mean:	5		0.310		
Sample Variance:	150		0.479		
t-value for 90%:	1.533	Need to Transform Data	1.533		
Upper Confidence Limit for 90%:			0.807		
Reverse Transformation for 90%			20	mg/kg	0.6 mg/l
t-value for 95%:	2.132		2.132		
Upper Confidence Limit for 95%:			0.993		
Reverse Transformation for 95%			23	mg/kg	0.8 mg/l

TABLE C7
LEAD ANALYSES – GROUP 1 - SURFACE TO 4 FOOT LAYER

Sample ID	Depth (feet bgs)	Total Lead (mg/kg)	Total Lead % of Maximum	Transformed Data Arcsine
B1-0.5	0.5	17	0.6071	0.652459897
B1-1.5	1.5	22	0.7857	0.903849982
B1-3.0	3	0.5	0.0179	0.017858092
B1-4.0	4	0.5	0.0179	0.017858092
B2-0.5	0.5	5.2	0.1857	0.186798744
B2-1.5	1.5	0.5	0.0179	0.017858092
B2-3.0	3.0	3.8	0.1357	0.136134383
B2-4.0	4.0	28	1.0000	1.570796327
B3-0.5	0.5	14	0.5000	0.523598776
B3-1.5	1.5	3.1	0.1107	0.110941725
B3-3.0	3.0	20	0.7143	0.795602953
B3-4.0	4.0	1.1	0.0393	0.039295827
B4-0.5	0.5	4.2	0.1500	0.150568273
B4-1.5	1.5	1.5	0.0536	0.053597086
B4-3.0	3	0.5	0.0179	0.017858092
B4-4.0	4	0.5	0.0179	0.017858092
B5-0.5	0.5	4.4	0.1571	0.157796896
B5-1.5	1.5	0.5	0.0179	0.017858092
B5-3.0	3.0	2.4	0.0857	0.085819591
B5-4.0	4.0	0.5	0.0179	0.017858092

Total Lead	Max TTLC:	28	**Transformed Data**	**Soluble Data**
Number of Samples:	20		20	
Sample Mean:	7		0.275	
Delta = RT - mean	993			
Appropriate Number of Samples:	0.00			
Standard Deviation of Sample:	9		0.413	
Standard Deviation of Mean:	2		0.092	
Sample Variance:	74		0.170	
t-value for 90%:	1.328	Need to Transform Data	1.328	
Upper Confidence Limit for 90%:			0.397	
Reverse Transformation for 90%			11	mg/kg 0.1 mg/l
t-value for 95%:	1.729		1.729	
Upper Confidence Limit for 95%:			0.434	
Reverse Transformation for 95%			12	mg/kg 0.1 mg/l

TABLE C8
LEAD ANALYSES – GROUP 2 - SURFACE LAYER

Sample ID	Depth (feet bgs)	Total Lead (mg/kg)	Total Lead % of Maximum	Transformed Data Arcsine
B6-0.5	0.5	13	0.0118	0.011818457
B7-0.5	0.5	600	0.5455	0.576931345
B8-0.5	0.5	1100	1.0000	1.570796327
B9-0.5	0.5	42	0.0382	0.038191102
B10-0.5	0.5	140	0.1273	0.127618858
B11-0.5	0.5	76	0.0691	0.069145996
B12-0.5	0.5	14	0.0127	0.012727616
B13-0.5	0.5	17	0.0155	0.015455161
B14-0.5	0.5	110	0.1000	0.100167421
B15-0.5	0.5	2.7	0.0025	0.002454548
B16-0.5	0.5	60	0.0545	0.054572538
B17-0.5	0.5	56	0.0509	0.050931107
B18-0.5	0.5	18	0.0164	0.016364367
B19-0.5	0.5	310	0.2818	0.285688573
B20-0.5	0.5	68	0.0618	0.061857623

Total Lead	Max TTLC:	1100	**Transformed Data**		**Soluble Data**	
Number of Samples:	15		15			
Sample Mean:	175		0.200			
Delta = RT - mean	825					
Appropriate Number of Samples:	0.24					
Standard Deviation of Sample:	300		0.408			
Standard Deviation of Mean:	77		0.105			
Sample Variance:	89837		0.166			
t-value for 90%:	1.345	Need to Transform Data	1.345			
Upper Confidence Limit for 90%:			0.341			
Reverse Transformation for 90%			368	mg/kg	21.1	mg/l
t-value for 95%:	1.761		1.761			
Upper Confidence Limit for 95%:			0.385			
Reverse Transformation for 95%			413	mg/kg	23.7	mg/l

TABLE C9
LEAD ANALYSES – GROUP 2 - 1½ TO 4 FOOT LAYER

Sample ID	Depth (feet bgs)	Total Lead (mg/kg)	Total Lead % of Maximum	Transformed Data Arcsine
B6-1.5	1.5	130	0.4194	0.432734534
B6-3.0	3.0	1.7	0.0055	0.005483898
B6-4.0	4.0	0.5	0.0016	0.001612904
B7-1.5	1.5	23	0.0742	0.074261786
B7-3.0	3.0	0.5	0.0016	0.001612904
B7-4.0	4.0	0.5	0.0016	0.001612904
B8-1.5	1.5	13	0.0419	0.041947785
B8-3.0	3.0	1.4	0.0045	0.004516144
B8-4.0	4.0	20	0.0645	0.064560969
B9-1.5	1.5	14	0.0452	0.045176656
B9-3.0	3.0	0.5	0.0016	0.001612904
B9-4.0	4.0	11	0.0355	0.035491322
B10-1.5	1.5	12	0.0387	0.038719351
B10-3.0	3.0	170	0.5484	0.580434223
B10-4.0	4.0	4.7	0.0152	0.015161871
B11-1.5	1.5	120	0.3871	0.397480802
B11-3.0	3.0	270	0.8710	1.057168492
B11-4.0	4.0	310	1.0000	1.570796327
B12-1.5	1.5	6.4	0.0206	0.020646628
B12-3.0	3.0	22	0.0710	0.071027448
B12-4.0	4.0	56	0.1806	0.181642365
B13-1.5	1.5	29	0.0935	0.093685372
B13-3.0	3.0	32	0.1032	0.103410013
B13-4.0	4.0	45	0.1452	0.145675988
B14-1.5	1.5	160	0.5161	0.542325303
B14-3.0	3.0	0.5	0.0016	0.001612904
B14-4.0	4.0	15	0.0484	0.048405998
B15-1.5	1.5	0.5	0.0016	0.001612904
B15-3.0	3.0	8.6	0.0277	0.027745495
B16-1.5	1.5	41	0.1323	0.132646712
B16-3.0	3.0	81	0.2613	0.264358723
B16-4.0	4.0	24	0.0774	0.077496903
B17-1.5	1.5	54	0.1742	0.175086736
B17-3.0	3.0	7.4	0.0239	0.023873235
B17-4.0	4.0	0.5	0.0016	0.001612904
B18-1.5	1.5	18	0.0581	0.058097193
B18-3.0	3.0	1.0	0.0032	0.003225812
B18-4.0	4.0	2.7	0.0087	0.008709788
B19-1.5	1.5	0.5	0.0016	0.001612904
B19-3.0	3.0	0.5	0.0016	0.001612904

TABLE C9
LEAD ANALYSES – GROUP 2 - 1½ TO 4 FOOT LAYER

Sample ID	Depth (feet bgs)	Total Lead (mg/kg)	Total Lead % of Maximum	Transformed Data Arcsine
B19-4.0	4.0	4.3	0.0139	0.013871413
B20-1.5	1.5	0.5	0.0016	0.001612904
B20-3.0	3.0	0.5	0.0016	0.001612904
B20-4.0	4.0	0.5	0.0016	0.001612904

Total Lead	Max TTLC:	310	**Transformed Data**		**Soluble Data**	
Number of Samples:	44		44			
Sample Mean:	39		0.145			
Delta = RT - mean	961					
Appropriate Number of Samples:	0.01					
Standard Deviation of Sample:	70		0.300			
Standard Deviation of Mean:	11		0.045			
Sample Variance:	4874		0.090			
t-value for 90%:	1.302	Need to Transform Data	1.302			
Upper Confidence Limit for 90%:			0.204			
Reverse Transformation for 90%			63	mg/kg	3.1	mg/l
t-value for 95%:	1.682		1.682			
Upper Confidence Limit for 95%:			0.221			
Reverse Transformation for 95%			68	mg/kg	3.4	mg/l

TABLE C10
LEAD ANALYSES – GROUP 2 - SURFACE TO 1½ FOOT LAYER

Sample ID	Depth (feet bgs)	Total Lead (mg/kg)	Total Lead % of Maximum	Transformed Data Arcsine
B6-0.5	0.5	13	0.0118	0.011818457
B6-1.5	1.5	130	0.1182	0.118458668
B7-0.5	0.5	600	0.5455	0.576931345
B7-1.5	1.5	23	0.0209	0.020910615
B8-0.5	0.5	1100	1.0000	1.570796327
B8-1.5	1.5	13	0.0118	0.011818457
B9-0.5	0.5	42	0.0382	0.038191102
B9-1.5	1.5	14	0.0127	0.012727616
B10-0.5	0.5	140	0.1273	0.127618858
B10-1.5	1.5	12	0.0109	0.010909307
B11-0.5	0.5	76	0.0691	0.069145996
B11-1.5	1.5	120	0.1091	0.109308455
B12-0.5	0.5	14	0.0127	0.012727616
B12-1.5	1.5	6.4	0.0058	0.005818215
B13-0.5	0.5	17	0.0155	0.015455161
B13-1.5	1.5	29	0.0264	0.026366691
B14-0.5	0.5	110	0.1000	0.100167421
B14-1.5	1.5	160	0.1455	0.145972389
B15-0.5	0.5	2.7	0.0025	0.002454548
B15-1.5	1.5	0.5	0.0005	0.000454545
B16-0.5	0.5	60	0.0545	0.054572538
B16-1.5	1.5	41	0.0373	0.037281363
B17-0.5	0.5	56	0.0509	0.050931107
B17-1.5	1.5	54	0.0491	0.049110648
B18-0.5	0.5	18	0.0164	0.016364367
B18-1.5	1.5	18	0.0164	0.016364367
B19-0.5	0.5	310	0.2818	0.285688573
B19-1.5	1.5	0.5	0.0005	0.000454545
B20-0.5	0.5	68	0.0618	0.061857623
B20-1.5	1.5	0.5	0.0005	0.000454545

Total Lead	Max TTLC:	1100	**Transformed Data**	**Soluble Data**
Number of Samples:	30		30	
Sample Mean:	108		0.119	
Delta = RT - mean	892			
Appropriate Number of Samples:	0.11			
Standard Deviation of Sample:	222		0.297	
Standard Deviation of Mean:	41		0.054	
Sample Variance:	49298		0.088	
t-value for 90%:	1.311	Need to Transform Data	1.311	
Upper Confidence Limit for 90%:			0.190	
Reverse Transformation for 90%			207	mg/kg 11.6 mg/l
t-value for 95%:	1.699		1.699	
Upper Confidence Limit for 95%:			0.211	
Reverse Transformation for 95%			230	mg/kg 13.0 mg/l

TABLE C11
LEAD ANALYSES – GROUP 2 - 3 TO 4 FOOT LAYER

Sample ID	Depth (feet bgs)	Total Lead (mg/kg)	Total Lead % of Maximum	Transformed Data Arcsine
B6-3.0	3.0	1.7	0.0055	0.005483898
B6-4.0	4.0	0.5	0.0016	0.001612904
B7-3.0	3.0	0.5	0.0016	0.001612904
B7-4.0	4.0	0.5	0.0016	0.001612904
B8-3.0	3.0	1.4	0.0045	0.004516144
B8-4.0	4.0	20	0.0645	0.064560969
B9-3.0	3.0	0.5	0.0016	0.001612904
B9-4.0	4.0	11	0.0355	0.035491322
B10-3.0	3.0	170	0.5484	0.580434223
B10-4.0	4.0	4.7	0.0152	0.015161871
B11-3.0	3.0	270	0.8710	1.057168492
B11-4.0	4.0	310	1.0000	1.570796327
B12-3.0	3.0	22	0.0710	0.071027448
B12-4.0	4.0	56	0.1806	0.181642365
B13-3.0	3.0	32	0.1032	0.103410013
B13-4.0	4.0	45	0.1452	0.145675988
B14-3.0	3.0	0.5	0.0016	0.001612904
B14-4.0	4.0	15	0.0484	0.048405998
B15-3.0	3.0	8.6	0.0277	0.027745495
B16-3.0	3.0	81	0.2613	0.264358723
B16-4.0	4.0	24	0.0774	0.077496903
B17-3.0	3.0	7.4	0.0239	0.023873235
B17-4.0	4.0	0.5	0.0016	0.001612904
B18-3.0	3.0	1.0	0.0032	0.003225812
B18-4.0	4.0	2.7	0.0087	0.008709788
B19-3.0	3.0	0.5	0.0016	0.001612904
B19-4.0	4.0	4.3	0.0139	0.013871413
B20-3.0	3.0	0.5	0.0016	0.001612904
B20-4.0	4.0	0.5	0.0016	0.001612904

Total Lead	Max TTLC:	310	**Transformed Data**	**Soluble Data**
Number of Samples:	29		29	
Sample Mean:	38		0.149	
Delta = RT - mean	962			
Appropriate Number of Samples:	0.01			
Standard Deviation of Sample:	78		0.350	
Standard Deviation of Mean:	15		0.065	
Sample Variance:	6125		0.123	
t-value for 90%:	1.313	Need to Transform Data	1.313	
Upper Confidence Limit for 90%:			0.234	
Reverse Transformation for 90%			72	mg/kg 3.7 mg/l
t-value for 95%:	1.701		1.701	
Upper Confidence Limit for 95%:			0.260	
Reverse Transformation for 95%			80	mg/kg 4.1 mg/l

TABLE C12
LEAD ANALYSES – GROUP 2 - SURFACE TO 3 FOOT LAYER

Sample ID	Depth (feet bgs)	Total Lead (mg/kg)	Total Lead % of Maximum	Transformed Data Arcsine
B6-0.5	0.5	13	0.0118	0.011818457
B6-1.5	1.5	130	0.1182	0.118458668
B6-3.0	3.0	1.7	0.0015	0.001545455
B7-0.5	0.5	600	0.5455	0.576931345
B7-1.5	1.5	23	0.0209	0.020910615
B7-3.0	3.0	0.5	0.0005	0.000454545
B8-0.5	0.5	1100	1.0000	1.570796327
B8-1.5	1.5	13	0.0118	0.011818457
B8-3.0	3.0	1.4	0.0013	0.001272728
B9-0.5	0.5	42	0.0382	0.038191102
B9-1.5	1.5	14	0.0127	0.012727616
B9-3.0	3.0	0.5	0.0005	0.000454545
B10-0.5	0.5	140	0.1273	0.127618858
B10-1.5	1.5	12	0.0109	0.010909307
B10-3.0	3.0	170	0.1545	0.155167364
B11-0.5	0.5	76	0.0691	0.069145996
B11-1.5	1.5	120	0.1091	0.109308455
B11-3.0	3.0	270	0.2455	0.247988554
B12-0.5	0.5	14	0.0127	0.012727616
B12-1.5	1.5	6.4	0.0058	0.005818215
B12-3.0	3.0	22	0.0200	0.020001334
B13-0.5	0.5	17	0.0155	0.015455161
B13-1.5	1.5	29	0.0264	0.026366691
B13-3.0	3.0	32	0.0291	0.029095014
B14-0.5	0.5	110	0.1000	0.100167421
B14-1.5	1.5	160	0.1455	0.145972389
B14-3.0	3.0	0.5	0.0005	0.000454545
B15-0.5	0.5	2.7	0.0025	0.002454548
B15-1.5	1.5	0.5	0.0005	0.000454545
B15-3.0	3.0	8.6	0.0078	0.007818261
B16-0.5	0.5	60	0.0545	0.054572538
B16-1.5	1.5	41	0.0373	0.037281363
B16-3.0	3.0	81	0.0736	0.073703073
B17-0.5	0.5	56	0.0509	0.050931107
B17-1.5	1.5	54	0.0491	0.049110648
B17-3.0	3.0	7.4	0.0067	0.006727323
B18-0.5	0.5	18	0.0164	0.016364367
B18-1.5	1.5	18	0.0164	0.016364367
B18-3.0	3.0	1.0	0.0009	0.000909091
B19-0.5	0.5	310	0.2818	0.285688573
B19-1.5	1.5	0.5	0.0005	0.000454545
B19-3.0	3.0	0.5	0.0005	0.000454545
B20-0.5	0.5	68	0.0618	0.061857623

TABLE C12
LEAD ANALYSES – GROUP 2 - SURFACE TO 3 FOOT LAYER

Sample ID	Depth (feet bgs)	Total Lead (mg/kg)	Total Lead % of Maximum	Transformed Data Arcsine
B20-1.5	1.5	0.5	0.0005	0.000454545
B20-3.0	3.0	0.5	0.0005	0.000454545

Total Lead	Max TTLC:	1100	**Transformed Data**	**Soluble Data**
Number of Samples:	45		45	
Sample Mean:	85		0.091	
Delta = RT - mean	915			
Appropriate Number of Samples:	0.07			
Standard Deviation of Sample:	188		0.247	
Standard Deviation of Mean:	28		0.037	
Sample Variance:	35516		0.061	
t-value for 90%:	1.302	Need to Transform Data	1.302	
Upper Confidence Limit for 90%:			0.139	
Reverse Transformation for 90%			153	mg/kg 8.4 mg/l
t-value for 95%:	1.681		1.681	
Upper Confidence Limit for 95%:			0.153	
Reverse Transformation for 95%			168	mg/kg 9.3 mg/l

TABLE C13
LEAD ANALYSES – GROUP 2 - 4 FOOT LAYER

Sample ID	Depth (feet bgs)	Total Lead (mg/kg)	Total Lead % of Maximum	Transformed Data Arcsine
B6-4.0	4.0	0.5	0.0016	0.001612904
B7-4.0	4.0	0.5	0.0016	0.001612904
B8-4.0	4.0	20	0.0645	0.064560969
B9-4.0	4.0	11	0.0355	0.035491322
B10-4.0	4.0	4.7	0.0152	0.015161871
B11-4.0	4.0	310	1.0000	1.570796327
B12-4.0	4.0	56	0.1806	0.181642365
B13-4.0	4.0	45	0.1452	0.145675988
B14-4.0	4.0	15	0.0484	0.048405998
B16-4.0	4.0	24	0.0774	0.077496903
B17-4.0	4.0	0.5	0.0016	0.001612904
B18-4.0	4.0	2.7	0.0087	0.008709788
B19-4.0	4.0	4.3	0.0139	0.013871413
B20-4.0	4.0	0.5	0.0016	0.001612904

Total Lead	Max TTLC:	310	**Transformed Data**		**Soluble Data**
Number of Samples:	14		14		
Sample Mean:	35		0.155		
Delta = RT - mean	965				
Appropriate Number of Samples:	0.01				
Standard Deviation of Sample:	81		0.411		
Standard Deviation of Mean:	22		0.110		
Sample Variance:	6550		0.169		
t-value for 90%:	1.350	Need to Transform Data	1.350		
Upper Confidence Limit for 90%:			0.303		
Reverse Transformation for 90%			93	mg/kg	4.9 mg/l
t-value for 95%:	1.771		1.771		
Upper Confidence Limit for 95%:			0.350		
Reverse Transformation for 95%			106	mg/kg	5.7 mg/l

TABLE C14
LEAD ANALYSES – GROUP 2 - SURFACE TO 4 FOOT LAYER

Sample ID	Depth (feet bgs)	Total Lead (mg/kg)	Total Lead % of Maximum	Transformed Data Arcsine
B6-0.5	0.5	13	0.0118	0.011818457
B6-1.5	1.5	130	0.1182	0.118458668
B6-3.0	3.0	1.7	0.0015	0.001545455
B6-4.0	4.0	0.5	0.0005	0.000454545
B7-0.5	0.5	600	0.5455	0.576931345
B7-1.5	1.5	23	0.0209	0.020910615
B7-3.0	3.0	0.5	0.0005	0.000454545
B7-4.0	4.0	0.5	0.0005	0.000454545
B8-0.5	0.5	1100	1.0000	1.570796327
B8-1.5	1.5	13	0.0118	0.011818457
B8-3.0	3.0	1.4	0.0013	0.001272728
B8-4.0	4.0	20	0.0182	0.018182820
B9-0.5	0.5	42	0.0382	0.038191102
B9-1.5	1.5	14	0.0127	0.012727616
B9-3.0	3.0	0.5	0.0005	0.000454545
B9-4.0	4.0	11	0.0100	0.010000167
B10-0.5	0.5	140	0.1273	0.127618858
B10-1.5	1.5	12	0.0109	0.010909307
B10-3.0	3.0	170	0.1545	0.155167364
B10-4.0	4.0	4.7	0.0043	0.004272740
B11-0.5	0.5	76	0.0691	0.069145996
B11-1.5	1.5	120	0.1091	0.109308455
B11-3.0	3.0	270	0.2455	0.247988554
B11-4.0	4.0	310	0.2818	0.285688573
B12-0.5	0.5	14	0.0127	0.012727616
B12-1.5	1.5	6.4	0.0058	0.005818215
B12-3.0	3.0	22	0.0200	0.020001334
B12-4.0	4.0	56	0.0509	0.050931107
B13-0.5	0.5	17	0.0155	0.015455161
B13-1.5	1.5	29	0.0264	0.026366691
B13-3.0	3.0	32	0.0291	0.029095014
B13-4.0	4.0	45	0.0409	0.040920510
B14-0.5	0.5	110	0.1000	0.100167421
B14-1.5	1.5	160	0.1455	0.145972389
B14-3.0	3.0	0.5	0.0005	0.000454545
B14-4.0	4.0	15	0.0136	0.013636786
B15-0.5	0.5	2.7	0.0025	0.002454548
B15-1.5	1.5	0.5	0.0005	0.000454545
B15-3.0	3.0	8.6	0.0078	0.007818261
B16-0.5	0.5	60	0.0545	0.054572538
B16-1.5	1.5	41	0.0373	0.037281363
B16-3.0	3.0	81	0.0736	0.073703073
B16-4.0	4.0	24	0.0218	0.021819913
B17-0.5	0.5	56	0.0509	0.050931107
B17-1.5	1.5	54	0.0491	0.049110648

TABLE C14
LEAD ANALYSES – GROUP 2 - SURFACE TO 4 FOOT LAYER

Sample ID	Depth (feet bgs)	Total Lead (mg/kg)	Total Lead % of Maximum	Transformed Data Arcsine
B17-3.0	3.0	7.4	0.0067	0.006727323
B17-4.0	4.0	0.5	0.0005	0.000454545
B18-0.5	0.5	18	0.0164	0.016364367
B18-1.5	1.5	18	0.0164	0.016364367
B18-3.0	3.0	1.0	0.0009	0.000909091
B18-4.0	4.0	2.7	0.0025	0.002454548
B19-0.5	0.5	310	0.2818	0.285688573
B19-1.5	1.5	0.5	0.0005	0.000454545
B19-3.0	3.0	0.5	0.0005	0.000454545
B19-4.0	4.0	4.3	0.0039	0.003909101
B20-0.5	0.5	68	0.0618	0.061857623
B20-1.5	1.5	0.5	0.0005	0.000454545
B20-3.0	3.0	0.5	0.0005	0.000454545
B20-4.0	4.0	0.5	0.0005	0.000454545

Total Lead	Max TTLC:	1100	**Transformed Data**	**Soluble Data**
Number of Samples:	59		59	
Sample Mean:	74		0.077	
Delta = RT - mean	926			
Appropriate Number of Samples:	0.06			
Standard Deviation of Sample:	170		0.220	
Standard Deviation of Mean:	22		0.029	
Sample Variance:	28874		0.048	
t-value for 90%:	1.297	Need to Transform Data	1.297	
Upper Confidence Limit for 90%:			0.114	
Reverse Transformation for 90%			126	mg/kg 6.8 mg/l
t-value for 95%:	1.672		1.672	
Upper Confidence Limit for 95%:			0.125	
Reverse Transformation for 95%			137	mg/kg 7.5 mg/l

Reproduction Reference
DD2566822—C19554
Georgia Department of Transportation
VF-2420-27x90-66-A
Display Manual

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1) This page is for reproduction reference only; do not include in the manual.

2) Copy this manual on front and back pages using 8 $^{1}/_{2}$ x 11 paper.

Note: Section heading pages always start on a new page; they never start on the back of another page.

Materials included in this manual:

Appendix A: Refer to the list of drawings in **Appendix A.** Print A-size drawings on A-size paper and B- and C-size drawings on B-size paper.
Appendix B: **ED-14480**
Appendix C: **SL-02374**

3) Separate each section with labeled, tabbed dividers as follows. Use Arial font on the tabs.

- **Section 1**: Introduction
- **Section 2:** Components
- **Section 3:** Mechanical Installation
- **Section 4**: Electrical Installation
- **Section 5**: Maintenance and Troubleshooting
- **Section 6:** Replacement Parts / Exchange / Repair
- **Glossary**
- **Appendix A:** Reference Drawings
- **Appendix B:** VFC-3000 Manual
- **Appendix C:** Daktronics Warranty

4) Bind with a blue window cover and blue back cover.

5) Bind the manual along the left edge with a large spiral binder.

6) Please direct questions and suggestions to Transportation Admin.

Template Record of Revisions				
Revision	**Date**	**Reason for Revision**	**Author**	**Approval**
0	7/19/12	Initial Document	Pamela Parliament	SS
1	12/4/12	Updated Margins	Sarah Sutton	SS

Georgia
Department of Transportation
VF-2420-27x90-66-A

Display Manual

DD2566822 *Rev 0—12 June 2013*

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DAKTRONICS

DD2566822
Contract 19554
Rev 0—12 June 2013

DAKTRONICS, INC.

Table of Contents

Section 1: Introduction

1.1 How to Use This Manual

This manual explains the installation, maintenance, and troubleshooting of VF-2400 series Dynamic Message Signs (DMS). For information regarding the safety, installation, operation, or service of this system, refer to the telephone numbers on the cover page of this manual.

Daktronics identifies manuals by the ED or DD number located on the cover page of each manual. For example, this manual is referred to as **DD2566822**.

Daktronics uses many types of drawings. Drawings referenced in this manual are located in **Appendix A**.

- **Shop Drawings:** Fan locations, light and temperature sensor locations, display dimensions, mounting information, power and signal entrance points, and access method.
- **Schematics:** Power and signal wiring, panelboard assignments, and signal termination panel assignments.
- **Assembly:** Component locations, part numbers, and assembly instructions.
- **Layout Drawings:** Component locations and part numbers for circuit boards.

Figure 1 illustrates a Daktronics drawing label. The drawing number is located in the lower-right corner of the drawing. The drawing in **Figure 1** is called **Drawing B-1051927**

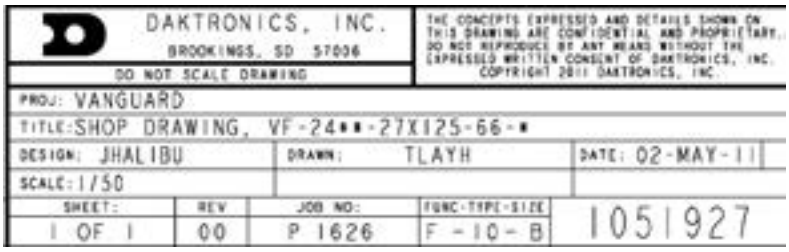


Figure 1: *Drawing Label*

All references to drawings, appendices, figures, or other manuals are bolded, as shown below.

> Refer to the **Shop Drawing** for the sensor location.

Any drawings referenced within a section are listed at the beginning of that section as seen in this example:

Reference Drawing:

Shop Drawing ..... **Appendix A**

The serial and model numbers for the display are on the ID label attached to the display. This label looks similar to **Figure 2**. When calling Daktronics Customer Service, please have this information available to ensure timely response.

***Figure 2:** Display ID Label*

Daktronics builds displays for long life, and they require little maintenance. However, from time to time, certain components need replacing. The replacement parts list in **Section 6.2** provides names and numbers of components that may need ordering during the life of the displays. Refer to the Daktronics Exchange and Repair & Return Programs in **Section 6.3** if any component needs replacement or repair.

1.2 DMS Overview

Reference Drawings:

The VF-2400 series displays have rear access. Refer to the **Rear Electrical** drawing and the **Shop Drawing** for detailed specifications about your displays.

1.3 Theory of Operation

Reference Drawings:

Vanguard® Software

Daktronics Vanguard® software allows the DMS operator to check display status and to control messages. Refer to the **Vanguard® Software Help File** for information about operating Vanguard® software.

VFC-3000 Controller

The VFC-3000 controller is the communication hub for DMS management; it is located in the display or in the traffic cabinet. Refer to the **Rear Electrical** drawing or the **Traffic Cabinet Final Assembly** for the location.

The central controller creates messages and transmits them to the VFC-3000 controller for storage. Upon request from the central controller or the front panel interface, the VFC-3000 controller locates the message to display and sends it to the display's modules via the Vanguard® control board. The modules activate the appropriate pixels to form the message. Refer to **Figure 3** on the following page for signal routing information.

The VFC-3000 controller also monitors local sensors (display-based sensors) like temperature, light level, and door detection. The VFC-3000 controller interprets sensor data for display control and diagnostic functions, such as adjusting the display's intensity for current lighting conditions. **ED-14480**, located in **Appendix B**, contains setup and operation information for the VFC-3000 controller.

Auxiliary Control Panel (Optional)

The auxiliary control panel (ACP) complements the VFC-3000 controller by providing a secondary control interface panel at the DMS site. The ACP allows a maintenance technician to perform diagnostics while working in one location without having to access the VFC-3000 controller in another location. This improves safety and reduces maintenance time. Refer to the **Rear Electrical** drawing or the **Traffic Cabinet Final Assembly** for the ACP location.

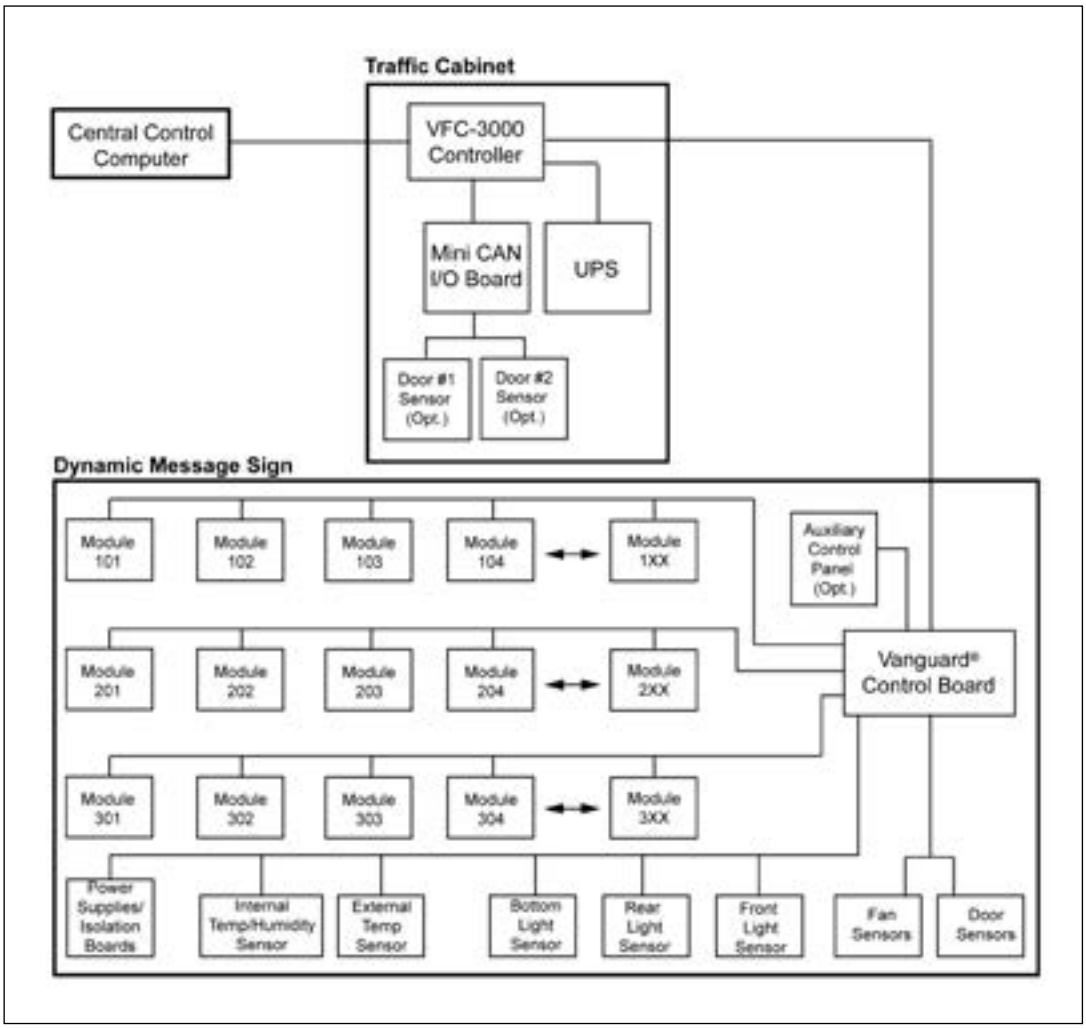


Figure 3: *Typical Network*

1.4 Display Peripherals

Reference Drawing:

Sign Signal Schematic ..... **Appendix A**

A peripheral is a display component configured through the VFC-3000 controller. Peripherals include sensors, power supplies, isolation boards, fans, and heaters.

Refer to the table on the **Sign Signal Schematic** for a list of the peripherals included with your display and the settings to configure these peripherals using the VFC-3000 controller. For instructions on configuring peripherals, refer to the VFC-3000 controller manual in **Appendix B**.

Section 2: Components

2.1 Modules

A module is a replaceable unit consisting of a display panel with clusters of LEDs, called pixels. The pixels display messages on the display. Refer to **Figure 4**.

Each module contains drive electronics that receive data packets from the Vanguard® control board and lights the appropriate pixels at the correct dimming level.

2.2 Power Supplies

Reference Drawing:

Rear Electrical..... **Appendix A**

Power Supplies

The power supplies provide voltage to power the modules. Multiple power supplies provide power redundancy. If one power supply in the group fails, the other supports the full power load, preventing power failure to the modules. Power supplies are mounted to panels on the rear wall of the display. Refer to the **Rear Electrical** drawing for power supply locations.

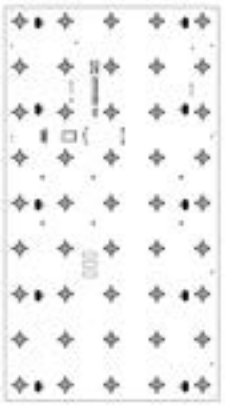


Figure 4: *Module (Rear View)*

Isolation Board

One isolation board mounts to each power supply. The isolation board provides input and output voltage to the power supply. **Figure 5** shows an isolation board. The isolation board receives 120 VAC input voltage from the distribution panel. Output from the power supply routes through the isolation board. From there, the 24 VDC output routes to the DC breaker rail.

Isolation board diagnostics include power supply data sent to the VFC-3000 controller about output voltage.

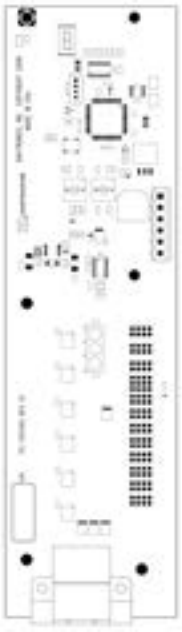


Figure 5: *Isolation Board*

2.3 Service Control Panel

Reference Drawing:

Rear Electrical..... **Appendix A**

The service control panel (SCP) is located on the right side of the display's back wall; refer to the **Rear Electrical** drawing for the exact location. The internal components of the SCP use information received from the VFC-3000 controller to control the display.

Vanguard® Control Board

The Vanguard® control board (VCB) receives high-speed serial data from the VFC-3000 controller through a fiber-optic or Cat-5 cable. It then distributes the signal to the appropriate modules and sensors. The VCB receives diagnostic data from the modules, temperature and light sensors, and isolation boards and transmits the data to the VFC-3000 controller. The VCB uses an I/O interface to control beacons. The VCB also monitors door sensors, ventilation fans, defog heaters, and power supplies.

The VCB uses a protocol that routes signal to each horizontal line of the display. With this protocol, signal failure to one module in a horizontal line does not affect other LED modules in that line.

Panelboard
The panelboard is a circuit breaker box that distributes incoming power to the display components that require AC power.

Surge Suppressor
The parallel surge suppressor protects the display from transient voltage spikes.

Relays
Relays are solid-state switches in which the electrical current applied across one port or terminal controls electrical currents for another terminal, such as a beacon, heater, or fan. Relays receive signal from the VCB.

2.4 DC Breaker Rail

The DC breaker rail recieves incoming power from the power supplies and distributes power to the modules and the VCB.

2.5 Sensors Network

Reference Drawings:

Rear Electrical ..... **Appendix A**
Sign Signal Schematic ..... **Appendix A**

Rear Sensor
The rear light sensor consists of a small printed circuit board (PCB) mounted to the back of the display.

The light sensor transmits the ambient light level behind the display to the VCB. The VFC-3000 controller adjusts the display accordingly.

Internal Sensor
The internal temperature, humidity, and front light sensor measures the temperature near the LED pixels and the ambient light level in front of the display. The sensor transmits these measurements to the VCB, and the VFC-3000 controller adjusts LED intensity to protect the LEDs from overheating.

Bottom Sensor
The bottom light sensor is located on the bottom-right of the display. It detects the light intensity below the display.

Left-End Sensor (Optional)
The left-end sensor measures the internal temperature. The sensor transmits these measurements to the VCB, and the VFC-3000 controller adjusts LED intensity to protect the LEDs from overheating.

Face Panel Detection
The face panel sensor is located at the bottom of the face panel opening(s). The sensor detects whether the doors are open or shut, and it routes this information to the VCB, which monitors the status of the door sensors and reports it to the VFC-3000 controller.

2.6 Ventilation and Heater Systems

Reference Drawing:

Rear Electrical..... **Appendix A**

Intake Fans and Filters

Filtered intake fans mount to the lower rear of the display; refer to the **Rear Electrical** drawing for locations. The VFC-3000 controller analyzes temperature readings from the temperature sensor network and adjusts fan usage. Additionally, an internal thermostat activates the fans if the internal temperature exceeds a set limit. A filter removes dust and debris from the incoming air to protect the internal display components.

Defog Heater Fans (Optional)

If equipped, the heater fans mount to the bottom of the display; refer to the **Rear Electrical** drawing. The heater fans warm the front face to prevent fogging. The VFC-3000 controller analyzes internal temperature readings from the temperature sensor network and adjusts heater fan usage accordingly.

Fan RPM Sensors

Each ventilation fan has an internal RPM sensor. The fans fail if they do not revolve at least 1,000 RPM. This information is then reported to and displayed on the VFC-3000 Controller.

2.7 Lights (Optional)

If equipped, the display will have a light mounted behind every face panel. The lights turn on when any of the face panels are opened. Switches are located at the bottom of the face panel openings. Refer to the **Rear Electrical** drawing for light and switch locations.

2.8 Beacon(s) (Optional)

Refer to the **Rear Electrical** drawing for the location of the beacon(s), if equipped.

Beacons are turned on and off independently from the rest of the sign by the VCB. Refer to the **Rear Electrical** drawing for locations of the beacon power supply and DC relays.

Beacons are used only during certain messages, such as emergency or warning messages, as an extra measure of alert.

2.9 Traffic Cabinet (Optional)

Reference Drawing:

Traffic Cabinet Final Assembly..... **Appendix A**

Refer to the **Traffic Cabinet Final Assembly** for information such as cabinet type, mounting style, and lock type for your traffic cabinet.

Cabinet Light

The traffic cabinet is equipped with a fluorescent light and sensor. The light is located on the top rack of the traffic cabinet. The door sensor, located at the bottom of the traffic cabinet door opening, activates the light when the cabinet door opens.

Door Reporting (Optional)
The door sensor, located at the bottom of the traffic cabinet door opening, can report whether the door(s) are open or shut. This information routes to the mini CAN I/O board, which monitors the status of the door sensor(s) and reports the status to the VFC-3000 controller. To determine if your traffic cabinet is equipped with door reporting, refer to the **Traffic Cabinet Final Assembly**.

Pull-Out Drawers and Shelving
Traffic cabinets contain a pull-out drawer and several support shelves. The shelves hold components such as the VFC-3000 controller, the communication device, or a laptop computer.

The pull-out drawer is often used for storage of extra supplies such as screws, screwdrivers, or other hardware, and for the display and controller manuals. The pull-out drawer also can be used as a temporary location for a laptop computer.

Panelboard
The panelboard is equipped with switches that control power to lights, heat, and other power circuits.

Outlet Strip and Outlets
The GFCI and utility outlet are located next to the panelboard. The outlet strip offers several outlets for plugging in or charging electrical devices.

Exhaust Fan Assembly
The exhaust fan assembly is located at the top of the traffic cabinet and includes the exhaust fan and a thermostat. The fan and thermostat keep internal components and the interior of the traffic cabinet cool.

Cabinet Heater (Optional)
If equipped, the heater fan is located at the bottom of the traffic cabinet. The fan, thermostat, and heater regulate the temperature within the traffic cabinet, ensuring internal components operate at ideal temperatures. To determine if your traffic cabinet is equipped with a cabinet heater, refer to the **Traffic Cabinet Final Assembly**.

UPS (Optional)
A UPS contains batteries and an inverter. If the utility AC power fails, the UPS powers the VFC-3000 Controller and communication equipment for a limited amount of time. To determine if your traffic cabinet contains a UPS, refer to the **Traffic Cabinet Final Assembly**.

2.10 Laptop Interface Enclosure (Optional)

Reference Drawing:

LIE Shop Drawing ..... **Appendix A**

Refer to the **LIE Shop Drawing** for information such as cabinet type, dimensions, and mounting for your laptop interface enclosure (LIE).

Light
The LIE is equipped with a fluorescent light and light switch, located at the top of the LIE.

Fold-Down Shelf
The LIE has a fold-down shelf that holds a laptop computer.

Outlets
The GFCI and utility outlets provide a location within the LIE to plug in electrical equipment.

Section 3: Mechanical Installation

3.1 Lifting the Display

The top of the display is equipped with two $^{5}/_{8}$" eyebolts for lifting the display. Lift the display using a lifting bar. Use both eyebolts, and maintain a 90° lifting angle as shown in **Figure 6**. The eyebolts may fail if this is not done.

The eyebolts are designed to carry only the weight of the display cabinet. Do not lift the mounting structure or other additional weight. Do not permanently support the display with the eyebolts. Contact Daktronics with additional questions about display lifting.

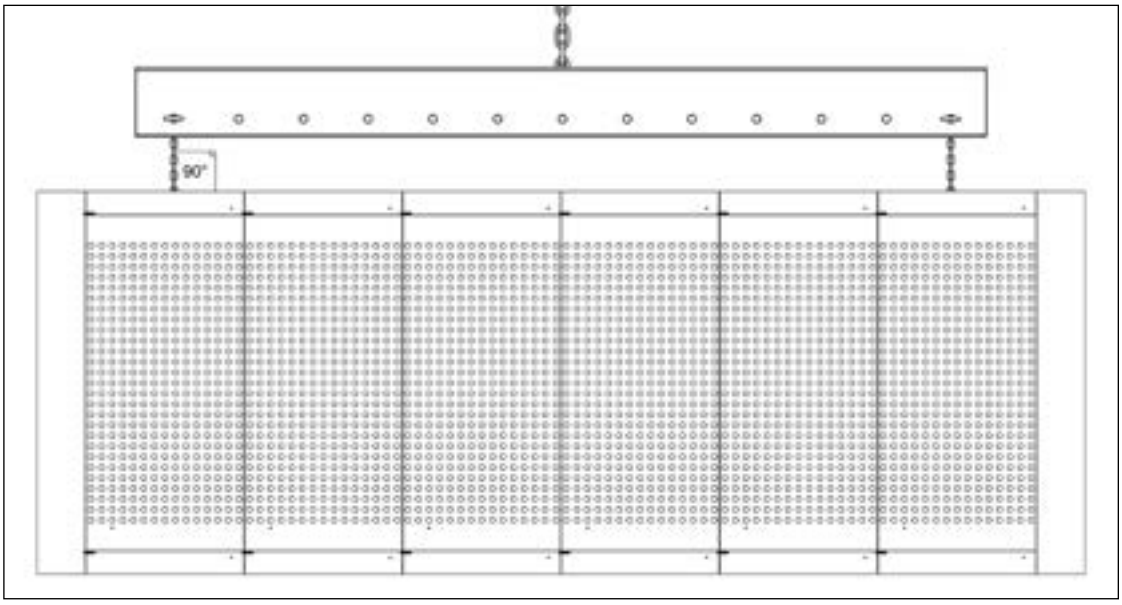


Figure 6: *Correctly Lifting the Display*

3.2 Setting the Display on the Ground

Several wood 2 x 4 transportation skids are attached to the bottom of the display. If setting the display on concrete, no additional supports are needed.

If setting the display on grass, place the supports directly under the transportation skids. Failure to use the transportation skids may result in damage to the display.

3.3 Display Mounting

Reference Drawing:

Shop Drawing ..... **Appendix A**

Securely mount each display to a suitable mounting structure provided by others. Daktronics attached aluminum Z-extrusions to the back of the display for mounting; refer to the **Shop Drawing**. Use all Z-extrusions when mounting the display.

Use appropriate hardware to support the weight of the display. Have a qualified engineer inspect the mounting structure.

Note: Daktronics is not responsible for mounting methods or the structural integrity of support structures provided by others.

After installing the display, inspect the top and sides of the display for any openings that may allow moisture to enter the display. Seal openings with silicone or another waterproof sealant. Not sealing openings may void the warranty.

The eyebolts can either remain in the display or be removed without compromising the water tightness and weather resistance of the display cabinet. If removed, Daktronics recommends replacing eyebolts with $^{5}/_{8}$" diameter stainless steel bolts to prevent debris from filling the threads of the permanent hardware.

3.4 Traffic Cabinet Mounting

Reference Drawings:

Traffic Cabinet Final Assembly ..... **Appendix A**
Traffic Cabinet Schematic ..... **Appendix A**

To determine whether your traffic cabinet is designed for ground or for pole mounting, refer to the **Traffic Cabinet Final Assembly**.

Ground Mounting

Secure the traffic cabinet to a concrete pad using anchor bolts. Daktronics recommends using $^{3}/_{4}$" stainless steel anchor bolts. When anchoring the traffic cabinet to the concrete pad, make sure the bottom of the cabinet allows for water drainage. Do not seal the cabinet to the concrete pad as this prevents water from draining properly.

The conduit for power and signal enter through the open area in the bottom of the cabinet. Refer to the **Traffic Cabinet Final Assembly** and the **Traffic Cabinet Schematic**.

Pole Mounting

Mount the cabinet using the pole-mount brackets at the locations indicated in the **Traffic Cabinet Final Assembly**. Make sure the brackets are secured at all locations.

3.5 LIE Mounting

Reference Drawing:

LIE Shop Drawing ..... **Appendix A**

LIEs are designed for pole-mounting. The dimensions of the LIE are given in the **LIE Shop Drawing**. After installing the LIE, select power and signal entrances on the bottom, sides, or rear of the LIE. Prior to drilling, be aware of internal component locations to avoid damaging the components. Ensure the entrances will not obstruct the drain holes on the bottom of the LIE.

Remove any fillings and seal any hole punched or drilled in the LIE with either a watertight plug or with a watertight conduit hub to prevent water from entering the LIE.

Section 4: Electrical Installation

4.1 Power Installation

Qualified personnel must perform electrical installations to prevent injury to personnel and damage to the equipment.

Grounding

Displays must be grounded according to Article 250 of the National Electrical Code® and must meet local codes. Daktronics requires a resistance to ground of 10 ohms or less. The electrical contractor performing the electrical installation can verify ground resistance.

Connect the display system and the traffic cabinet, if equipped, to earth ground to ensure reliable equipment operation and to protect the equipment from damaging electrical disturbances and lightning. The display and traffic cabinet must be properly grounded or the warranty will be void.

Daktronics does not recommend using the support structure as an earth-ground electrode; concrete, primer, corrosion, and other factors make the support structure a poor ground.

Note: The support structure may be used as an earth-ground electrode only if designed to do so. A qualified inspector must approve the support structure and grounding methods.

An earth ground can run from the ground lug on the outside of the cabinet to an earth-ground rod(s) within 10' of the display base, or the earth-ground wire can be connected into the earth-ground bus in the panelboard and run to a ground rod within 10' of the base of the cabinet.

Power

For installation with ground and neutral conductors provided, the power cable must contain an isolated earth-ground conductor. Do not connect neutral to ground at the disconnect or at the display; this violates electrical codes and voids the warranty. Use a disconnect so all hot lines and neutral can be disconnected.

Bonding Screw

A bonding screw is included (not installed) with the panelboard. If the bonding screw is required by national or local codes, install it to avoid violation of the National Electrical Code®.

4.2 Power Connections

Reference Drawing:

SCP Schematic ..... **Appendix A**

Each display operates on 120/240 VAC 3-wire plus ground, single-phase power. Power routes through the opening in the display rear and terminates at the panelboard.

Route power and signal cables to the display in conduit approved by national and local electrical codes. Terminate all wires as labeled in the termination panels and per the **SCP Schematic** drawing.

Display Termination

Power enters the display through the rear wall near the panelboard. To connect power to the display:

1. Locate the A41 panelboard inside the display.
2. Remove the panelboard cover to reveal the panelboard blocks.

3. Route the power cables through the 1 1/2" conduit hub, into the SCP, and into the A41 panelboard.

4. Terminate each wire at the appropriate terminal block and earth-ground lug per the **SCP Schematic** drawing.

Conduit Sealing
Fill the ends of conduits entering the display with duct seal.

Module Connection
2-pin connectors make the low voltage power connections within the display. Power for each module is provided with the use of one red and one black wire. Power connections are completed at the factory.

Fans and Power Supplies Connection
The fans and power supplies use 120 VAC from the panelboard. The surge suppressor in the panelboard protects the power supplies and modules from damaging power surges.

4.3 Traffic Cabinet (Optional)

Reference Drawings:

Individually wire the following items directly to the earth-ground rod with an 8 AWG or larger wire according to the National Electrical Code® and local regulations, referring to the **Traffic Cabinet Final Assembly** and the **Traffic Cabinet Schematic** drawings.

- Earth-ground lug mounted on the rear of the panelboard.
- Conduit grounding collars.
- Earth-ground connection inside the panelboard.

Earth-ground rods must be installed and connected per National Electrical Code® and local regulations.

1. Connect the auxiliary power connection to the panelboard.
2. Connect the neutral power wire to the neutral bus.
3. Connect the hot wires from the terminals to the panelboard lugs.

4.4 VFC-3000 Controller and Communications Setup

To set up the VFC-3000 controller and communications, refer to **ED-14480** in **Appendix B**.

4.5 First Time Fire Up

After installing the display and DMS site equipment, test the site according to the field test procedure. This ensures all equipment is installed properly and is operational. If a field test procedure is not available, call Daktronics Transportation Customer Service to obtain a copy.

Section 5: Maintenance and Troubleshooting

Important notes:

1. Disconnect power before performing any repair or maintenance to the displays.

2. Only qualified service personnel should access internal display electronics. Contact Daktronics Customer Service for training needs.

3. Daktronics engineering staff must approve changes made to the displays. If making modifications, submit detailed drawings to the Daktronics engineering staff for evaluation and approval or the warranty will be void.

5.1 Service and Diagnostics

The VF-2400 series DMS are front accessible — all internal components are accessible from within the display.

The following tools are required to service the display:

- Hex-head wrench ($^{5}/_{16}$")
- Stubby Phillips screwdriver
- Small Phillips screwdriver
- Small flat-head screwdriver
- Small pliers
- Medium Phillips screwdriver
- Medium flat-head screwdriver
- Nut driver ($^{3}/_{8}$")
- Cable ties
- Ohmmeter
- Clamp-on ground meter

5.2 Module Numbering System

Daktronics uses a module numbering system to help with troubleshooting; refer to **Figure 7**.

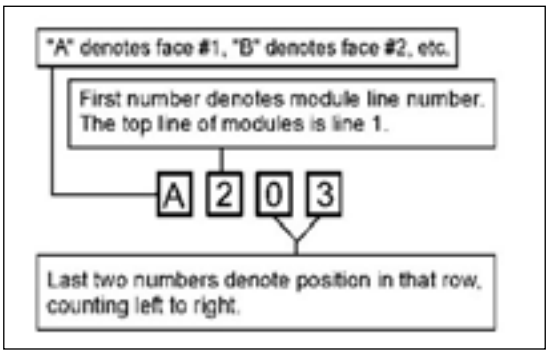


Figure 7: *Module Numbering*

5.3 7-Segment Error Codes

A 7-segment indicator appears on the following components; refer to **Figure 8**. The 7-segment indicator provides codes to indicate any present errors and their cause. When an error occurs, the 7-segment will flash the error code. If multiple errors are present, the 7-segment will flash the errors individually in succession. If no errors are present, the 7-segment will show a continuously looping figure-8.

Figure 8: *7-Segment*

Modules

7-Segment Error Code	Error	Cause
1	Communications Lost	No CAN packets received for 10 seconds
2	Failed Pixel	Refer to the troubleshooting table in **Section 5.13**.
3	Power Failure	Input Voltage has dropped below 20 VDC
8	Lost Packet	Diagnostic packet, FIFO full

VCB

7- Segment Error Code	Error	Cause
1	Communications Lost	No fiber packets for 15 seconds
3	Power Failure	Board voltages below limit: V-In, 1 and 2 < 20 VDC 9 V < 8.52 VDC 3.3 V < 3 VDC 2.5 V < 2.37 VDC 1.2 V < 1.1 VDC

Isolation Board

7-Segment Error Code	Error	Cause
1	Communications Lost	No CAN packets for 10 seconds
2	Input power failure	V-In < 21 VDC
5	Output power failure	V-In < 21 VDC (with V-In OK)

5.4 VFC-3000 Controller Replacement

1. Turn off the power switch on the VFC-3000 controller face.
2. Label and remove all of the connections from the front and rear of the VFC-3000 controller.
3. Remove the screws securing the VFC-3000 controller to the inside of the display or the traffic cabinet and remove the controller.
4. Perform the needed maintenance.
5. When the VFC-3000 controller is ready for installation, slide it back into place.
6. Hold the controller in place and install the mounting screws.

7. Reconnect all connectors removed from the VFC-3000 controller.

8. Secure any retaining screws and prepare the VFC-3000 controller for operation as described in **ED-14480**, located in **Appendix B**.

5.5 Module Replacement

Caution: Modules are not hot swap components. Always turn off power to the modules prior to servicing.

1. Turn off power to the failed module by turning off the breakers for all power supplies.

2. Remove the wire connections:

   a. Press the locking tabs of the 2-pin power connector and remove the connector.

   b. Press the tabs of the 8-pin signal connector and remove the connector.

3. Carefully unlatch the 10 locking tabs holding the module in place.

4. Remove the module from the display face.

5. Align the new module with the 10 tabs and carefully snap it into place, ensuring each tab is secure.

6. Plug the 2-pin power connector and 8-pin signal connector into the new module.

   Note: The connectors only fit together one way, do not force the connection.

7. Reapply power to the power supplies turned off in **Step 1**.

8. Test the modules:

   a. Display the moving row, moving column, and all on/all off test messages. Run the test messages at both 10% and 100% brightness settings. Watch for proper operation of the LED module during each test message.

   b. Perform a pixel test and check that all pixels operate correctly.

5.6 Power Supply Replacement

Reference Drawings:

Power Supply Replacement

Power supplies are mounted on the rear interior of the display; refer to the **Rear Electrical** drawing.

1. Turn off power to the power supplies by turning off the breaker in the distribution panel.

2. Locate the failed power supply reported by the VFC-3000 controller.

3. Note the location and orientation of the plugs connected to the isolation board on the failed power supply. Disconnect the plugs going into the isolation board.

4. Loosen the screws securing the power supply mounting plate to the backsheet, and gently lift the power supply and mounting plate off the backsheet.

5. Loosen the screws securing the power supply to the plate, and gently lift the faulty power supply off the plate.

6. Remove the screws connecting the isolation board to the power supply.

To replace the new power supply, repeat the above steps in reverse order.

Isolation Board Replacement

1. Turn off power to the power supplies by turning off the appropriate breakers in the distribution panel.

2. Note the location and orientation of the plugs connected to the failed isolation board on the power supply. Remove the screws connecting the isolation board to the power supply.

3. Gently lift the isolation board off the power supply.

To replace the isolation board, follow the previous steps in reverse order.

5.7 SCP Maintenance

Reference Drawing:

Rear Electrical ..... **Appendix A**

To replace VCB (PC1):

1. Turn off the circuit breakers powering all power supplies.

2. Remove all connections to the VCB, including incoming signal from the VFC-3000 controller and outgoing signal to the modules and sensors.

3. Remove the screws holding the board in place, and carefully remove the failed VCB.

4. Position the new board in the enclosure and secure with the screws removed in **Step 3**. Securely fasten the screws to ensure proper grounding.

5. Reconnect all connections removed in **Step 2**.

6. Restore power.

5.8 Ventilation Fan and Filter Maintenance

Reference Drawing:

Rear Electrical ..... **Appendix A**

Each time an intake fan assembly is opened, perform the following:

- Check the fan blades for dirt and debris. Clean the fan blades to maintain the fan's efficiency and to ensure proper cooling. If the fan blades have a large accumulation of dirt and debris, change the filters more often.

- Spin the fan blades with a pen or pencil to ensure the bearings are free and the fan is balanced.

- Check the filters every year. Clean the filters with water and a mild detergent, such as dish soap.
- Compressed air can be used to clean the filter provided the nozzle is held at least 6" away from the filter, the pressure is no greater than 60 psi, and the air is blown through the filter opposite the airflow direction as indicated by the arrow stamped on the filter frame.

Filter Replacement

1. Turn off the intake fan breaker.
2. Loosen the $^1/_4$-turn fasteners in the upper corners of the intake fan assembly panel.
3. Rotate the intake assembly forward and slide the filter out.
4. Slide a new filter into the panel.
5. Rotate the fan assembly back into its original position and tighten the $^1/_4$-turn fasteners.

Fan Replacement

1. Unplug the fan cord and cut the cable ties.
2. Remove the hardware holding the fan and finger guard in place.
3. Remove the failed ventilation fan.

To replace the ventilation intake fan, follow the previous steps in reverse order. Ensure the fan is properly oriented.

5.9 Traffic Cabinet Maintenance

Reference Drawings:

Traffic Cabinet Fan and Thermostat Assembly Replacement

1. Open the panelboard and turn off the circuit breaker supplying power to the fan and thermostat assembly. Refer to the **Traffic Cabinet Final Assembly** and the **Traffic Cabinet Schematic drawings**.
2. Disconnect the fan's power cord.
3. Remove the hardware securing the finger guard and fan to the assembly bracket and remove the fan.
4. Attach the new fan to the bracket and secure it using the hardware removed in **Step 3**. Note the airflow orientation when attaching the new fan.
5. Reconnect power to the fan.
6. Adjust the thermostat to test the fan.

Traffic Cabinet Light Replacement

1. Turn off the circuit breaker that powers the light; refer to the **Traffic Cabinet Final Assembly** and the **Traffic Cabinet Schematic** drawings.

2. Remove the lamp cover and lamp.

3. Insert a new lamp into the assembly and replace the cover.

4. Restore power and test the light.

5.10 LIE Maintenance

Reference Drawings:

To replace an LIE light:

1. Turn off the circuit breaker that powers the light; refer to the **LIE Final Assembly** and the **LIE Schematic** drawings.

2. Remove the lamp cover and lamp.

3. Insert a new lamp into the assembly and replace the cover.

4. Restore power and test the light.

5.11 Display Maintenance

The following service intervals are recommendations. Contact Daktronics for recommendations based upon location-specific conditions.

Structure

At least once per year:

- Inspect the mounting structure for corrosion, loose bolts, and overall stability.

- Check the connections of the earth ground wires, if accessible.

Earth Ground Resistance

At least once per year ensure earth ground resistance measures 10 ohms or less at the site.

Note: Ground meters for this test are available for purchase from Daktronics.

Display Cabinet

At least once per year:

- Check for water stains and other signs of water intrusion in the display cabinet.

- Seal any leaks that have developed with a silicone sealant or another suitable sealer.

- Repair any door gaskets that have tears or missing pieces.
- Check the drainage holes in the bottom of the cabinet for obstructions.

Temperature and Light Sensors

At least once per year:

- Clear away any obstructions to airflow around the temperature and light sensors.
- Clean the windows if they are dirty.

Ventilation Fans

At least once per year:

- Verify all fans work by pushing the test button until the fans turn on.
- Open the intake fan assembly and clean any dirt and debris off the fan blades. Spin the fan blades with a pen or pencil to ensure the bearings are free and the fan is balanced.

Filters

Check and clean the filters at least once per year. If the filter has an excess of dirt and dust, check the filters more frequently.

VFC-3000 Controller

At least once per year:

- Ensure all connectors are secure and the cables are not damaged in any way.
- Check the VFC-3000 controller operation. Refer to **ED-14480** in **Appendix B**.

Face Panels

Clean the face panels as needed, using one of the following methods.

Wet Outdoor Cleaning Method

Cleaning supplies:

- Water
- 5-gal bucket
- Automotive detergent
- 4' to 8' telescoping, soft automotive brush with bristles that are light to medium in rigidity
- Several soft terry cloth towels

Cleaning process:

1. Mix the automotive detergent and cold water in the 5-gal bucket at 1 oz detergent to 1 gal of cold water. Distilled water is preferred, but not required.
2. Dip the brush in the bucket of soapy water.
3. Using brush strokes, wash the display from top to bottom.

   Note: Using a soap-dispensing brush with a low soap-to-water ratio eliminates excess soap residue.

4. Thoroughly rinse the display face with cold water under low pressure.

5. Use a soft, dry terry cloth to dry and remove any excess water.

Pressure Wash Cleaning Method

Cleaning supplies:

- Pressure washer
- 45° spray nozzle rated for 1,500 psi or less

Cleaning process:

1. Turn off power to the DMS.

2. Spray face and sides of the DMS. Keep the nozzle of the pressure washer at least 2' away from the display.

   Note: Use caution along areas of the display that contain seams, weather stripping, or silicone. Ensure the pressure washer does not peel or rip any sealing material.

LEDs

When necessary, clean the LEDs with a damp cloth, a soft brush, a feather duster, or an anti-static, polycarbonate-type cleaner applied to a damp cloth. Do not spray the cleaner directly onto the LEDs.

LED and Electronic Circuitry

Test LED and electronic circuitry at intervals determined by customer requirements. Daktronics recommends performing the tests at least monthly. Perform tests on the DMS to check for hardware problems and incorrect variable settings.

Note: The following tests display functions, not other DMS equipment hardware.

1. Connect to the VFC-3000 controller and establish communication with the display.

2. Check that the temperature levels shown on the Sign Status screen of the Sign Control tab are the appropriate values for both internal and external temperature.

3. Perform a diagnostics test and check that all the power supplies and other configured peripherals pass.

4. Make sure the photocell readings are appropriate for the current conditions.

5. Perform a pixel test and repair bad pixels.

5.12 Maintenance Checklist

Refer to the instructions in **Section 5.11**. One copy of the following table may be filled out for each display.

Display Location:

Maintenance Item	Service Interval			Dates Performed and Initials		
	Monthly Remote Diagnostics	1 yr.	As Needed			
Secure Connections		X				
Earth Ground Resistance		X				
Display Cabinet		X				
Structural Inspection		X				
Light/Temp Sensors		X				
Face Panels			X			
LEDs			X			
Ventilation Fans Inspection		X				
Internal Hardware		X				
LED and Electronic Circuitry	X					

5.13 Troubleshooting

For additional assistance, contact Daktronics Transportation Customer Service at the telephone number on the cover page.

Problem Observed	Possible Cause	Solution
No LEDs light, and the VFC-3000 controller does not communicate with the central controller.	No power.	Check that the traffic cabinet has power.
	VFC-3000 controller or modem is bad.	Refer to **Appendix B**.
No LEDs light, but the VFC-3000 controller communicates with the central controller. All peripherals indicate Communication Error.	No power at the display.	Check that the circuit breakers in the traffic cabinet are on and not tripped.
	VFC-3000 controller is bad or is not connected to the display.	Refer to **Appendix B**.
	VCB is bad.	Replace VCB.
No LEDs light, but the peripherals pass and the VFC-3000 controller is communicating with the central controller.	VCB is bad.	Replace VCB.
	No power to power supply groups.	Check that the circuit breakers are on and are not tripped.
LEDs on the entire display are garbled, or wrong LEDs are on throughout the display.	Signal connections at the VCB are incorrect.	Check the signal wiring.
	VFC-3000 controller is bad.	Refer to **Appendix B**.
	VFC-3000 controller has the wrong display configuration.	Refer to **Appendix B**.
One line of modules does not respond properly. LEDs are garbled, do not change, are too bright or too dim, etc.	One or more wires or terminals in the signal cable (for this line) is misplaced, open or shorted to wires or frame, in display, VFC-3000 controller, or control cable from display to VFC-3000 controller.	Repair wires as needed.
	Terminating resistor on the CAN bus for this line is bad.	Replace the terminating resistor.
	One or more drivers in this line are bad.	Replace modules in the line one at a time and retest each time. **Note:** There may be more than one bad driver. Repair the failed driver.
	VCB is bad.	Replace VCB.
No LEDs on a module light.	Power connector unplugged at module.	Plug in connector.
	Address and signal connector unplugged at module.	Plug in connector.
	Power plug terminals are not properly seated, or the wire is bad.	Inspect all wires and terminals for power plug. Repair as needed.
	The module is bad.	Replace failed module.
One module is garbled, too bright or too dim, erratic, etc.	Signal plug terminals are not seated well at driver board, or wire is bad.	Inspect all wires and terminals for 8-pin plug. Repair as needed.
	The module is bad.	Replace failed module.
One pixel does not turn off.	The module is bad.	Replace failed module.
One pixel does not light.	The module is bad.	Replace failed module.
One string (half the LEDs) in one pixel does not light.	The module is bad.	Replace failed module.

Problem Observed	Possible Cause	Solution
Electronically controlled fans or heaters are reported as on, but all are off.	Circuit breaker tripped.	Reset breaker.
	Relay is bad.	Replace relay.
	VCB is bad.	Replace failed VCB.
Ventilation fans do not run.	Circuit breaker tripped in traffic cabinet.	Reset the breaker.
	Temperature inside the display is lower than the thermostat setting.	This is not a problem.
	The thermostat or its wiring is bad.	Repair as needed.
	VCB is bad.	Replace failed VCB.
Ventilation fans run continuously.	Temperature inside the display exceeds the thermostat setting.	This is not a problem.
	The thermostat is stuck on or the wiring is shorted.	Replace the thermostat or repair wiring.
	VCB is bad.	Replace failed VCB.
LED brightness is wrong—entire display is too bright or too dim.	Light sensor assembly is obstructed.	Clear obstruction.
	One or more wires or terminals in the light/temp control cable are misplaced, open or shorted to other wires or the frame in display, VFC-3000 controller, or control cable from display to VFC-3000 controller.	Repair as needed.
	Light sensor is not configured correctly.	Correct the settings. Refer to **Appendix B**.
	Light sensor printed circuit board (PCB) is bad.	Replace light sensor.
	VFC-3000 controller is bad.	Refer to **Appendix B**.
Pixel test shows all pixels on all display lines as bad. Display lines play messages correctly.	Fiber or RS422 display output RX not terminated properly (fiber or copper option).	Re-terminate display output RX connections (fiber or copper option).
	VFC-3000 controller is bad.	Refer to **Appendix B**.
One or more internal temperature sensors not reading.	Signal or power wiring is bad. One or more wires or terminals are misplaced, or are open or shorted to wires or the frame at one of the temperature sensors or the VCB.	Repair wiring as needed.
	One or both of the temperature sensors is bad.	Remove connectors at the temperature sensor to test one sensor at a time. Replace any bad sensors.
	VCB is bad.	Replace VCB.
	Temperature sensor is not configured correctly.	Correct the settings. Refer to **Appendix B**.
One power supply indicates “bad” from the operator software or the VFC-3000 controller. All others indicate OK.	One isolation board is bad.	Replace isolation board.
	Bad power supply.	Replace power supply.
	Wiring for power supply in VCB is bad.	Repair as needed.

Section 6: Replacement Parts and Exchange and Repair Programs

6.1 Daktronics Part Numbers

All parts in Daktronics displays are assigned a part number. Daktronics part numbers are commonly found on drawings and are used when requesting replacement parts from Daktronics Customer Service. Take note of the following part number formats.

- "0P-_ _ _ _-_ _ _ _" denotes an individual circuit board.
- "0A-_ _ _ _-_ _ _ _" denotes an assembly. An assembly can be a single circuit board or a collection of components that function together, usually mounted on a single plate or in a single enclosure.
- "0Z-_ _ _ _-_ _ _ _" denotes an assembly.
- "W-_ _ _ _" denotes a wire or cable. Cables may also carry the assembly numbering format in certain circumstances. This is especially true of ribbon cables.
- "PR-_ _ _ _ _-_ _" denotes a specially ordered part.

Most circuit boards and components within this display carry a label listing the part number of the unit. If a circuit board or assembly is not in the replacement parts list, use the label to order a replacement. A typical label is shown in **Figure 9**. The part number is bolded.

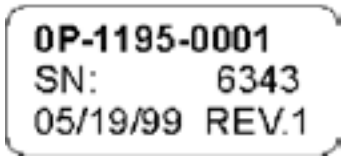


Figure 9: *Typical Label*

6.2 Replacement Parts List

When ordering replacement parts, refer to the Daktronics part numbers in the table below. Daktronics recommends putting replacement parts in a lockable storage cabinet to prevent theft or accidental loss.

VF-2400 Series DMS Parts	
Part Description	**Daktronics Part #**
Air Filter	EN-1632
Auxiliary Control Panel (Optional)	0A-1248-0020
CAN Temperature and Light Detector	0P-1247-0019
CAN Temperature, Light, and Humidity Detector (Optional)	0P-1247-0015
Defog Heater	A-1792
Defog Heater Fan (Optional)	B-1053
Fan Airflow Sensor (Optional)	A-2544
Fan with RPM Sensor	B-1075
Isolation Board	0P-1447-2000
Module	0P-1332-5031
Power Supply	A-1856R
Relay	K-1025
Surge Suppressor	A-2139
Vanguard® Control Board	0P-1248-0022
VFC-3000 Controller (Can also be located in the traffic cabinet)	0A-1248-0016

Traffic Cabinet Parts	
Part Description	**Daktronics Part #**
Air Filter	EN-1765
Auxiliary Control Panel (Optional)	0A-1248-0020
Fan	B-1053
Fluorescent Light Assembly	A-2185
Power Cord	W-1246
Thermostat	S-1128
UPS (Optional)	A-2361
VFC-3000 Controller (Can also be located in the display)	0A-1248-0016

LIE Parts	
Part Description	**Daktronics Part #**
Auxiliary Control Panel	0A-1248-0020
Fluorescent Light Assembly	A-1744

6.3 Daktronics Exchange and Repair & Return Programs

To serve customers' repair and maintenance needs, Daktronics offers both an Exchange Program and a Repair & Return Program.

Exchange Program

Daktronics offers a unique Exchange Program as a quick service for replacing key parts in need of repair. If a part requires repair or replacement, Daktronics sends the customer a replacement, and the customer sends the defective part to Daktronics. This decreases display downtime.

Before Contacting Daktronics

Identify these important part numbers:

Display Serial Number:
Display Model Number:
Contract Number: **C19554**
Date Installed:
Location of Display (Mile Marker Number):
Daktronics Customer ID Number: **152736**

To participate in the Exchange Program, follow these steps.

1. **Call Daktronics Customer Service:**

Market Description	Customer Service Number
Schools (primary through community/junior colleges), religious organizations, municipal clubs and community centers	877-605-1115
Universities and professional sporting events, live events for auditoriums and arenas	866-343-6018
Financial institutions, petroleum, sign companies, gaming, wholesale/ retail establishments	866-343-3122
Department of Transportation, mass transits, airports, parking facilities	**800-833-3157**

2. **When the new exchange part is received, mail the old part to Daktronics.**
   If the replacement part fixes the problem, send in the problem part which is being replaced.

   a. Package the old part in the same shipping materials in which the replacement part arrived.

   b. Fill out and attach the enclosed UPS shipping document.

   c. Ship the part to Daktronics.

3. **A charge is made for the replacement part immediately, unless a qualifying service agreement is in place.** In most circumstances, the replacement parts are invoiced at the time they are shipped.

4. **If the replacement part does not solve the problem, return the part within 30 working days or the full purchase price is charged.** If, after the exchange is made the equipment is still defective, please contact customer service immediately. Daktronics expects immediate return of an exchange part if it does not solve the problem. The company also reserves the right to refuse parts that have been damaged due to acts of nature or causes other than normal wear and tear.

Repair & Return Program

For items not subject to exchange, Daktronics offers a Repair & Return Program. To send a part for repair, follow these steps:

1. **Call or fax Daktronics Customer Service:**
   Refer to the appropriate market number in the chart listed on the previous page.
   Fax: 605-692-0145

2. **Receive a Return Materials Authorization (RMA) number before shipping.**
   This expedites repair of the part.

3. **Package and pad the item carefully to prevent damage during shipment.**
   Electronic components, such as printed circuit boards, should be placed in an antistatic bag before boxing. Daktronics does not recommend using packing peanuts when shipping.

4. **Enclose:**
    - your name
    - address
    - phone number
    - the RMA number
    - a clear description of symptoms

Shipping Address

Daktronics Customer Service
331 32nd Ave
RMA#_____
Brookings, SD 57006

Email

transportationhelp@daktronics.com

6.4 Daktronics Warranty and Limitation of Liability

The Daktronics Warranty and Limitation of Liability is located in **Appendix C**. The Warranty is independent of Extended Service agreements and is the authority in matters of service, repair, and display operation.

Glossary

Address: Identification number assigned to each sign in a network, set through the front panel interface. The central controller uses the address to differentiate between signs connected on the same network. Signs on the same network cannot have the same address.

Central Controller: Software system that can control displays remotely. This software contains a message studio, schedule studio, a display manager, and other tools and options that are used to configure displays and networks for an Intelligent Transportation System.

Column: Vertical line of pixels.

Dynamic Message Sign (DMS): An electronic message display used on roadways to give travelers information about traffic conditions. Such displays may inform of events like traffic congestion, accidents, incidents, or roadwork zones.

Eyebolt (Lifteye): Heavy steel bolt with a loop attached to the top of the display cabinet for lifting.

Isolation Board: Interface between the power supply and the redundant power bus. It provides isolation between the redundant power bus and a failed power supply.

Light Emitting Diode (LED): Low-energy, high-intensity lighting units. Multiple, closely spaced LEDs form a pixel on the DMS display.

Line: Horizontal row of modules.

Matrix: Visible area on a display, measured in rows and columns of pixels.

Module: Component containing an array of LED pixels and pixel driver circuitry. Modules are placed next to each other to form the matrix of the display.

NTCIP: National Transportation Communication for ITS Protocol.

Panelboard: Circuit breaker box that distributes incoming power to the internal display components. A single panel unit may include buses, automatic overcurrent devices, and switches for light, heat, and power.

Pixel: A group of LEDs that turn on and off to form the characters and graphics making up the message content.

Power Supply: Unit that converts incoming AC power to DC power as required by several components within the display.

Power Supply Enclosure: 2–4 power supplies that provide redundant power to the display modules.

Relay: An electromechanical or semiconductor switch in which a current or voltage applied across one port or terminal controls electrical currents or voltages that appear across another terminal or terminals.

Row: Horizontal line of pixels.

RS232: Standard PC communication type with a maximum cable length of 25' (7.62 m).

RS422: Standard differential communication type with a maximum cable length of 4,000' (1.2 km).

Serial Port: Connector on the back of the control computer that controls the display network through either a 9- or a 25-pin serial connector.

Service Control Panel (SCP): Enclosure that serves as a central point for all data and power distribution. The SCP contains the VCB, relays, surge suppressors, and the main power distribution panel.

Vanguard® Control Board (VCB): Internal display component that sends and receives signals to and from the VFC-3000 controller. It distributes the signals received from the VFC-3000 controller to modules throughout the display. All diagnostic data from the sensors and modules transmit through the VCB back to the VFC-3000 controller.

VFC-3000 Controller: A component that receives signal information from the central controller, translates it, and activates the appropriate pixels on the display. It retains messages in its memory, determines the appropriate display brightness, and keeps the date and time through an internal clock/calendar. The VFC-3000 controller also reads and analyzes the diagnostic data from a variety of sensors. It is located in either the traffic cabinet or the display.

Appendix A: Reference Drawings

The Daktronics drawing number is located in the bottom-right corner of the drawing. The drawings are listed in alphanumeric order.

NOTES:
1. SWITCH CONTACTS ARE OPEN WHEN DOOR IS OPEN
2. TWO-DOOR TRAFFIC CABINET SHOWN. SOME CABINETS HAVE ONE DOOR ONLY.
3. IF MINI DC I/O BOARD IS LOCATED AT THE END OF CAN NETWORK. PLACE SHUNT JUMPER ACROSS X2 TO TERMINATE NETWORK.
4. "NC" AT END OF THE SHIELD WIRE MEANS NOT CONNECTED.
5. IF THERE ARE MULTIPLE FIELD CONTROLLERS IN A TRAFFIC CABINET, ALWAYS CONNECT THE MINI CAN BOARD TO THE BOTTOM FIELD CONTROLLER.

REV	DATE:		BY:
03	22 NOV 11	CHANGED VOLTAGE ON J2 PIN 1 FROM +5 TO +9 PER EC-2804	KAS
02	11 AUG 11	ADDED PACKET NUMBERS TO DESIGNATE THE HARNESSES IN THE DRAWING AS PER EC-1269	JJD
01	19 JUNE 08	ADDED NOTE 5.	GME

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ:
TITLE: DOOR SWITCHES, TRAF CAB, MINI CAN DC I/O BOARD
DESIGN: PLILLA | DRAWN: MBLOOM | DATE: 15 MAR 07
SCALE: NONE

SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	
	03	P1100	R-03-A	299454

BKR	SIZE	DESCRIPTION	DESCRIPTION	SIZE	BKR
1	30A	SIGN POWER FEED	LIGHTS, EXHAUST FAN & OUTLETS	20A	2
3			CONTROL EQUIPMENT	15A	4
5	--	NOT USED	NOT USED	--	6
7	15A	HEATER FAN (IF USED)	NOT USED	--	8
9	--	NOT USED	SURGE SUPPRESSOR	30A	10
11	--	NOT USED			12

BKR	SIZE	DESCRIPTION	DESCRIPTION	SIZE	BKR
1	30A	SIGN POWER FEED	LIGHTS, EXHAUST FAN & OUTLETS	20A	2
3			CONTROL EQUIPMENT	15A	4
5	--	NOT USED	NOT USED	--	6
7	15A	HEATER FAN (IF USED)	NOT USED	--	8
9	--	NOT USED	SURGE SUPPRESSOR	30A	10
11	--	NOT USED			12

BKR	SIZE	DESCRIPTION	DESCRIPTION	SIZE	BKR
1	30A	SIGN POWER FEED	LIGHTS, EXHAUST FAN & OUTLETS	20A	2
3			CONTROL EQUIPMENT	15A	4
5	--	NOT USED	NOT USED	--	6
7	15A	HEATER FAN (IF USED)	NOT USED	--	8
9	--	NOT USED	SURGE SUPPRESSOR	30A	10
11	--	NOT USED			12

NOTES:
-COPY ONTO LL-2533 WHITE ADHESIVE-BACKED POLYESTER
-DO NOT LAMINATE

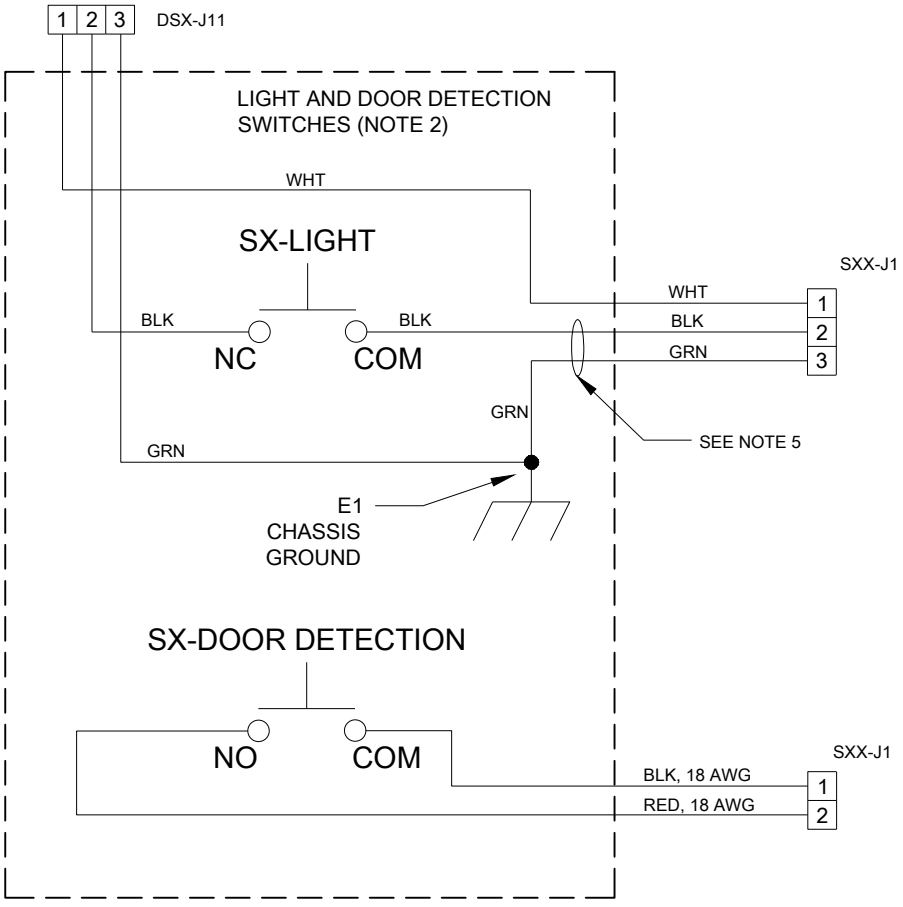
DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ: VANGUARD
TITLE: LABEL, BREAKER ASSIGNMENT, TC, VF-2000
DESIGN: JDILLON
DRAWN: JDILLON
DATE: 28 JAN 11
SCALE: 1=1

SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	
1 OF 1	00	P1249	E-07-A	1043816

NOTES

1. ALL WIRE TYPE; 14 AWG, STRAND, 600 V, 105C, THHN, THWN, OR MTW, NYLON JACKET, U.L. LISTED, UNLESS OTHERWISE NOTED.
2. SWITCHES HARNESS IS DAK PART # 0A-1600-7522.
3. SX ARE DAK PART NUMBER S-1170
4. SX WILL BE REPLACED BY THE LOCATION REFERENCE NUMBER WHEN INSTALLED IN THE SIGN.
5. ZIP TIE THE BLACK AND GREEN WIRE TOGETHER USING HE-1011 INSIDE THE SWITCH HOUSING.



REV	DATE:		BY:
02	14 DEC 12	CHANGED RED WIRE TO NO AND BLK WIRE TO COM ON DOOR DETECTION SWITCH, PER EC-8524	AJS
01	26 JUN 12	AS PER EC-5527 ADDED NOTE 5	JJD

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ:
TITLE: SCHEM, LIGHT AND DOOR OPEN REPORTING SWITCHES
DESIGN: ASTREIE | DRAWN: ASTREIE | DATE: 19 APR 11
SCALE: NONE

SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	
	02	P1626	F - 03 - A	1046353

1	15A	CABINET LIGHTS (IF EQUIPPED)	CONVENIENCE OUTLET(S), LIE OUTLETS	15A	2
3	15A	VENTILATION FANS	CONTROL EQUIP. OUTLET (IF EQUIPPED)	15A	4
5	15A	DEFOG HEATERS (IF EQUIPPED)		--	6
7	15A	BEACONS (IF EQUIPPED)	PANEL BOARD SURGE SUPPRESSOR	20A	8
9	15A				10
11	15A	POWER SUPPLY 1	POWER SUPPLY 2	15A	12
13	20A			--	14
15	15A	POWER SUPPLY 3 (IF EQUIPPED)	POWER SUPPLY 4 (IF EQUIPPED)	15A	16
17	15A	LAPTOP INTERFACE ENCL. (IF EQUIPPED)		--	18
19	20A		UPS (IF EQUIPPED)	25A	20

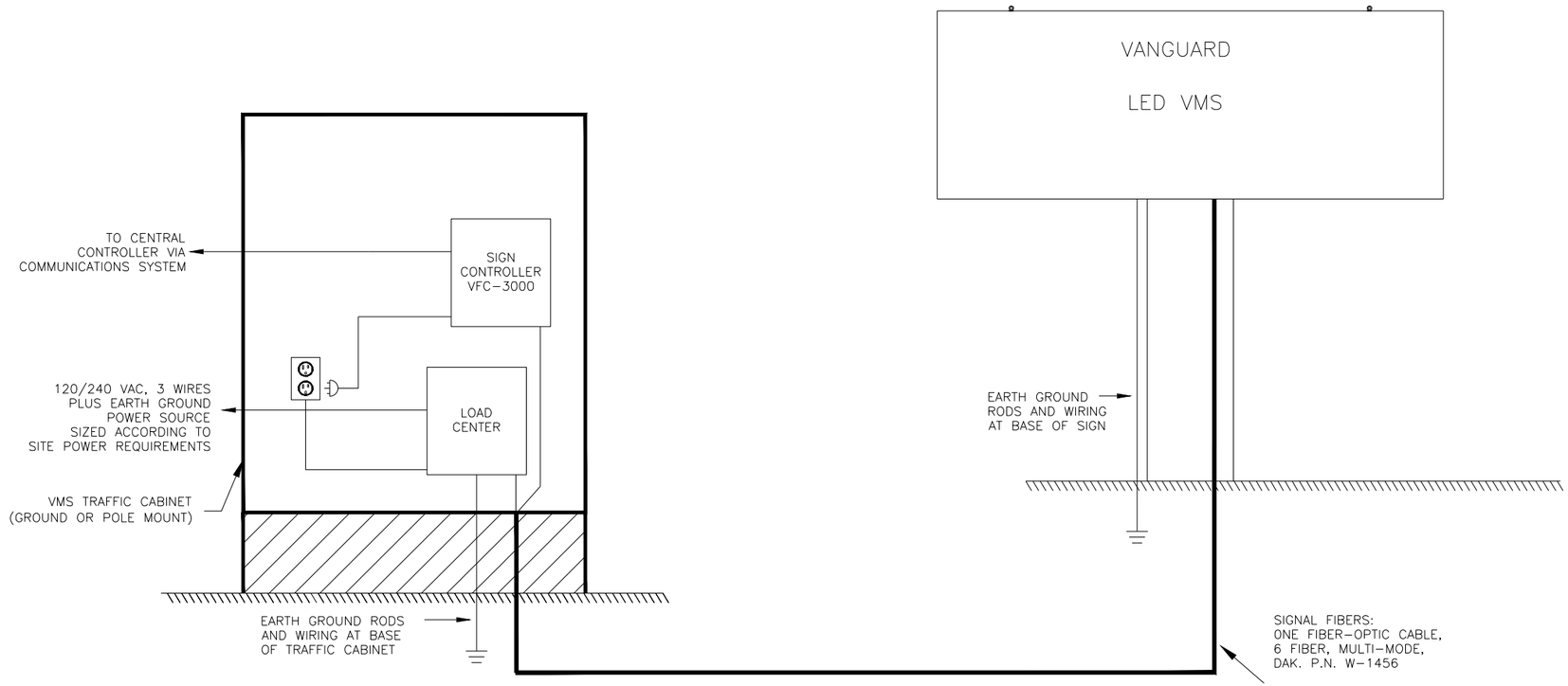
NOTES:

1. USE LL-2839 FOR LABELS.

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ:
TITLE: BREAKER SCHEDULE, STANDARD, VF-24X0, 20 POS PNL
DESIGN: ASTREIE | DRAWN: KSEIDL | DATE: 14 JUN 11
SCALE: NONE

SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	
	00	P1626	E-10-A	1057678



GENERAL NOTES:

THIS IS NOT A SCALED DRAWING AND SHOULD BE USED FOR POWER AND SIGNAL REQUIREMENTS ONLY.

IT IS THE RESPONSIBILITY OF THE ELECTRICAL INSTALLATION CONTRACTOR TO ENSURE THAT ALL ELECTRICAL WORK PERFORMED ON SITE MEETS OR EXCEEDS ALL LOCAL AND NATIONAL ELECTRICAL CODES.

ALL SIGNAL CABLE RUNS SHOULD BE LABELED AS TO ORIGIN AND DESTINATION.

FIBER OPTIC CABLE RUNS MUST BE CONTINUOUS WITH A MINIMUM 7" BEND RADIUS.

ALL VMS MUST BE GROUNDED PER ARTICLE 250 AND 600 OF THE NATIONAL ELECTRICAL CODE WITH NO MORE THAN 10 OHMS GROUND RESISTANCE.

POWER DISTRIBUTION EQUIPMENT TO DAKTRONICS SUPPLIED EQUIPMENT NOT PROVIDED BY DAKTRONICS.

DUE TO THE INRUSH CURRENT (MOMENTARY SURGE) CREATED BY THE DISPLAY EQUIPMENT ON STARTUP, THE OVER CURRENT PROTECTION DEVICE(S) MAY HAVE TO BE OVERSIZED.

DAKTRONICS IS NOT RESPONSIBLE FOR THE QUALITY OF THE POWER DELIVERY SYSTEM TO THE DISPLAY SYSTEM.

BECAUSE EACH INSTALLATION IS UNIQUE, DAKTRONICS OFFERS THESE INSTRUCTIONS AS GUIDELINES ONLY. DAKTRONICS, INC. ASSUMES NO LIABILITY IF INSTALLATION STEPS HAVE BEEN OMITTED OR OTHER NECESSARY PROCEDURES ARE NOT INCLUDED IN THIS SITE RISER DIAGRAM.

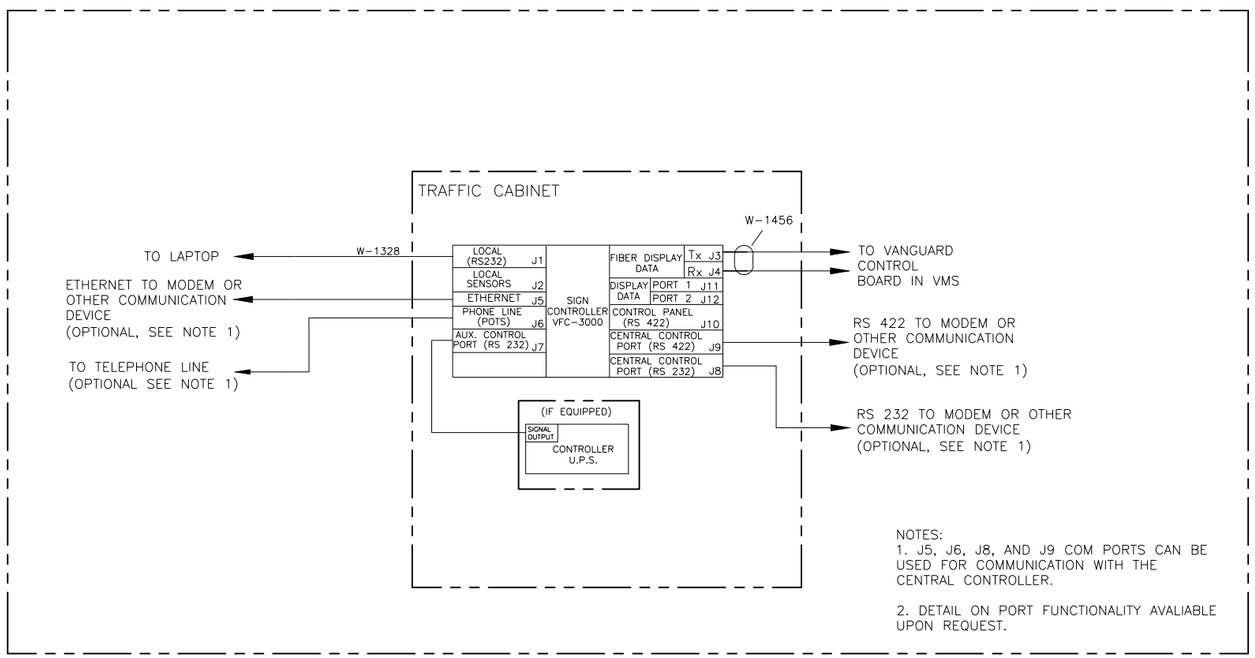
POWER AND SIGNAL REQUIREMENTS ARE SPECIFIED TO THE EQUIPMENT AND SETUP SHOWN. ANY CHANGES MADE TO EQUIPMENT OR THEIR SETUP SHOULD BE APPROVED BY DAKTRONICS DESIGN PERSONNEL AND WILL REQUIRE AN UPDATED SITE RISER DIAGRAM.

THE CONTRACTUAL AGREEMENT WILL DETERMINE THE PARTY OR PARTIES RESPONSIBLE FOR ITEMS LISTED AS FIELD INSTALLED. THIS DRAWING IS NOT INTENDED TO DETERMINE RESPONSIBILITIES AND SHOULD BE USED FOR REFERENCES ONLY.

ACTUAL PLACEMENT OF ELECTRICAL COMPONENTS, SUCH AS PANEL BOARDS, A/C'S, AND SPLICE PANELS, MAY VARY. THIS DRAWING REPRESENTS A GENERAL MOUNTING LOCATION OF THIS EQUIPMENT.

DO NOT REFERENCE THIS DRAWING FOR ACTUAL VMS PLACEMENT DETAILS. PLEASE REFERENCE THE SYSTEM SHOP DRAWING FOR THIS DETAIL.

INTERCONNECT DIAGRAM



NOTES:
1. J5, J6, J8, AND J9 COM PORTS CAN BE USED FOR COMMUNICATION WITH THE CENTRAL CONTROLLER.

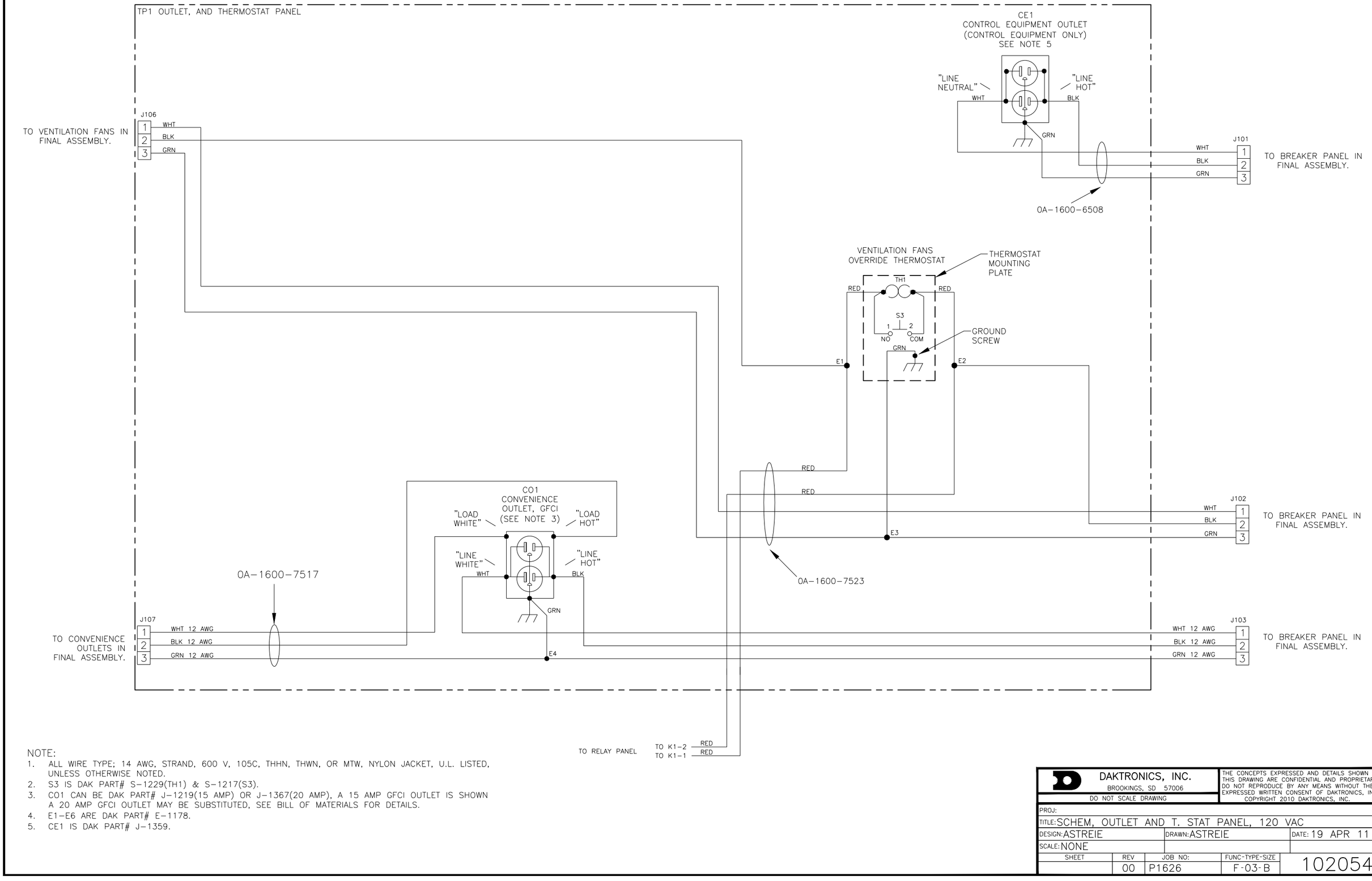
2. DETAIL ON PORT FUNCTIONALITY AVALIABLE UPON REQUEST.

REV	DATE:		BY:
01	03 AUG 10	CHANGED IT FROM SAYING ONE 1-1/2" CONDUIT HUB TO TWO 1-1/2" CONDUIT HUBS.	PLL

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ:
TITLE: SITE RISER, VMS, TC, VFC-TC
DESIGN: ASTREIE | DRAWN: ASTREIE | DATE: 03 FEB 10
SCALE: NONE

SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	
	01	P1341	F-01-B	968786



NOTE:

1. ALL WIRE TYPE; 14 AWG, STRAND, 600 V, 105C, THHN, THWN, OR MTW, NYLON JACKET, U.L. LISTED, UNLESS OTHERWISE NOTED.
2. S3 IS DAK PART# S-1229(TH1) & S-1217(S3).
3. CO1 CAN BE DAK PART# J-1219(15 AMP) OR J-1367(20 AMP), A 15 AMP GFCI OUTLET IS SHOWN A 20 AMP GFCI OUTLET MAY BE SUBSTITUTED, SEE BILL OF MATERIALS FOR DETAILS.
4. E1-E6 ARE DAK PART# E-1178.
5. CE1 IS DAK PART# J-1359.

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ:				
TITLE: SCHEM, OUTLET AND T. STAT PANEL, 120 VAC				
DESIGN: ASTREIE		DRAWN: ASTREIE		DATE: 19 APR 11
SCALE: NONE				
SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	1020541
	00	P1626	F-03-B	

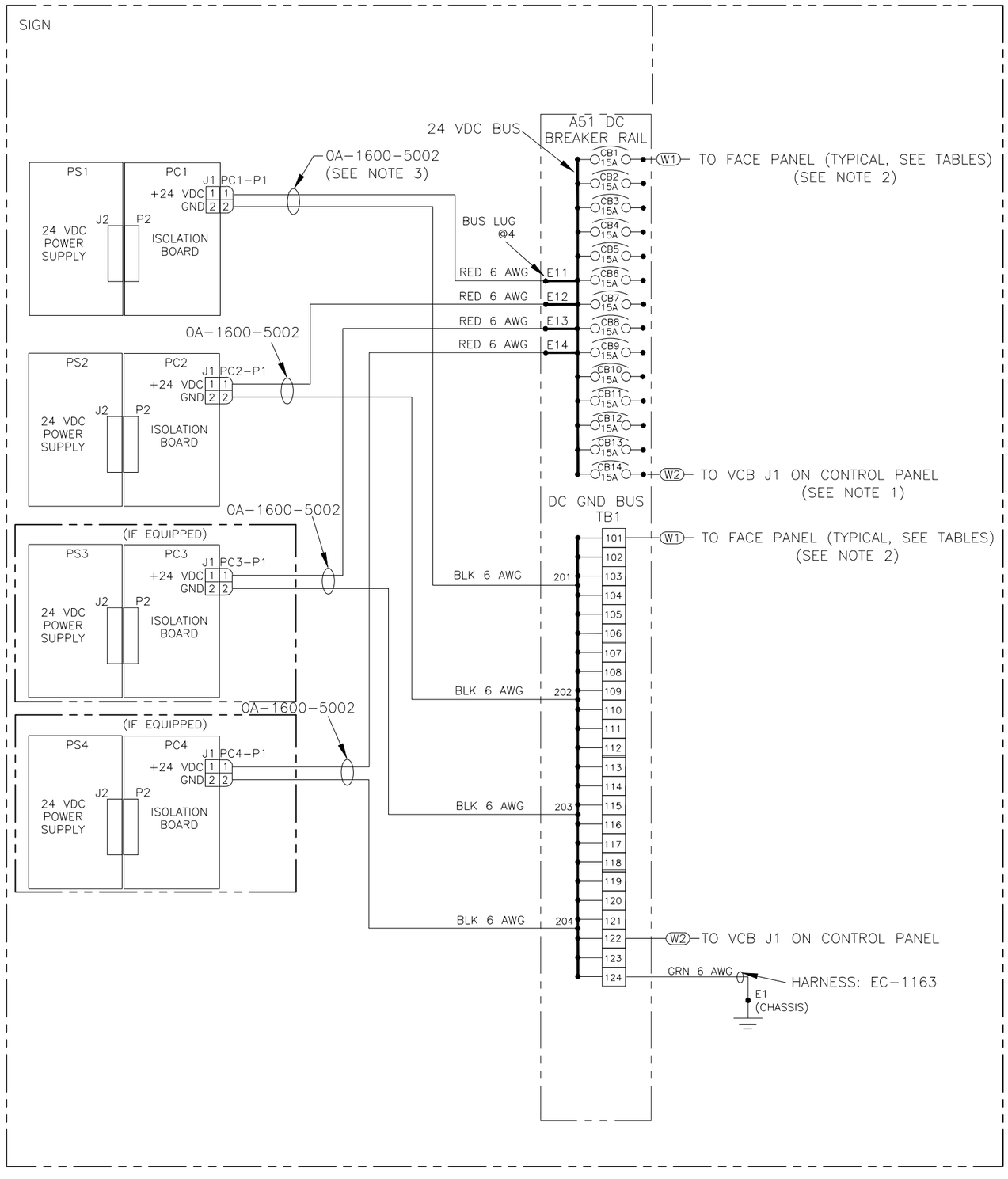


TABLE 1
ONE STRING PER FACE PANEL

FACE PANEL #	MOD STRING#	CB#	DC TB#
PANEL 1	STRING 1	1	101
PANEL 2	STRING 1	2	102
PANEL 3	STRING 1	3	103
PANEL 4	STRING 1	4	107
PANEL 5	STRING 1	5	108
PANEL 6	STRING 1	6	109
PANEL 7	STRING 1	7	113
PANEL 8	STRING 1	8	114
PANEL 9	STRING 1	9	115
PANEL 10	STRING 1	10	119
PANEL 11	STRING 1	11	120
PANEL 12	STRING 1	12	121
PANEL 13	STRING 1	13	116

TABLE 2
2 STRINGS PER FACE PANEL

FACE PANEL #	MOD STRING#	CB#	DC TB#
PANEL 1	STRING 1	1	101
	STRING 2	2	102
PANEL 2	STRING 1	3	103
	STRING 2	4	107
PANEL 3	STRING 1	5	108
	STRING 2	6	109
PANEL 4	STRING 1	7	113
	STRING 2	8	114
PANEL 5	STRING 1	9	115
	STRING 2	10	119
PANEL 6	STRING 1	11	120
	STRING 2	12	121

NOTES:
1. FOR DETAILED VCB POWER WIRING SEE VF-24XO SIGNAL SCHEMATIC.
2. TABLE 1 IS FOR SIGNS HAVING FACE PANELS WITH ONE STRING OF MODULES, SIGN SIZES: 18 HIGH 46MM AND 18-27 HIGH 66MM. TABLE 2 IS FOR SIGNS HAVING FACE PANELS WITH 2 STRINGS OF MODULES, SIGN SIZES: 36-45 HIGH 46MM. SEE VF-24XO DC POWER SCHEMATIC FOR STRINGS PER FACE PANEL.
3. DO NOT CUT 0A-1600-5002 HARNESS TO LENGTH, TIE BACK EXCESS HARNESS, BE SURE TO LEAVE ADEQUATE STRAIN RELIEF AT THE CONNECTION POINTS.

DC HARNESS

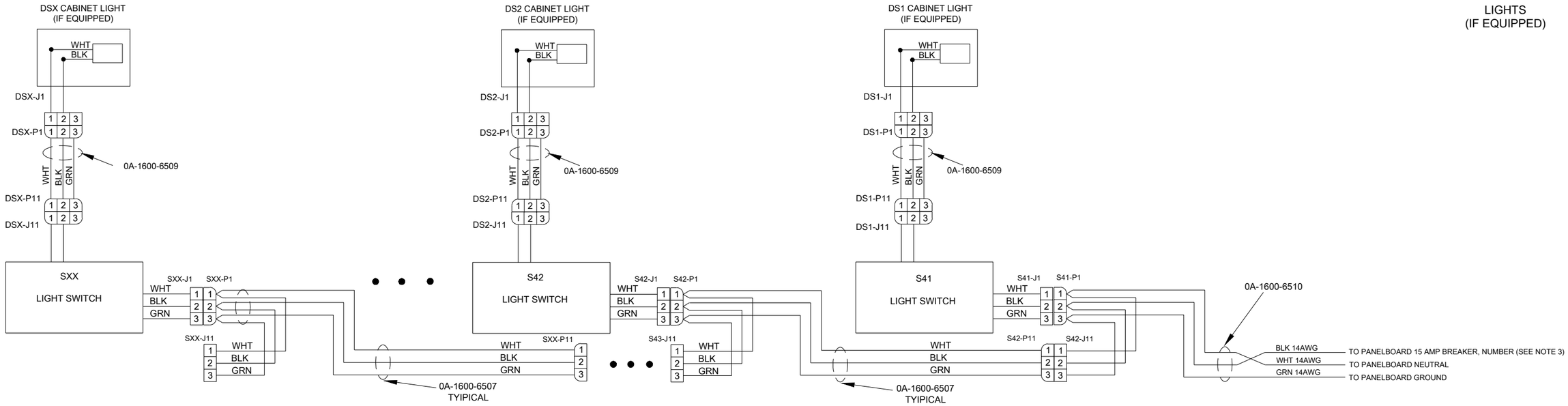
W1 0A-1600-5000
HARN, BRKR TO MOD, 312"

W2 0A-1600-5001
HARN, 2-PIN M-MNL TO PIGTAIL, 220"

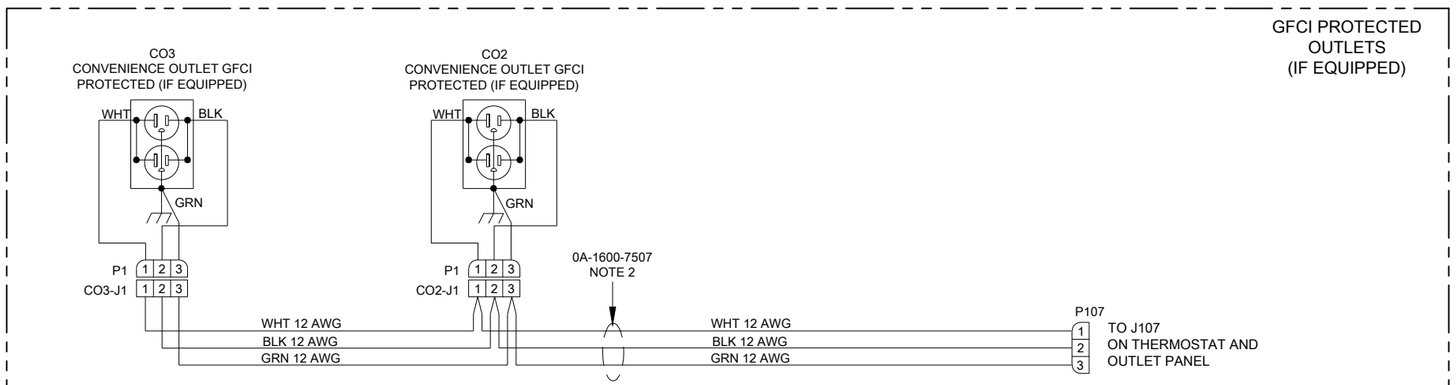
PROJ:
TITLE: SCHEM, DC PWR SYS, 4 PS, 1 OR 2 MOD STRINGS/DOOR
DESIGN: ASTREIE | DRAWN: ASTREIE | DATE: 04 MAR 11
SCALE: NONE

SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	
	00	P1626	F-03-B	1046599

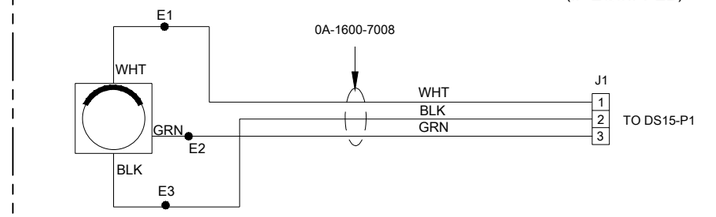
LIGHTS (IF EQUIPPED)



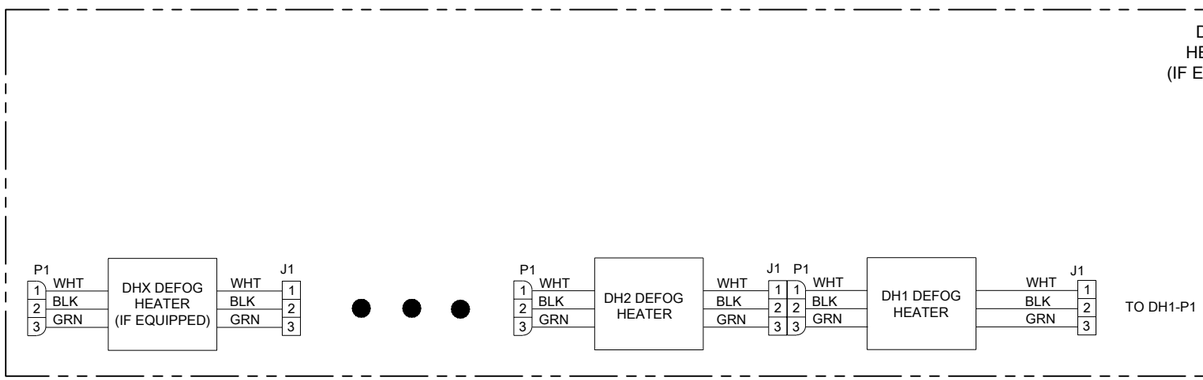
GFCI PROTECTED OUTLETS (IF EQUIPPED)



DS15 STROBE LIGHT (IF EQUIPPED)



DEFOG HEATERS (IF EQUIPPED)



NOTES:

1. ALL WIRE TYPE; 14 AWG, STRAND, 600 V, 105C, THHN, THWN, OR MTW, NYLON JACKET, U.L. LISTED, UNLESS OTHERWISE NOTED.
2. IF SIGN IS NOT EQUIPPED WITH CONVENIENCE OUTLET CO3, THE UNUSED PLUG "CO3-J1" WILL BE TIED BACK.
3. SEE SIGN 120 VAC SCHEMATIC FOR BREAKER ASSIGNMENT.

REV	DATE:		BY:
02	02 APR 12	CHANGED LIGHT TO PANEL BOARD HARNESS FROM 0A-1600-6507 TO 0A-1600-6510, PER EC-3953	AJS

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ: VANGUARD
TITLE: SCHEM, DEFOG HEATERS, LIGHTING, AND OUTLETS 120VAC
DESIGN: ASTREIE | DRAWN: ASTREIE | DATE: 21 APR 11
SCALE: NONE

SHEET	REV	JOB NO:	FUNC - TYPE - SIZE	
	02	P1626	F - 03 - B	1050337

RS8 RPM SENSOR (INSIDE VF8)
RS7 RPM SENSOR (INSIDE VF7)
RS6 RPM SENSOR (INSIDE VF6)
RS5 RPM SENSOR (INSIDE VF5)
RS4 RPM SENSOR (INSIDE VF4)
RS3 RPM SENSOR (INSIDE VF3)
RS2 RPM SENSOR (INSIDE VF2)
RS1 RPM SENSOR (INSIDE VF1)

SEE NOTE 3

SEE NOTE 4

RS8-J2 1 2 3 4
RS8-P2 1 2 3 4
RS7-J2 1 2 3 4
RS7-P2 1 2 3 4
RS6-P2 1 2 3 4
RS6-P2 1 2 3 4
RS5-J2 1 2 3 4
RS5-P2 1 2 3 4
RS4-J2 1 2 3 4
RS4-P2 1 2 3 4
RS3-J2 1 2 3 4
RS3-P2 1 2 3 4
RS2-J2 1 2 3 4
RS2-P2 1 2 3 4
RS1-J2 1 2 3 4
RS1-P2 1 2 3 4

RED BLK WHT

2 PR, 22 AWG W-1234 TYPICAL

WHT BLK RED NC

HARNESS: 0A-1600-0508, (TYPICAL)

PC1 VANGUARD CONTROL BOARD

TB8	1	1	SENSOR 1
	2	2	GND
	3	3	SENSOR 2
	4	4	GND
	5	5	SENSOR 3
	6	6	GND
	7	7	SENSOR 4
	8	8	GND
TB7	1	1	SENSOR 5
	2	2	GND
	3	3	SENSOR 6
	4	4	GND
	5	5	SENSOR 7
	6	6	GND
	7	7	SENSOR 8
	8	8	GND

TO TB4 PIN 1 ON VANGUARD CONTROL BOARD

HARNESS: 0A-1600-5004

RED

E1 E2 E3

E-1178 WIRE CONNECTOR (SEE NOTE 5)

RPM SENSOR DETAIL (TYPICAL)

RSX RPM SENSOR (INSIDE VFX)

BLK RED WHT

RSX-J2 1 2 3 4

NOTES:
1. THE RPM SENSOR IS PART OF THE FAN. THE FAN PART NUMBER IS: B-1075
2. WHILE THE FAN IS TURNING THE RPM SENSOR WILL OUTPUT PULSES.
3. THE NUMBER OF FANS AND RPM SENSORS WILL DEPEND ON THE SIZE OF THE SIGN.
4. A PERMANENT MARKER MAY BE USED FOR LABELING PLUGS AND JACKS.
5. E2 AND E3 ONLY USED WHEN NECESSARY, DISCARD WHEN NOT NEEDED.

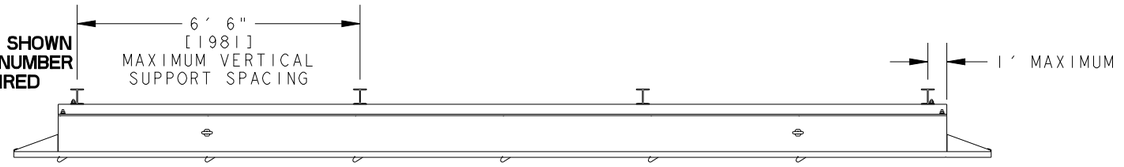
REV	DATE:		BY:
01	23 JUN 11	ADDED 8TH RPM SENSOR	AJS

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

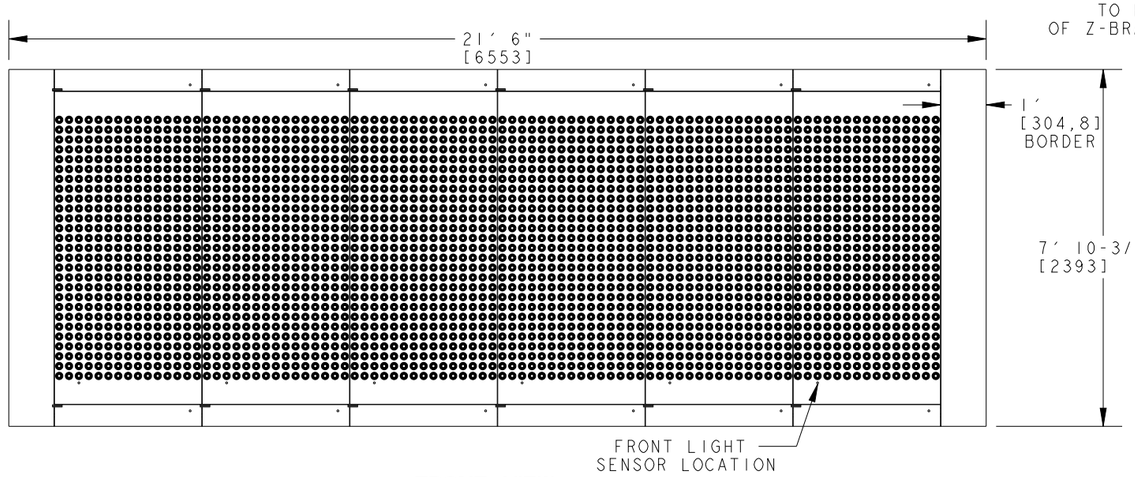
PROJ:			
TITLE: SCHEM, RPM SENSORS, SIGNAL AND DC PWR			
DESIGN: ASTREIE	DRAWN: ASTREIE	DATE: 19 APR 11	
SCALE: NONE			
SHEET	REV	JOB NO:	FUNC-TYPE-SIZE
	01	P1626	F-03-B

1050829

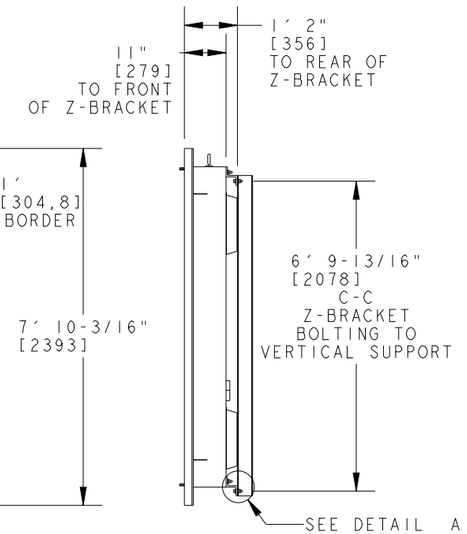
NOTE
NUMBER OF SUPPORTS SHOWN MAY NOT BE ACTUAL NUMBER OF SUPPORTS REQUIRED



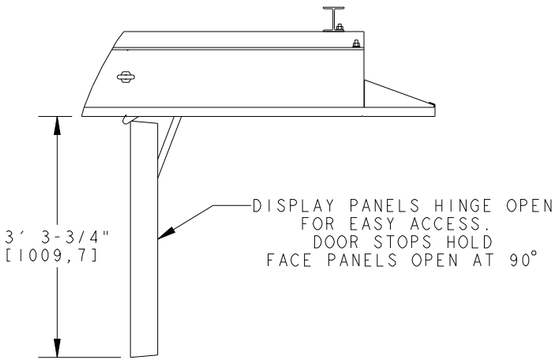
TOP VIEW



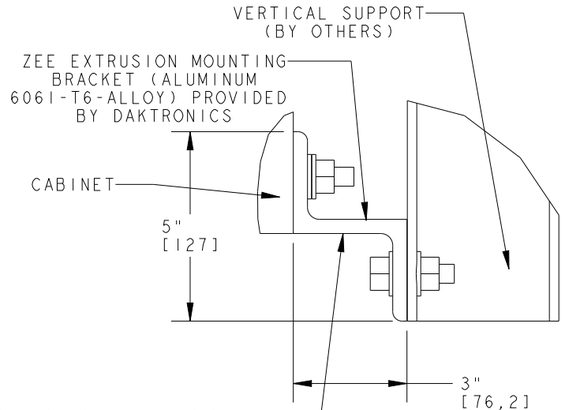
FRONT VIEW



RIGHT SIDE VIEW



TOP PARTIAL VIEW
FACEPANEL OPEN
SCALE 1/25

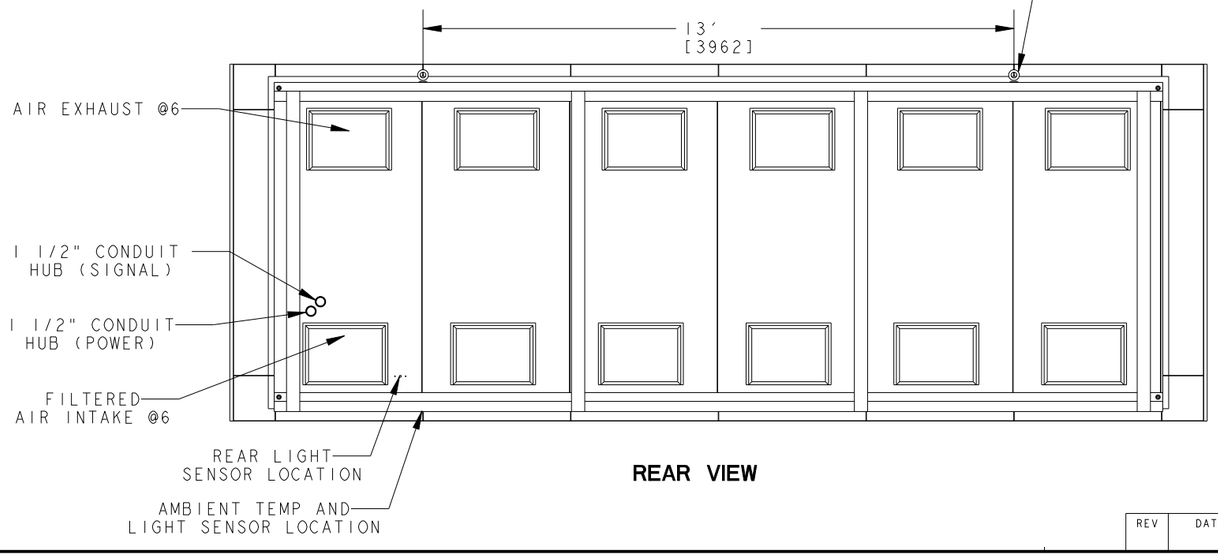


DETAIL A
SCALE 1/4

Z-BRACKETS ARE BOLTED TO THE REAR OF THE DISPLAY BY DAKTRONICS. THE VERTICAL SUPPORTS SHOWN ARE PROVIDED BY OTHERS. EACH Z-BRACKET IS ATTACHED TO THE CABINET USING Ø1/2" A325 MECHANICALLY GALVANIZED STRUCTURAL GRADE HARDWARE. FINAL REVIEW OF MOUNTING DETAIL IS THE RESPONSIBILITY OF THE CUSTOMER AND THE CUSTOMER'S ENGINEERS. THE VERTICAL SUPPORTS MUST BE ATTACHED AS SHOWN WITHIN THE STATED TOLERANCE.

WHEN LIFTING DISPLAY WITH LIFT EYES USE SPREADER BEAM.

IF LIFT EYES ARE REMOVED AFTER INSTALLATION THEY SHOULD BE REPLACED WITH SS BOLTS TO PREVENT DEBRIS BUILDUP IN THE THREADS OF THE PERMANENT HARDWARE. THIS DOES NOT EFFECT WATER TIGHTNESS.



REAR VIEW

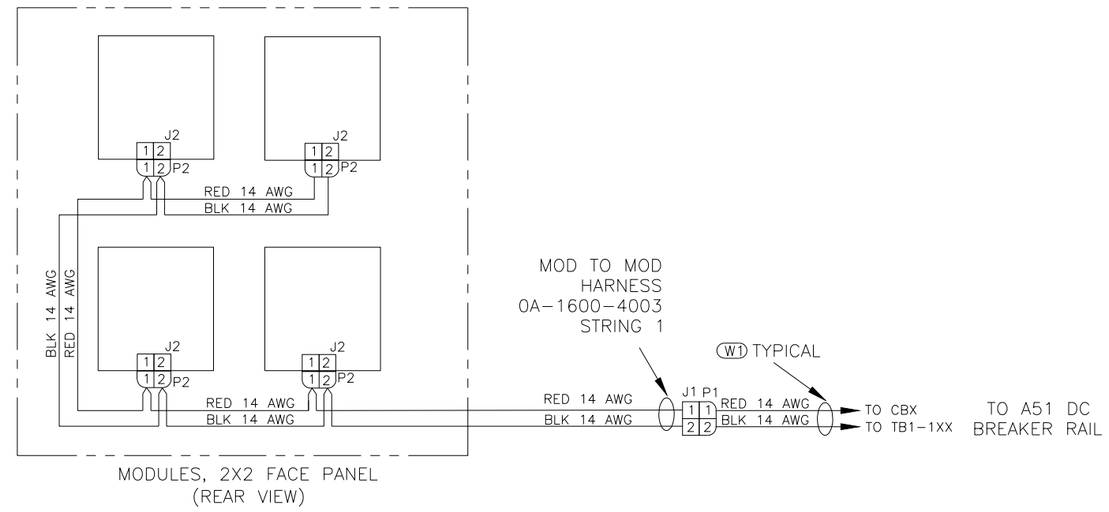
NOTES:
1.) MATRIX SIZE 27 X 90, 18" NOMINAL CHARACTER
2.) SEE ILLUSTRATIONS FOR POWER AND SIGNAL CONDUIT ENTRANCES.
3.) ALL DIMENSIONS ARE IN INCHES [mm].
4.) FULL PROTECTIVE MASKED FACE PANEL.
5.) MAINTENANCE OF DISPLAY IS INTERNAL VIA FRONT ACCESS FACE PANEL.
6.) ALL ALUMINUM CONSTRUCTION
7.) POSITIVE PRESSURE VENTILATION SYSTEM
8.) WEIGHT OF THE DISPLAY IS APPROXIMATELY 1660 LBS (753 KG).
9.) VERTICAL SUPPORTS DESIGNED AND SUPPLIED BY OTHERS.
10.) MOUNTING CALCULATIONS DONE TO "AASHTO STANDARD SPEC. FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS. AASHTO 5TH EDITION 2009;"
11.) IF VERTICAL SUPPORTS NEED TO BE MOVED OUTSIDE OF STATED MAXIMUM SPACING OR IF SPECIFICATIONS EXCEED NOTE #10 THEN CONTACT DAKTRONICS ENGINEERING.

REV	DATE:		BY:

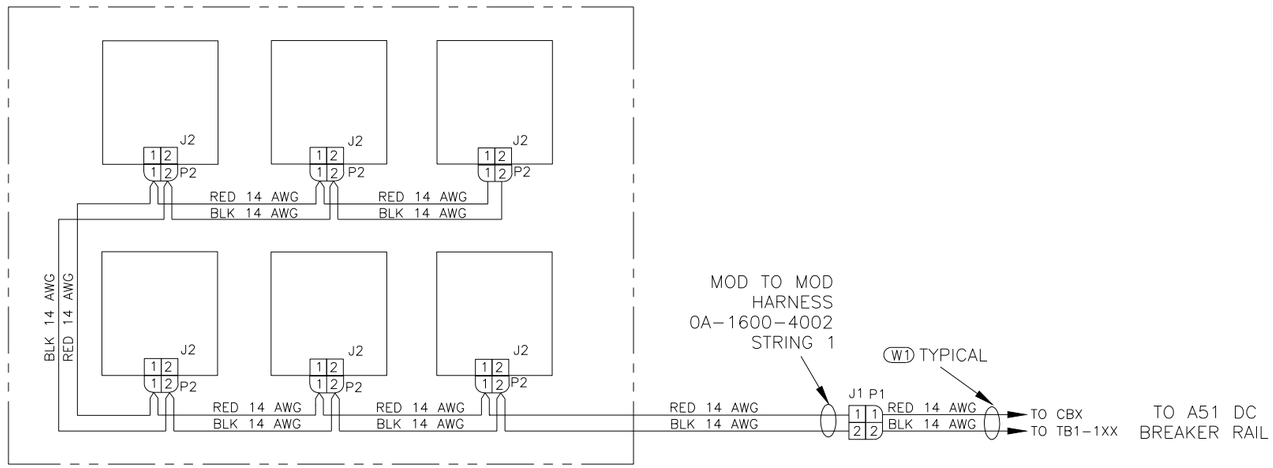
DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ: VANGUARD			
TITLE: SHOP DRAWING, VF-24**-27X90-66-*			
DESIGN: JHALIBU	DRAWN: TLAYH	DATE: 02-MAY-11	
SCALE: 1/40			

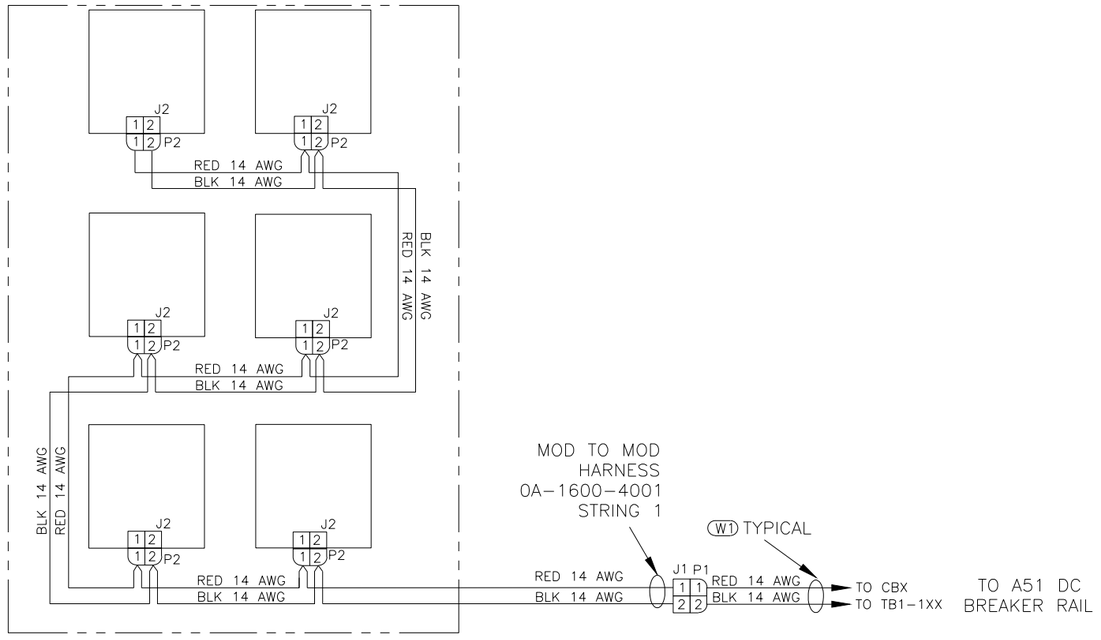
SHEET:	REV	JOB NO:	FUNC-TYPE-SIZE	
1 OF 1	00	P 1626	F-10-B	1051913



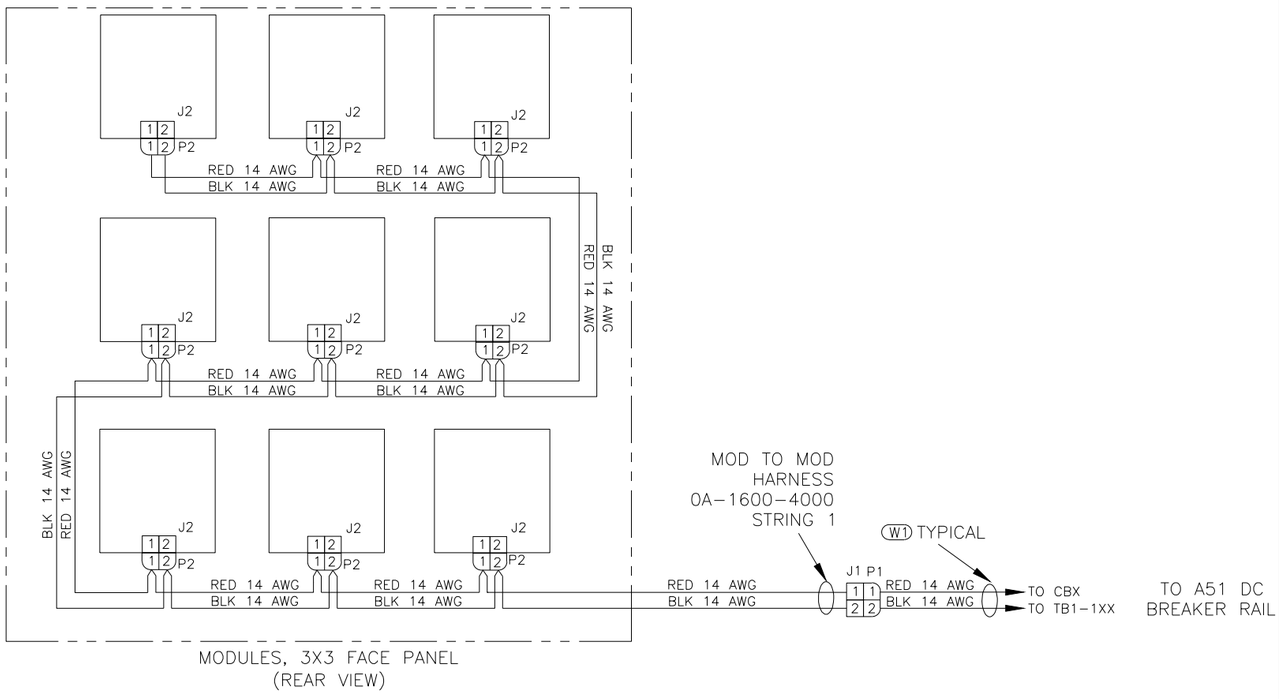
MODULES, 2X2 FACE PANEL
(REAR VIEW)



MODULES, 2X3 FACE PANEL
(REAR VIEW)



MODULES, 3X2 FACE PANEL
(REAR VIEW)



MODULES, 3X3 FACE PANEL
(REAR VIEW)

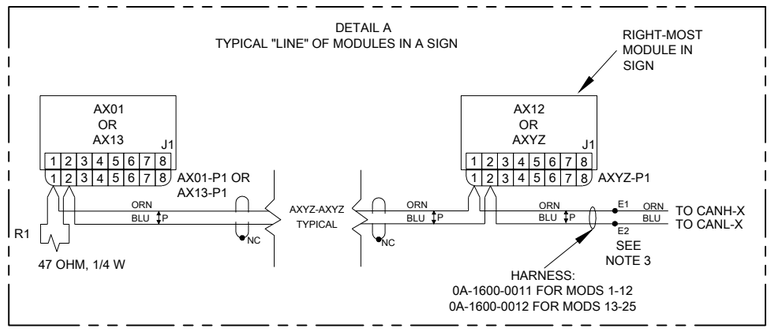
DC HARNESS

W1 0A-1600-5000
HARN, BRKR TO MOD, 312"

NOTES:
1. FOR DETAILED POWER SUPPLY AND A51 DC RAIL WIRING SEE DC POWER SYSTEM SCHEMATIC.

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ:				
TITLE: SCHEM, DC POWER, VF-24X0, 66MM, 18 AND 27 HIGH				
DESIGN: ASTREIE		DRAWN: ASTREIE		DATE: 25 MAY 11
SCALE: NONE				
SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	1054885
	00	P1626	F-03-B	



NTCIP VERSION
1

PERIPHERAL NAME	QTY	M/A	TB"X"	PIN	PERIPHERAL NAME	QTY	M/A	TB"X"	PIN
REAR LIGHT SENSOR	1	A	--	--	RPM SENSOR(S)	6	A	--	--
AMBIENT TEMP SENSOR	1	A	--	--	AIR FLOW SENSOR(S)	--	A	--	--
AMBIENT LIGHT SENSOR	1	A	--	--	# OF BEACON RELAYS USED (SEE NOTE 6)	--	A	--	--
FRONT LIGHT SENSOR	1	A	--	--	MINI CAN BOARD 1 ADDRESS 5	--	?	--	--
INTERNAL TEMP SENSOR	1	A	--	--	MINI CAN BOARD 2 ADDRESS 1	--	?	--	--
HUMIDITY SENSOR	1	A	--	--	MINI CAN BOARD 3 ADDRESS 6	--	?	--	--
POWER SUPPLIES	3	A	--	--	MINI CAN BOARD 4 ADDRESS 2	--	?	--	--
VENTILATION FAN RELAY	1	A	--	--	MINI CAN BOARD 5 ADDRESS 7	--	?	--	--
DEFOG HEATER RELAY	1	A	--	--	MINI CAN BOARD 6 ADDRESS 3	--	?	--	--
DOOR DETECTION	6	A	--	--					
SURGE SUPRESSOR(S)	1	A	--	--					

NOTES:
1. FIBER OPTIC CABLE TERMINATIONS ARE "ST" CONNECTORS WHERE USED.
2. R11 TERMINATING RESISTOR IS LOCATED ON THE LAST DEVICE ON THE END OF THE WIRING DAISY CHAIN. THERE CAN BE NO MORE THAN 1 NETWORK TERMINATING RESISTOR.
3. E1-E3 ARE DAK PART# E-1178. F101 IS DAK PART# F-1071.
4. FOR DETAILED VENTILATION FAN RPM SENSOR WIRING SEE DWG-1050829.
5. FOR DETAILED AIR FLOW SENSOR WIRING SEE DWG-1050828.
6. ONE RELAY FOR SIMULTANEOUS FLASH TWO RELAYS FOR ALTERNATING FLASH.
7. USE PT-1014 TUBING TO INSULATE RESISTOR LEADS.

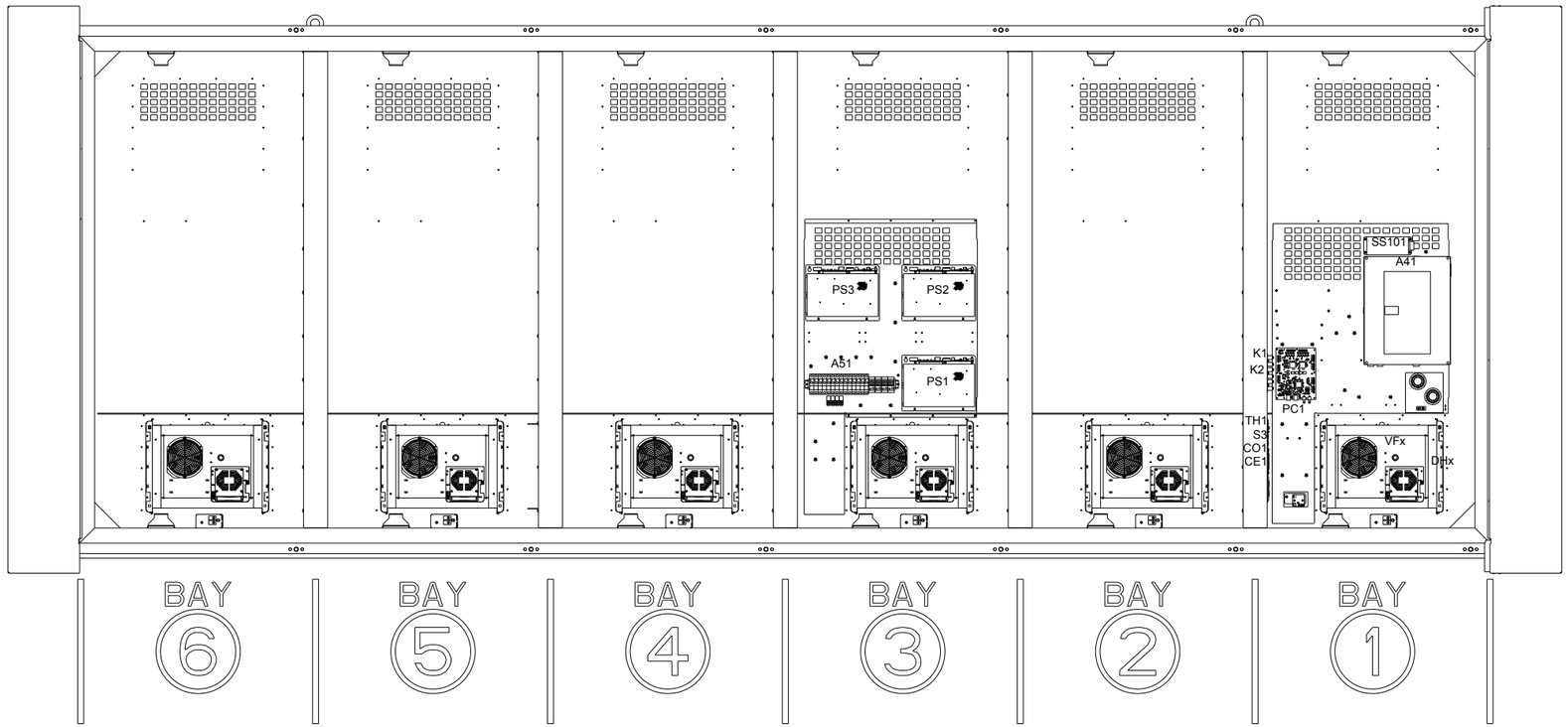
DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ:			
TITLE: SIGN SIGNAL SCHEMATIC, VF-2420-27X90-66-A			
DESIGN: JDILLON	DRAWN: JDILLON	DATE: 02 JAN 13	
SCALE: NONE			

SHEET	REV	JOB NO:	FUNC - TYPE - SIZE	
	00	C 19554	F - 03 - B	1122972

REFERENCE NO.	PART NUMBER	QTY	PER DWG-0	NOTES
S3 CO1 CE1	0A-1626-0320	1	1050751	SEE BAY 1 FOR LOCATIONS
PC1	0P-1248-0022	1	1056281	SEE BAY 1 FOR LOCATION
SS10x	0A-1589-0101	1	1050741	SEE BAY 1 FOR LOCATIONS. REFER TO SS LOCATION FOR "x"
PSx	0A-1589-0501	3	1050741	SEE BAY 3 FOR LOCATIONS. REFER TO PS LOCATION FOR "x" USE 0M-xxxxxxx FOR PS4. SEE BAY X.
A51	A-2887	1	1050741	SEE BAY 3 FOR LOCATIONS
VFx	0A-1589-0200	6	1050926	ALL BAYS. REFER TO BAY NUMBER FOR POSITION "x"
DHx	0A-1589-0203	6	0944799	ALL BAYS. REFER TO BAY NUMBER FOR POSITION "x"
Kx	0A-1626-0205	1	1050962	SEE BAY 1 FOR PLACEMENT

APPLY PR-175003-02 2" REFLECTIVE TAPE PER DWG-01122873



FRONT VIEW

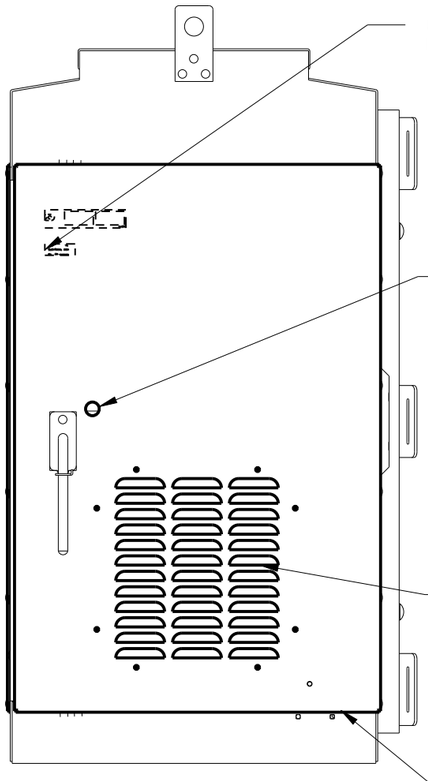
FACEPANEL INSTALLATION PER: DWG-01050917
END SHROUD INSTALLATION PER: DWG-01050947
GAP FILLER INSTALLATION PER: DWG-01051011
GENERAL INSTALLATION: DWG-01050926

BAY	FACEPANEL PN	QTY	HARNESS PN	QTY
1-6	0A-1626-1322	6	0A-1600-4000	6

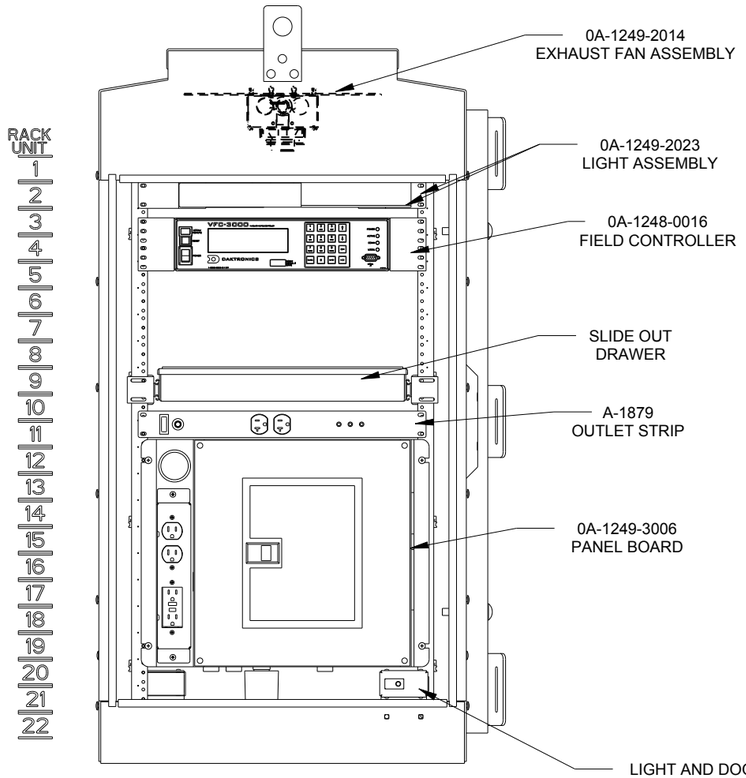
REV	DATE:		BY:

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

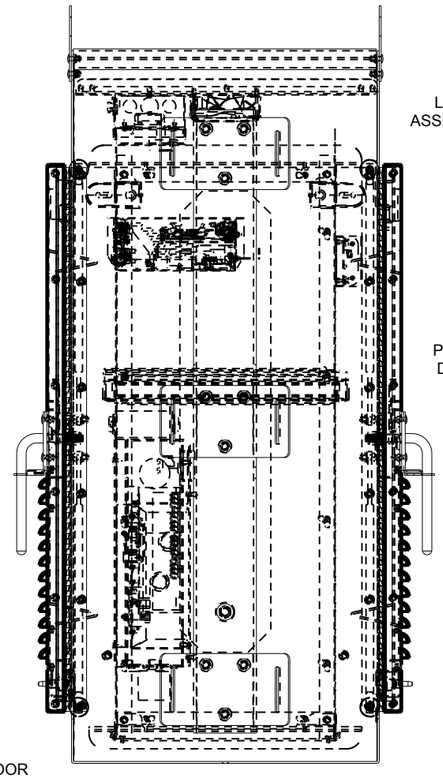
PROJ: VANGUARD					
TITLE: REAR ELEC, VF-24**-27X90-66-A					
DESIGN: DREITZ		DRAWN: DREITZ		DATE: 03-JAN-13	
SCALE: 1/25					
SHEET:	REV	JOB NO:	FUNC-TYPE-SIZE	1123039	
1 OF 1	00	C 19554	E _ 10 _ B		



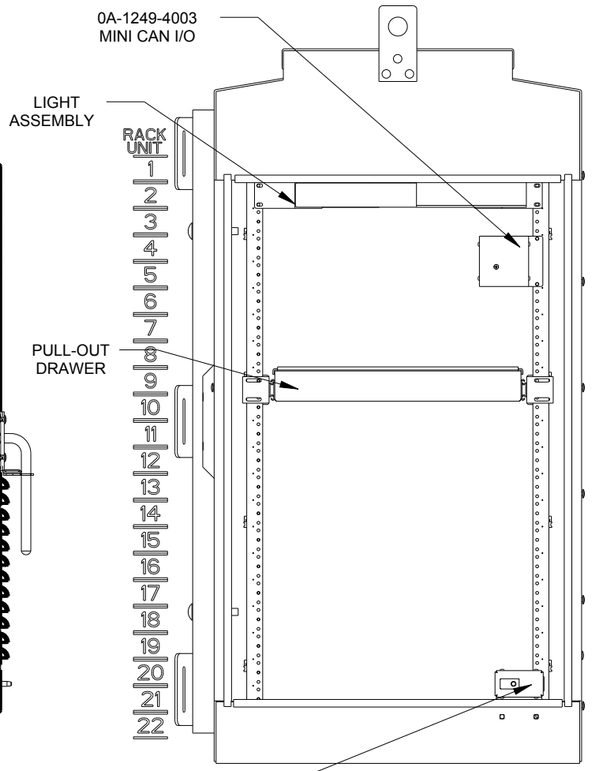
FRONT VIEW
(DOORS SHOWN)



FRONT VIEW
(NO DOORS SHOWN)



SIDE VIEW
(DOORS SHOWN)



REAR VIEW
(NO DOORS SHOWN)

USE HC-1446 SCREWS TO
ATTACH ALL COMPONENTS TO RACK

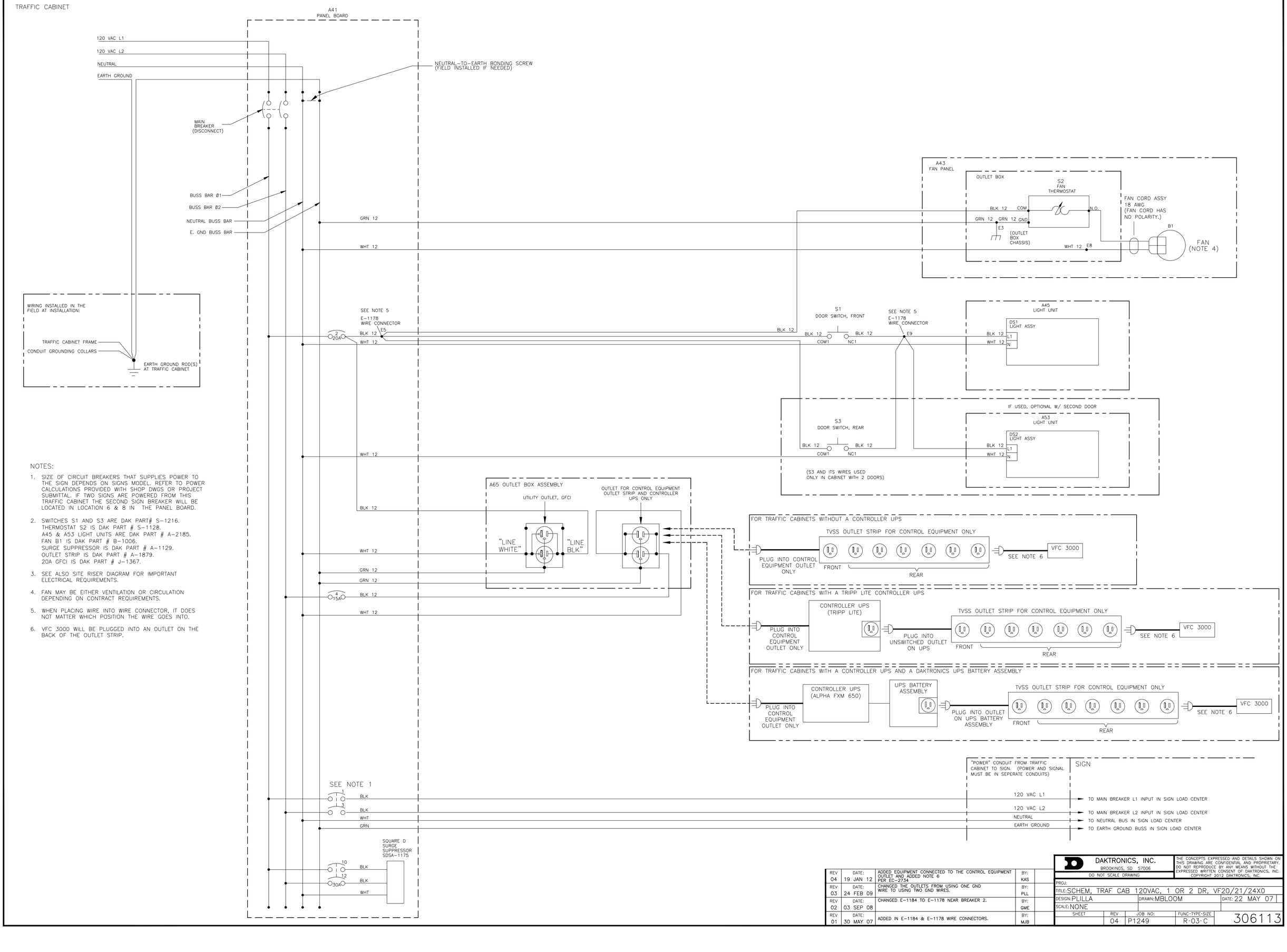
0Z-19554-1000TC

REV	DATE:		BY:

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ: VANGUARD				
TITLE: FA, TC, 336S, ALU, POLE, DOD				
DESIGN: DREITZ		DRAWN: DREITZ		DATE: 03-JAN-13
SCALE: 1=10				
SHEET:	REV	JOB NO:	FUNC-TYPE-SIZE	1123079
1 OF 1	00	C 19554	E - 10 - B	

TRAFFIC CABINET



NOTES:

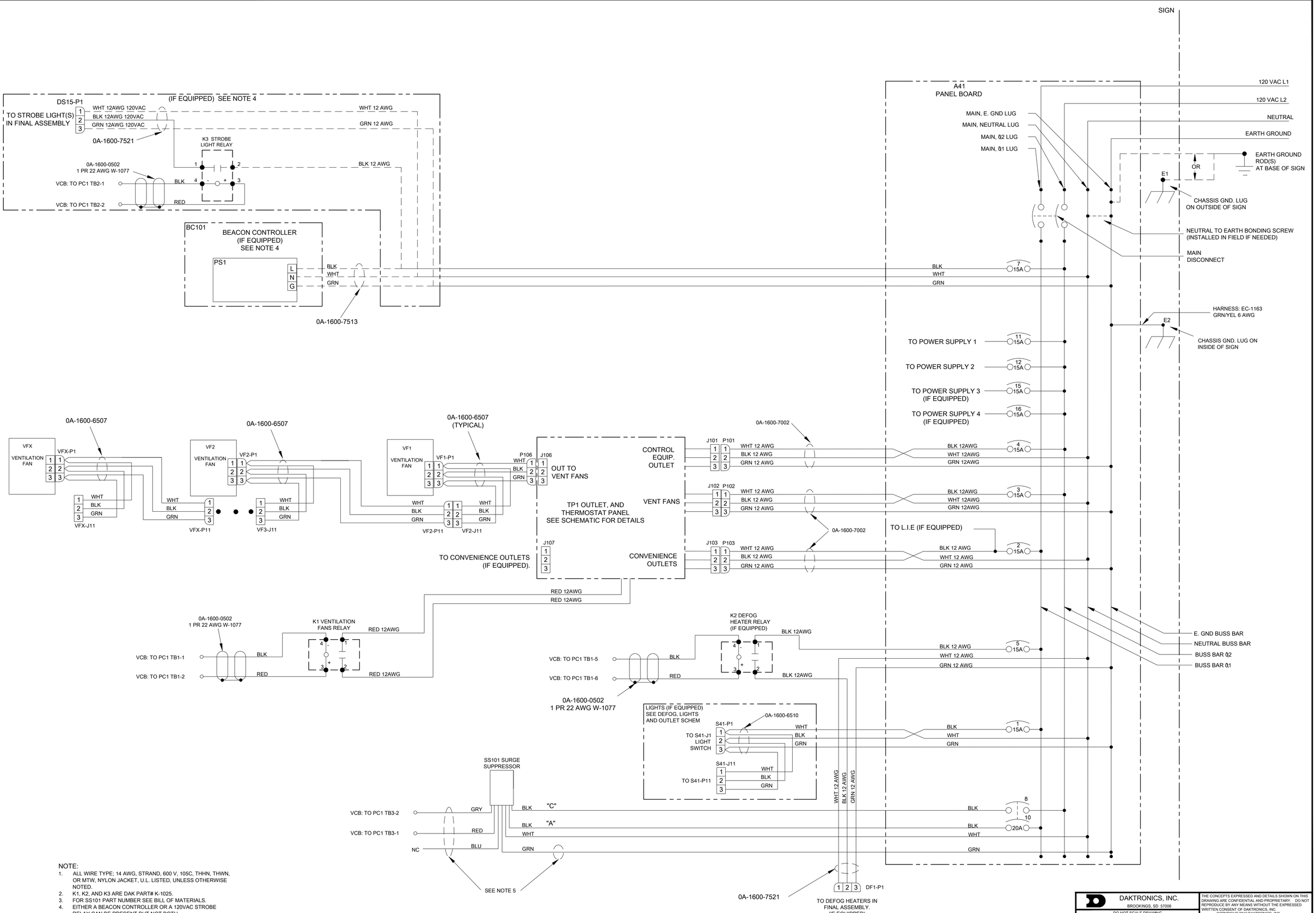
1. SIZE OF CIRCUIT BREAKERS THAT SUPPLIES POWER TO THE SIGN DEPENDS ON SIGNS MODEL. REFER TO POWER CALCULATIONS PROVIDED WITH SHOP DWGS OR PROJECT SUBMITTAL. IF TWO SIGNS ARE POWERED FROM THIS TRAFFIC CABINET THE SECOND SIGN BREAKER WILL BE LOCATED IN LOCATION 6 & 8 IN THE PANEL BOARD.
2. SWITCHES S1 AND S3 ARE DAK PART# S-1216.
   THERMOSTAT S2 IS DAK PART # S-1128.
   A45 & A53 LIGHT UNITS ARE DAK PART # A-2185.
   FAN B1 IS DAK PART # B-1006.
   SURGE SUPPRESSOR IS DAK PART # A-1129.
   OUTLET STRIP IS DAK PART # A-1879.
   20A GFCI IS DAK PART # J-1367.
3. SEE ALSO SITE RISER DIAGRAM FOR IMPORTANT ELECTRICAL REQUIREMENTS.
4. FAN MAY BE EITHER VENTILATION OR CIRCULATION DEPENDING ON CONTRACT REQUIREMENTS.
5. WHEN PLACING WIRE INTO WIRE CONNECTOR, IT DOES NOT MATTER WHICH POSITION THE WIRE GOES INTO.
6. VFC 3000 WILL BE PLUGGED INTO AN OUTLET ON THE BACK OF THE OUTLET STRIP.

REV	DATE:		BY:
04	19 JAN 12	ADDED EQUIPMENT CONNECTED TO THE CONTROL EQUIPMENT OUTLET AND ADDED NOTE 6 PER EC-2734	KAS
03	24 FEB 09	CHANGED THE OUTLETS FROM USING ONE GND WIRE TO USING TWO GND WIRES.	PLL
02	03 SEP 08	CHANGED E-1184 TO E-1178 NEAR BREAKER 2.	GME
01	30 MAY 07	ADDED IN E-1184 & E-1178 WIRE CONNECTORS.	MJB

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ:
TITLE: SCHEM, TRAF CAB 120VAC, 1 OR 2 DR, VF20/21/24X0
DESIGN: PLILLA | DRAWN: MBLOOM | DATE: 22 MAY 07
SCALE: NONE

SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	
	04	P1249	R-03-C	306113



NOTE:

1. ALL WIRE TYPE; 14 AWG, STRAND, 600 V, 105C, THHN, THWN, OR MTW, NYLON JACKET, U.L. LISTED, UNLESS OTHERWISE NOTED.
2. K1, K2, AND K3 ARE DAK PART# K-1025.
3. FOR SS101 PART NUMBER SEE BILL OF MATERIALS.
4. EITHER A BEACON CONTROLLER OR A 120VAC STROBE RELAY CAN BE PRESENT BUT NOT BOTH.
5. WHEN SQUARE D SURGE SUPPRESSOR, DAK PART# A-1129 IS USED THESE WIRES ARE NOT PRESENT. ALSO WIRE LABELS A AND C WILL NOT BE PRESENT.

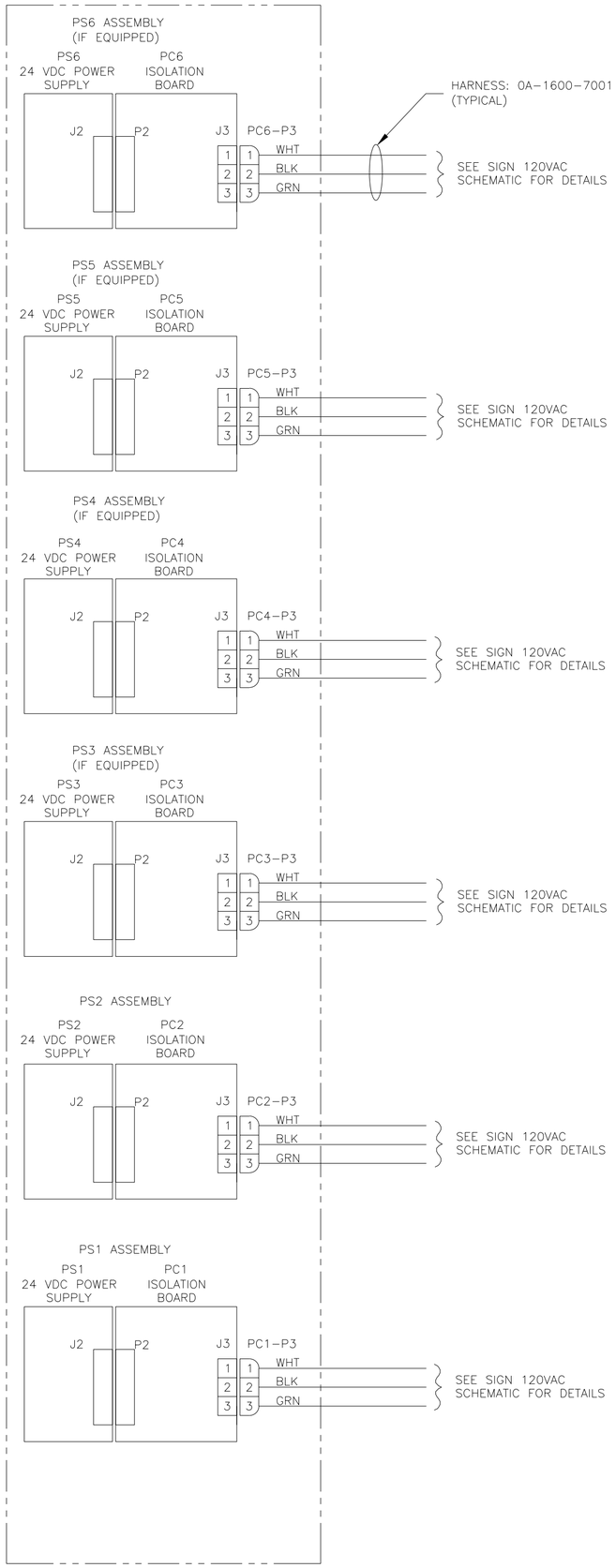
REV	DATE:		BY:
02	02 APR 12	UPDATED HARNESS FOR LIGHTS, 0A-1600-6507 REPLACED WITH 0A-1600-6510. PER EC-3953	AJS
01	19 JUL 11	REVISED TEXT	KAS

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

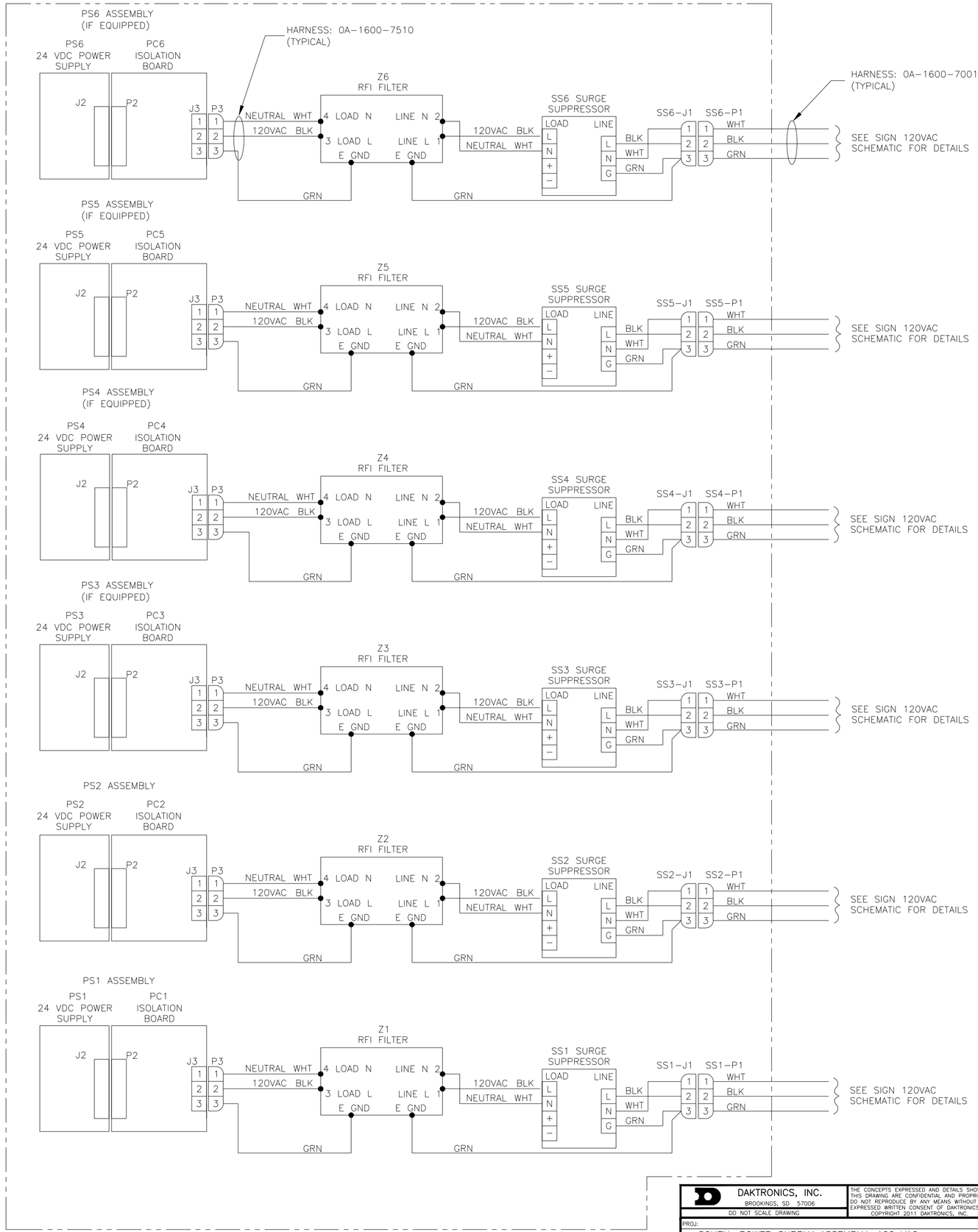
PROJ:			
TITLE: SCHEM, VF-24X0, 120 VAC			
DESIGN: ASTREIE	DRAWN: ASTREIE	DATE: 07 JUN 11	
SCALE: NONE			

SHEET	REV	JOB NO:	FUNC · TYPE · SIZE	
	02	P1626	F · 03 · C	1056399

WITHOUT FILTERS AND SURGE SUPPRESSORS



WITH FILTERS AND SURGE SUPPRESSORS



PROJ:

TITLE: SCHEM, POWER SUPPLY ASSEMBLY, 120 VAC

DESIGN: ASTREIE	DRAWN: ASTREIE	DATE: 11 JUL 11
SCALE: NONE		

SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	
	00	P1626	F-03-C	1061148

NOTES:
1. SWITCH CONTACTS ARE OPEN WHEN DOOR IS OPEN
2. TWO-DOOR TRAFFIC CABINET SHOWN. SOME CABINETS HAVE ONE DOOR ONLY.
3. IF MINI DC I/O BOARD IS LOCATED AT THE END OF CAN NETWORK. PLACE SHUNT JUMPER ACROSS X2 TO TERMINATE NETWORK.
4. "NC" AT END OF THE SHIELD WIRE MEANS NOT CONNECTED.
5. IF THERE ARE MULTIPLE FIELD CONTROLLERS IN A TRAFFIC CABINET, ALWAYS CONNECT THE MINI CAN BOARD TO THE BOTTOM FIELD CONTROLLER.

REV	DATE:		BY:
03	22 NOV 11	CHANGED VOLTAGE ON J2 PIN 1 FROM +5 TO +9 PER EC-2804	KAS
02	11 AUG 11	ADDED PACKET NUMBERS TO DESIGNATE THE HARNESSES IN THE DRAWING AS PER EC-1269	JJD
01	19 JUNE 08	ADDED NOTE 5.	GME

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ:
TITLE: DOOR SWITCHES, TRAF CAB, MINI CAN DC I/O BOARD
DESIGN: PLILLA | DRAWN: MBLOOM | DATE: 15 MAR 07
SCALE: NONE

SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	
	03	P1100	R-03-A	299454

BKR	SIZE	DESCRIPTION	DESCRIPTION	SIZE	BKR
1	30A	SIGN POWER FEED	LIGHTS, EXHAUST FAN & OUTLETS	20A	2
3			CONTROL EQUIPMENT	15A	4
5	--	NOT USED	NOT USED	--	6
7	15A	HEATER FAN (IF USED)	NOT USED	--	8
9	--	NOT USED	SURGE SUPPRESSOR	30A	10
11	--	NOT USED			12

BKR	SIZE	DESCRIPTION	DESCRIPTION	SIZE	BKR
1	30A	SIGN POWER FEED	LIGHTS, EXHAUST FAN & OUTLETS	20A	2
3			CONTROL EQUIPMENT	15A	4
5	--	NOT USED	NOT USED	--	6
7	15A	HEATER FAN (IF USED)	NOT USED	--	8
9	--	NOT USED	SURGE SUPPRESSOR	30A	10
11	--	NOT USED			12

BKR	SIZE	DESCRIPTION	DESCRIPTION	SIZE	BKR
1	30A	SIGN POWER FEED	LIGHTS, EXHAUST FAN & OUTLETS	20A	2
3			CONTROL EQUIPMENT	15A	4
5	--	NOT USED	NOT USED	--	6
7	15A	HEATER FAN (IF USED)	NOT USED	--	8
9	--	NOT USED	SURGE SUPPRESSOR	30A	10
11	--	NOT USED			12

NOTES:
-COPY ONTO LL-2533 WHITE ADHESIVE-BACKED POLYESTER
-DO NOT LAMINATE

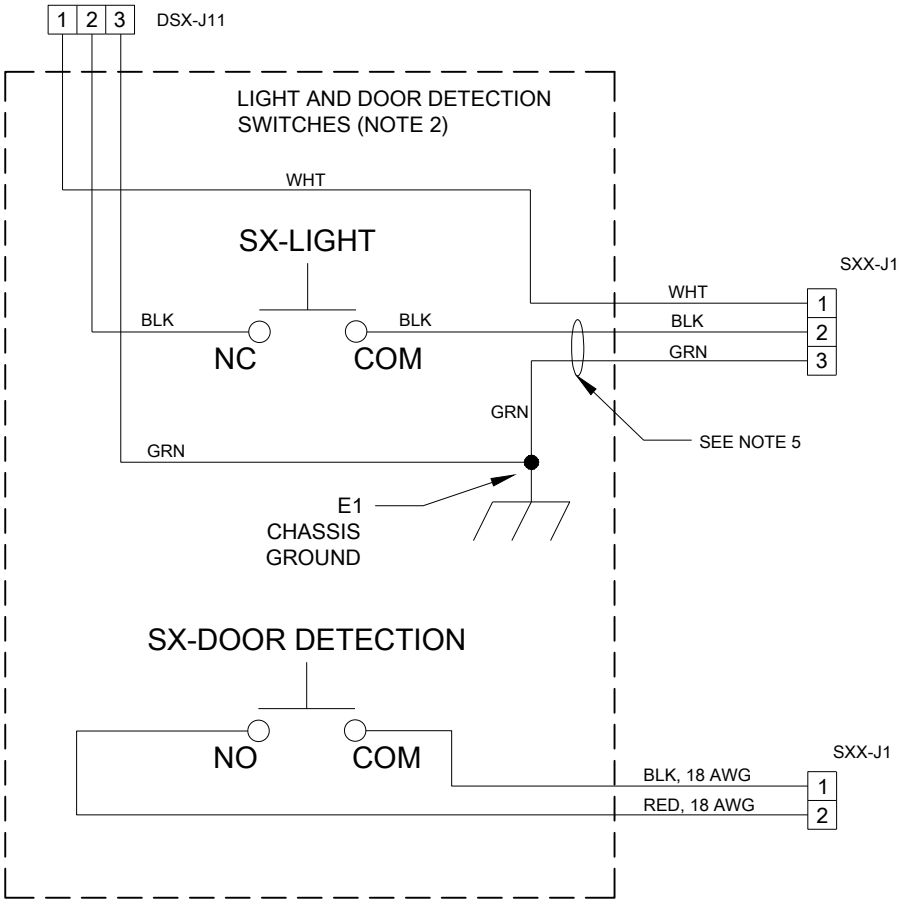
DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ: VANGUARD
TITLE: LABEL, BREAKER ASSIGNMENT, TC, VF-2000
DESIGN: JDILLON
DRAWN: JDILLON
DATE: 28 JAN 11
SCALE: 1=1

SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	
1 OF 1	00	P1249	E-07-A	1043816

NOTES

1. ALL WIRE TYPE; 14 AWG, STRAND, 600 V, 105C, THHN, THWN, OR MTW, NYLON JACKET, U.L. LISTED, UNLESS OTHERWISE NOTED.
2. SWITCHES HARNESS IS DAK PART # 0A-1600-7522.
3. SX ARE DAK PART NUMBER S-1170
4. SX WILL BE REPLACED BY THE LOCATION REFERENCE NUMBER WHEN INSTALLED IN THE SIGN.
5. ZIP TIE THE BLACK AND GREEN WIRE TOGETHER USING HE-1011 INSIDE THE SWITCH HOUSING.



REV	DATE:		BY:
02	14 DEC 12	CHANGED RED WIRE TO NO AND BLK WIRE TO COM ON DOOR DETECTION SWITCH, PER EC-8524	AJS
01	26 JUN 12	AS PER EC-5527 ADDED NOTE 5	JJD

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ:
TITLE: SCHEM, LIGHT AND DOOR OPEN REPORTING SWITCHES
DESIGN: ASTREIE | DRAWN: ASTREIE | DATE: 19 APR 11
SCALE: NONE

SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	
	02	P1626	F - 03 - A	1046353

1	15A	CABINET LIGHTS (IF EQUIPPED)	CONVENIENCE OUTLET(S), LIE OUTLETS	15A	2
3	15A	VENTILATION FANS	CONTROL EQUIP. OUTLET (IF EQUIPPED)	15A	4
5	15A	DEFOG HEATERS (IF EQUIPPED)		--	6
7	15A	BEACONS (IF EQUIPPED)	PANEL BOARD SURGE SUPPRESSOR	20A	8
9	15A				10
11	15A	POWER SUPPLY 1	POWER SUPPLY 2	15A	12
13	20A			--	14
15	15A	POWER SUPPLY 3 (IF EQUIPPED)	POWER SUPPLY 4 (IF EQUIPPED)	15A	16
17	15A	LAPTOP INTERFACE ENCL. (IF EQUIPPED)		--	18
19	20A		UPS (IF EQUIPPED)	25A	20

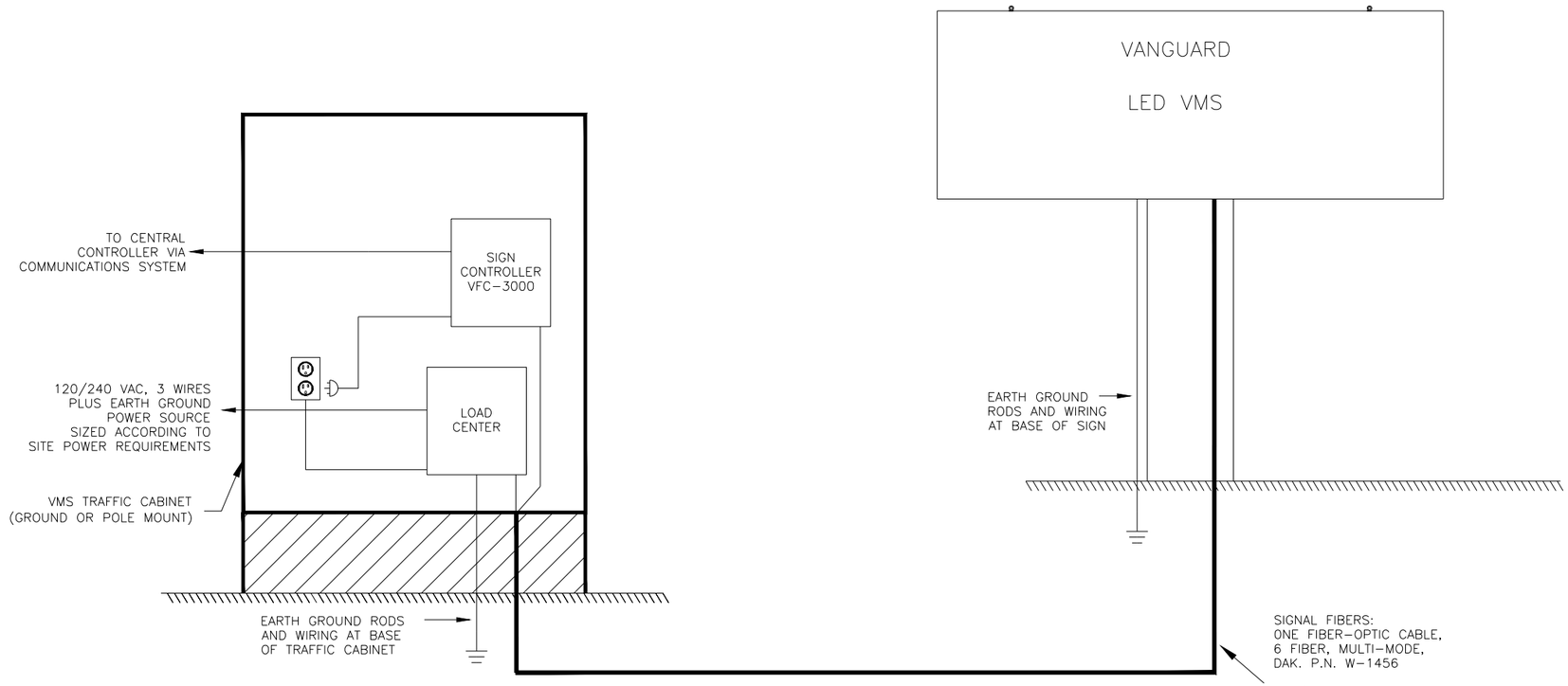
NOTES:

1. USE LL-2839 FOR LABELS.

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ:
TITLE: BREAKER SCHEDULE, STANDARD, VF-24X0, 20 POS PNL
DESIGN: ASTREIE | DRAWN: KSEIDL | DATE: 14 JUN 11
SCALE: NONE

SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	
	00	P1626	E-10-A	1057678



GENERAL NOTES:

THIS IS NOT A SCALED DRAWING AND SHOULD BE USED FOR POWER AND SIGNAL REQUIREMENTS ONLY.

IT IS THE RESPONSIBILITY OF THE ELECTRICAL INSTALLATION CONTRACTOR TO ENSURE THAT ALL ELECTRICAL WORK PERFORMED ON SITE MEETS OR EXCEEDS ALL LOCAL AND NATIONAL ELECTRICAL CODES.

ALL SIGNAL CABLE RUNS SHOULD BE LABELED AS TO ORIGIN AND DESTINATION.

FIBER OPTIC CABLE RUNS MUST BE CONTINUOUS WITH A MINIMUM 7" BEND RADIUS.

ALL VMS MUST BE GROUNDED PER ARTICLE 250 AND 600 OF THE NATIONAL ELECTRICAL CODE WITH NO MORE THAN 10 OHMS GROUND RESISTANCE.

POWER DISTRIBUTION EQUIPMENT TO DAKTRONICS SUPPLIED EQUIPMENT NOT PROVIDED BY DAKTRONICS.

DUE TO THE INRUSH CURRENT (MOMENTARY SURGE) CREATED BY THE DISPLAY EQUIPMENT ON STARTUP, THE OVER CURRENT PROTECTION DEVICE(S) MAY HAVE TO BE OVERSIZED.

DAKTRONICS IS NOT RESPONSIBLE FOR THE QUALITY OF THE POWER DELIVERY SYSTEM TO THE DISPLAY SYSTEM.

BECAUSE EACH INSTALLATION IS UNIQUE, DAKTRONICS OFFERS THESE INSTRUCTIONS AS GUIDELINES ONLY. DAKTRONICS, INC. ASSUMES NO LIABILITY IF INSTALLATION STEPS HAVE BEEN OMITTED OR OTHER NECESSARY PROCEDURES ARE NOT INCLUDED IN THIS SITE RISER DIAGRAM.

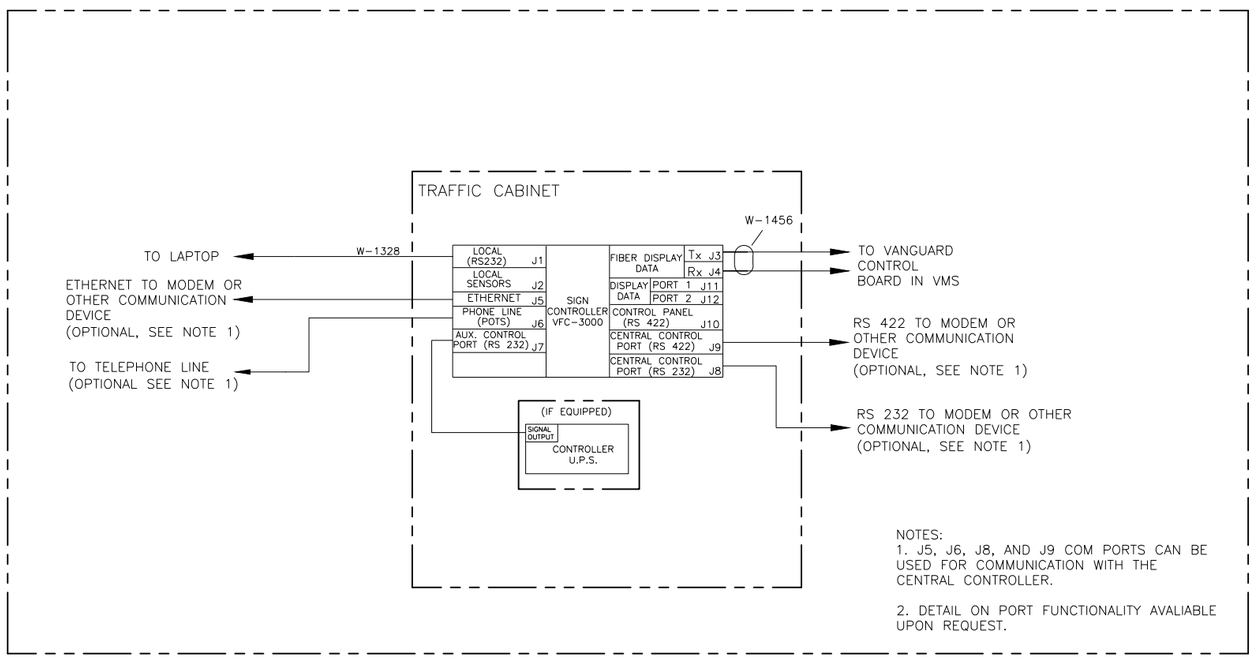
POWER AND SIGNAL REQUIREMENTS ARE SPECIFIED TO THE EQUIPMENT AND SETUP SHOWN. ANY CHANGES MADE TO EQUIPMENT OR THEIR SETUP SHOULD BE APPROVED BY DAKTRONICS DESIGN PERSONNEL AND WILL REQUIRE AN UPDATED SITE RISER DIAGRAM.

THE CONTRACTUAL AGREEMENT WILL DETERMINE THE PARTY OR PARTIES RESPONSIBLE FOR ITEMS LISTED AS FIELD INSTALLED. THIS DRAWING IS NOT INTENDED TO DETERMINE RESPONSIBILITIES AND SHOULD BE USED FOR REFERENCES ONLY.

ACTUAL PLACEMENT OF ELECTRICAL COMPONENTS, SUCH AS PANEL BOARDS, A/C'S, AND SPLICE PANELS, MAY VARY. THIS DRAWING REPRESENTS A GENERAL MOUNTING LOCATION OF THIS EQUIPMENT.

DO NOT REFERENCE THIS DRAWING FOR ACTUAL VMS PLACEMENT DETAILS. PLEASE REFERENCE THE SYSTEM SHOP DRAWING FOR THIS DETAIL.

INTERCONNECT DIAGRAM



NOTES:
1. J5, J6, J8, AND J9 COM PORTS CAN BE USED FOR COMMUNICATION WITH THE CENTRAL CONTROLLER.

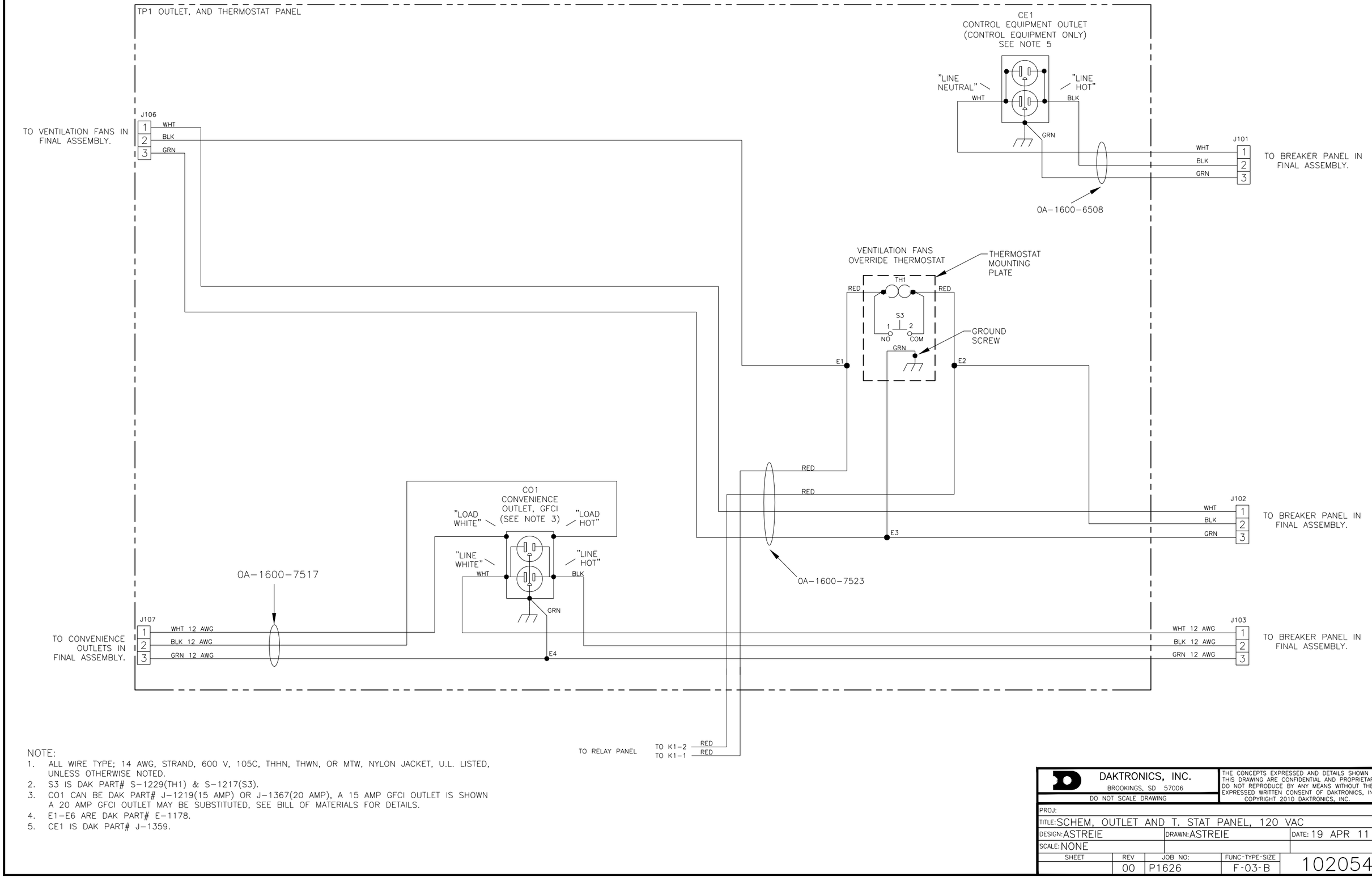
2. DETAIL ON PORT FUNCTIONALITY AVALIABLE UPON REQUEST.

REV	DATE:		BY:
01	03 AUG 10	CHANGED IT FROM SAYING ONE 1-1/2" CONDUIT HUB TO TWO 1-1/2" CONDUIT HUBS.	PLL

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ:
TITLE: SITE RISER, VMS, TC, VFC-TC
DESIGN: ASTREIE | DRAWN: ASTREIE | DATE: 03 FEB 10
SCALE: NONE

SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	
	01	P1341	F-01-B	968786



NOTE:

1. ALL WIRE TYPE; 14 AWG, STRAND, 600 V, 105C, THHN, THWN, OR MTW, NYLON JACKET, U.L. LISTED, UNLESS OTHERWISE NOTED.
2. S3 IS DAK PART# S-1229(TH1) & S-1217(S3).
3. CO1 CAN BE DAK PART# J-1219(15 AMP) OR J-1367(20 AMP), A 15 AMP GFCI OUTLET IS SHOWN A 20 AMP GFCI OUTLET MAY BE SUBSTITUTED, SEE BILL OF MATERIALS FOR DETAILS.
4. E1-E6 ARE DAK PART# E-1178.
5. CE1 IS DAK PART# J-1359.

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ:				
TITLE: SCHEM, OUTLET AND T. STAT PANEL, 120 VAC				
DESIGN: ASTREIE		DRAWN: ASTREIE		DATE: 19 APR 11
SCALE: NONE				
SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	1020541
	00	P1626	F-03-B	

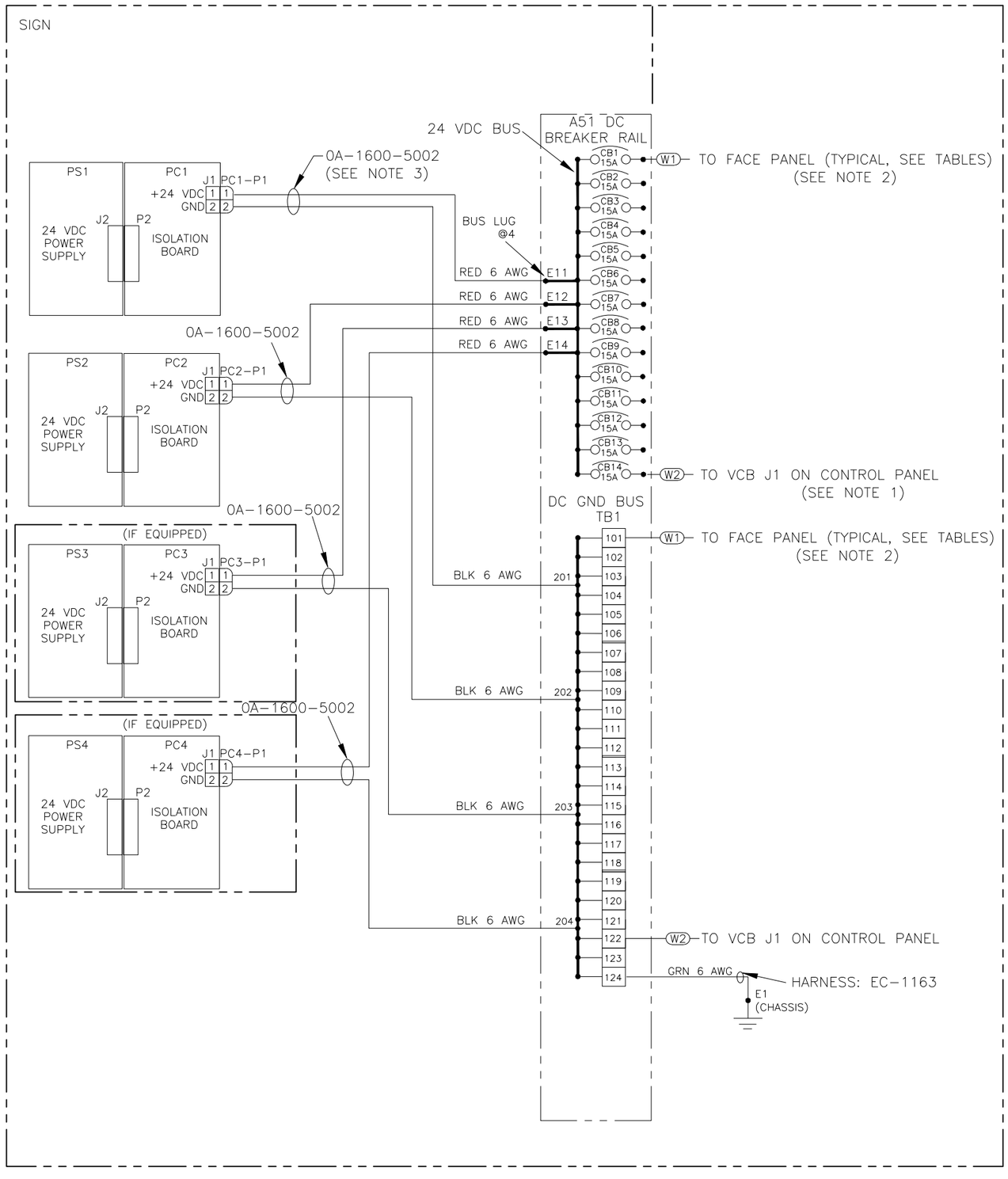


TABLE 1
ONE STRING PER FACE PANEL

FACE PANEL #	MOD STRING#	CB#	DC TB#
PANEL 1	STRING 1	1	101
PANEL 2	STRING 1	2	102
PANEL 3	STRING 1	3	103
PANEL 4	STRING 1	4	107
PANEL 5	STRING 1	5	108
PANEL 6	STRING 1	6	109
PANEL 7	STRING 1	7	113
PANEL 8	STRING 1	8	114
PANEL 9	STRING 1	9	115
PANEL 10	STRING 1	10	119
PANEL 11	STRING 1	11	120
PANEL 12	STRING 1	12	121
PANEL 13	STRING 1	13	116

TABLE 2
2 STRINGS PER FACE PANEL

FACE PANEL #	MOD STRING#	CB#	DC TB#
PANEL 1	STRING 1	1	101
	STRING 2	2	102
PANEL 2	STRING 1	3	103
	STRING 2	4	107
PANEL 3	STRING 1	5	108
	STRING 2	6	109
PANEL 4	STRING 1	7	113
	STRING 2	8	114
PANEL 5	STRING 1	9	115
	STRING 2	10	119
PANEL 6	STRING 1	11	120
	STRING 2	12	121

NOTES:
1. FOR DETAILED VCB POWER WIRING SEE VF-24XO SIGNAL SCHEMATIC.
2. TABLE 1 IS FOR SIGNS HAVING FACE PANELS WITH ONE STRING OF MODULES, SIGN SIZES: 18 HIGH 46MM AND 18-27 HIGH 66MM. TABLE 2 IS FOR SIGNS HAVING FACE PANELS WITH 2 STRINGS OF MODULES, SIGN SIZES: 36-45 HIGH 46MM. SEE VF-24XO DC POWER SCHEMATIC FOR STRINGS PER FACE PANEL.
3. DO NOT CUT 0A-1600-5002 HARNESS TO LENGTH, TIE BACK EXCESS HARNESS, BE SURE TO LEAVE ADEQUATE STRAIN RELIEF AT THE CONNECTION POINTS.

DC HARNESS

W1 0A-1600-5000
HARN, BRKR TO MOD, 312"

W2 0A-1600-5001
HARN, 2-PIN M-MNL TO PIGTAIL, 220"

PROJ:
TITLE: SCHEM, DC PWR SYS, 4 PS, 1 OR 2 MOD STRINGS/DOOR
DESIGN: ASTREIE | DRAWN: ASTREIE | DATE: 04 MAR 11
SCALE: NONE

SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	
	00	P1626	F-03-B	1046599

RS8 RPM SENSOR (INSIDE VF8)
RS7 RPM SENSOR (INSIDE VF7)
RS6 RPM SENSOR (INSIDE VF6)
RS5 RPM SENSOR (INSIDE VF5)
RS4 RPM SENSOR (INSIDE VF4)
RS3 RPM SENSOR (INSIDE VF3)
RS2 RPM SENSOR (INSIDE VF2)
RS1 RPM SENSOR (INSIDE VF1)

SEE NOTE 3

SEE NOTE 4

RS8-J2 1 2 3 4
RS8-P2 1 2 3 4
RS7-J2 1 2 3 4
RS7-P2 1 2 3 4
RS6-P2 1 2 3 4
RS6-P2 1 2 3 4
RS5-J2 1 2 3 4
RS5-P2 1 2 3 4
RS4-J2 1 2 3 4
RS4-P2 1 2 3 4
RS3-J2 1 2 3 4
RS3-P2 1 2 3 4
RS2-J2 1 2 3 4
RS2-P2 1 2 3 4
RS1-J2 1 2 3 4
RS1-P2 1 2 3 4

RED BLK WHT

2 PR, 22 AWG W-1234 TYPICAL

WHT BLK RED NC

HARNESS: 0A-1600-0508, (TYPICAL)

PC1 VANGUARD CONTROL BOARD

TB8	1	1	SENSOR 1
	2	2	GND
	3	3	SENSOR 2
	4	4	GND
	5	5	SENSOR 3
	6	6	GND
	7	7	SENSOR 4
	8	8	GND
TB7	1	1	SENSOR 5
	2	2	GND
	3	3	SENSOR 6
	4	4	GND
	5	5	SENSOR 7
	6	6	GND
	7	7	SENSOR 8
	8	8	GND

TO TB4 PIN 1 ON VANGUARD CONTROL BOARD

HARNESS: 0A-1600-5004

RED

E1 E2 E3

E-1178 WIRE CONNECTOR (SEE NOTE 5)

RPM SENSOR DETAIL (TYPICAL)

RSX RPM SENSOR (INSIDE VFX)

BLK RED WHT

RSX-J2 1 2 3 4

NOTES:
1. THE RPM SENSOR IS PART OF THE FAN. THE FAN PART NUMBER IS: B-1075
2. WHILE THE FAN IS TURNING THE RPM SENSOR WILL OUTPUT PULSES.
3. THE NUMBER OF FANS AND RPM SENSORS WILL DEPEND ON THE SIZE OF THE SIGN.
4. A PERMANENT MARKER MAY BE USED FOR LABELING PLUGS AND JACKS.
5. E2 AND E3 ONLY USED WHEN NECESSARY, DISCARD WHEN NOT NEEDED.

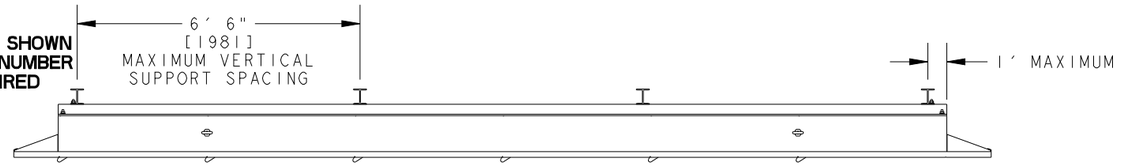
REV	DATE:		BY:
01	23 JUN 11	ADDED 8TH RPM SENSOR	AJS

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

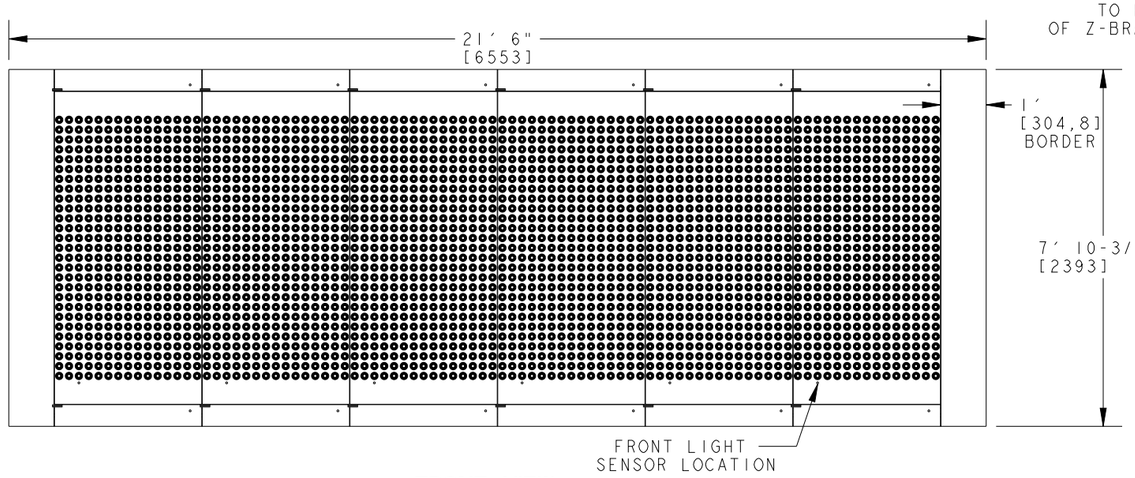
PROJ:			
TITLE: SCHEM, RPM SENSORS, SIGNAL AND DC PWR			
DESIGN: ASTREIE	DRAWN: ASTREIE	DATE: 19 APR 11	
SCALE: NONE			
SHEET	REV	JOB NO:	FUNC-TYPE-SIZE
	01	P1626	F-03-B

1050829

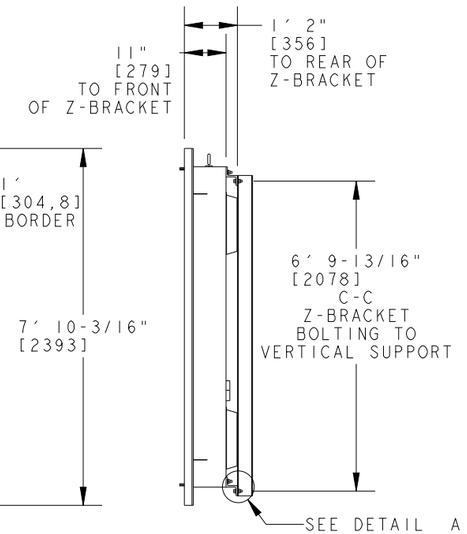
NOTE
NUMBER OF SUPPORTS SHOWN MAY NOT BE ACTUAL NUMBER OF SUPPORTS REQUIRED



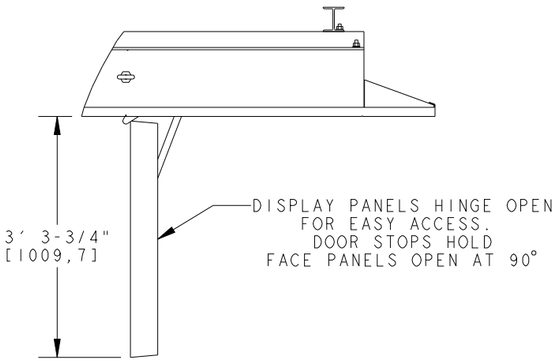
TOP VIEW



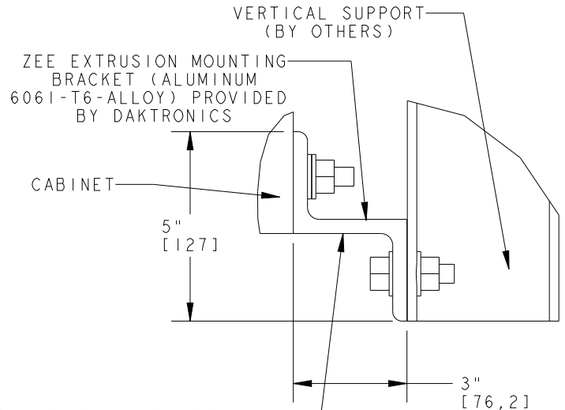
FRONT VIEW



RIGHT SIDE VIEW



TOP PARTIAL VIEW
FACEPANEL OPEN
SCALE 1/25

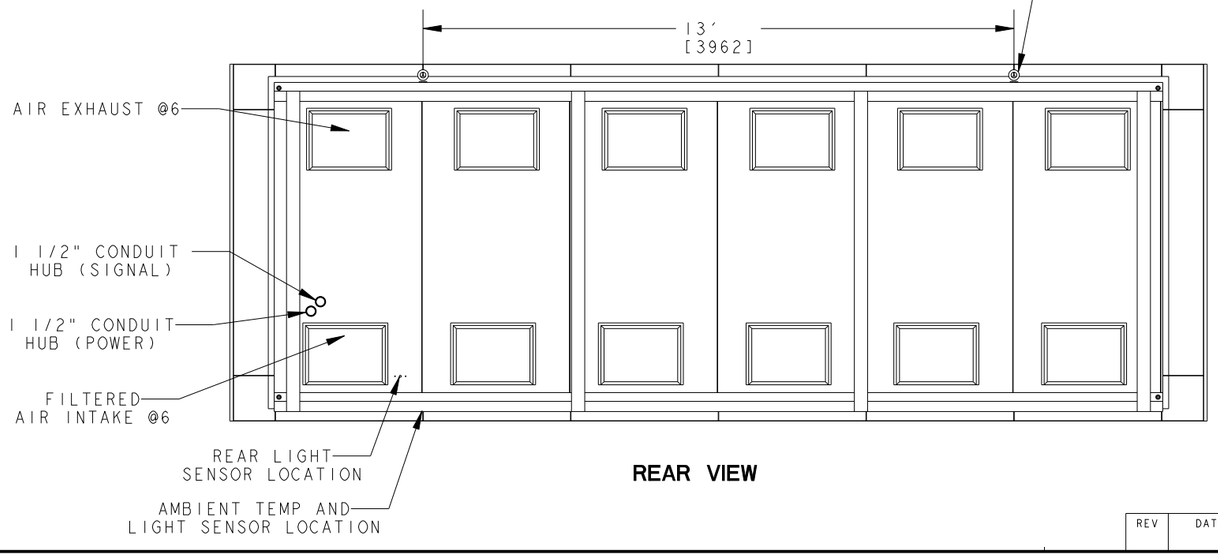


DETAIL A
SCALE 1/4

Z-BRACKETS ARE BOLTED TO THE REAR OF THE DISPLAY BY DAKTRONICS. THE VERTICAL SUPPORTS SHOWN ARE PROVIDED BY OTHERS. EACH Z-BRACKET IS ATTACHED TO THE CABINET USING Ø1/2" A325 MECHANICALLY GALVANIZED STRUCTURAL GRADE HARDWARE. FINAL REVIEW OF MOUNTING DETAIL IS THE RESPONSIBILITY OF THE CUSTOMER AND THE CUSTOMER'S ENGINEERS. THE VERTICAL SUPPORTS MUST BE ATTACHED AS SHOWN WITHIN THE STATED TOLERANCE.

WHEN LIFTING DISPLAY WITH LIFT EYES USE SPREADER BEAM.

IF LIFT EYES ARE REMOVED AFTER INSTALLATION THEY SHOULD BE REPLACED WITH SS BOLTS TO PREVENT DEBRIS BUILDUP IN THE THREADS OF THE PERMANENT HARDWARE. THIS DOES NOT EFFECT WATER TIGHTNESS.



REAR VIEW

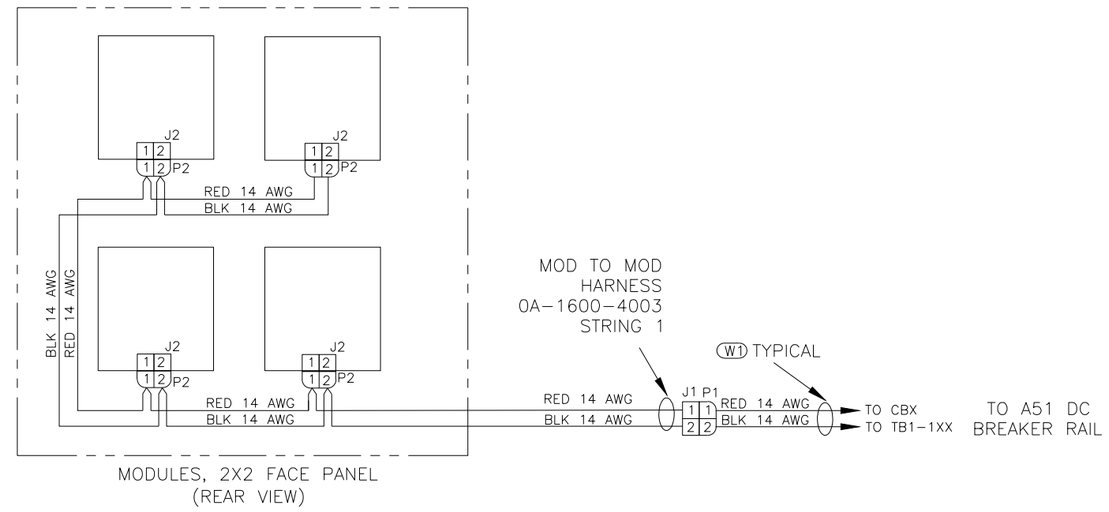
NOTES:
1.) MATRIX SIZE 27 X 90, 18" NOMINAL CHARACTER
2.) SEE ILLUSTRATIONS FOR POWER AND SIGNAL CONDUIT ENTRANCES.
3.) ALL DIMENSIONS ARE IN INCHES [mm].
4.) FULL PROTECTIVE MASKED FACE PANEL.
5.) MAINTENANCE OF DISPLAY IS INTERNAL VIA FRONT ACCESS FACE PANEL.
6.) ALL ALUMINUM CONSTRUCTION
7.) POSITIVE PRESSURE VENTILATION SYSTEM
8.) WEIGHT OF THE DISPLAY IS APPROXIMATELY 1660 LBS (753 KG).
9.) VERTICAL SUPPORTS DESIGNED AND SUPPLIED BY OTHERS.
10.) MOUNTING CALCULATIONS DONE TO "AASHTO STANDARD SPEC. FOR STRUCTURAL SUPPORTS FOR HIGHWAY SIGNS, LUMINARIES AND TRAFFIC SIGNALS. AASHTO 5TH EDITION 2009;"
11.) IF VERTICAL SUPPORTS NEED TO BE MOVED OUTSIDE OF STATED MAXIMUM SPACING OR IF SPECIFICATIONS EXCEED NOTE #10 THEN CONTACT DAKTRONICS ENGINEERING.

REV	DATE:		BY:

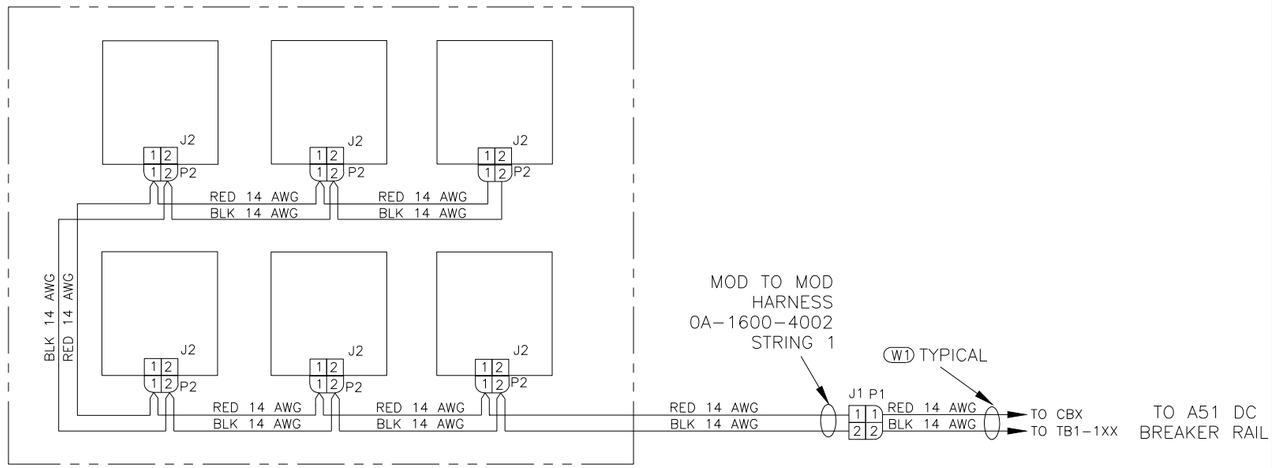
DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ: VANGUARD			
TITLE: SHOP DRAWING, VF-24**-27X90-66-*			
DESIGN: JHALIBU	DRAWN: TLAYH	DATE: 02-MAY-11	
SCALE: 1/40			

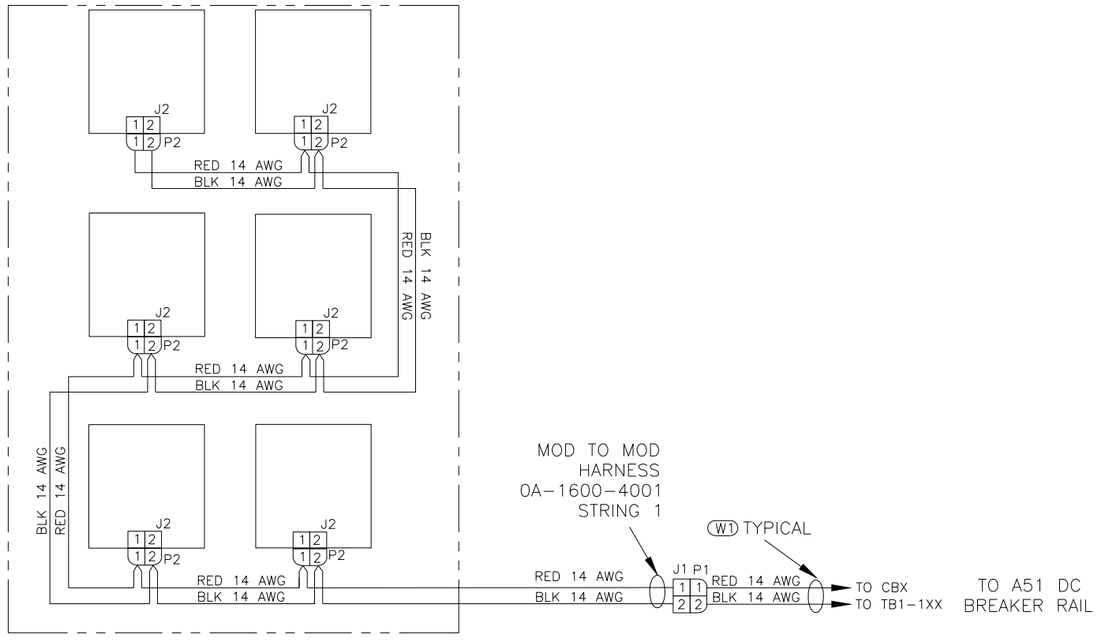
SHEET:	REV	JOB NO:	FUNC-TYPE-SIZE	
1 OF 1	00	P 1626	F-10-B	1051913



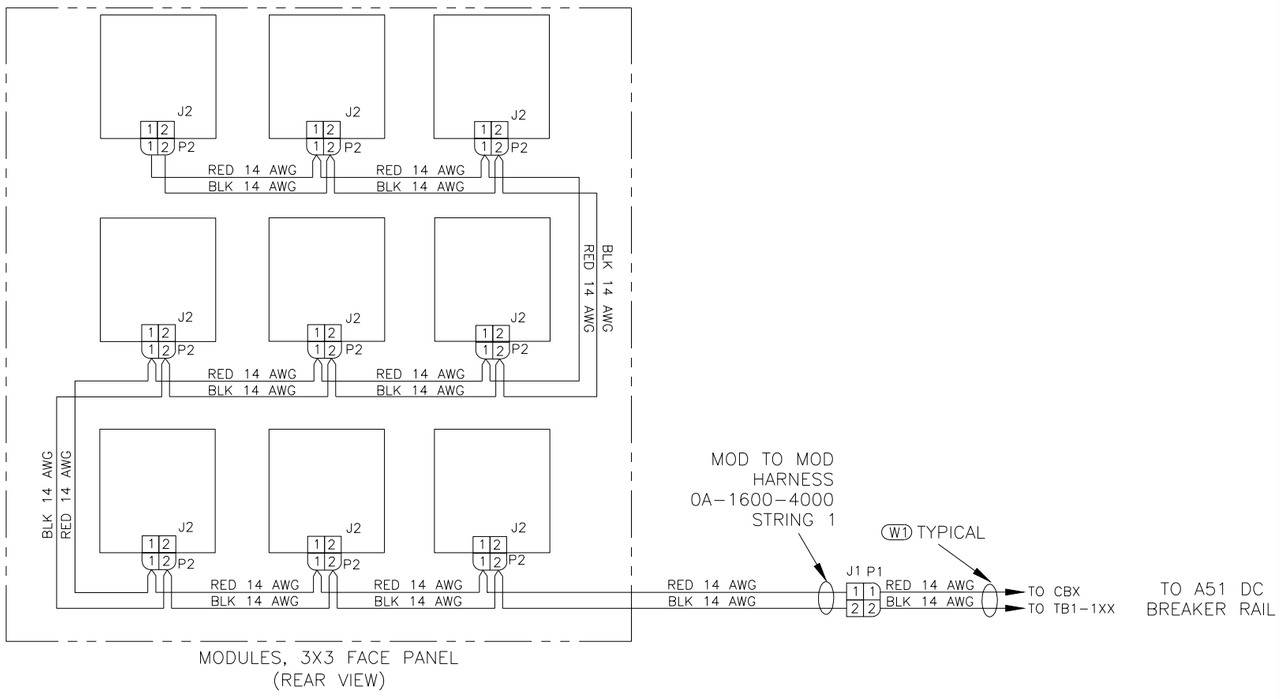
MODULES, 2X2 FACE PANEL
(REAR VIEW)



MODULES, 2X3 FACE PANEL
(REAR VIEW)



MODULES, 3X2 FACE PANEL
(REAR VIEW)



MODULES, 3X3 FACE PANEL
(REAR VIEW)

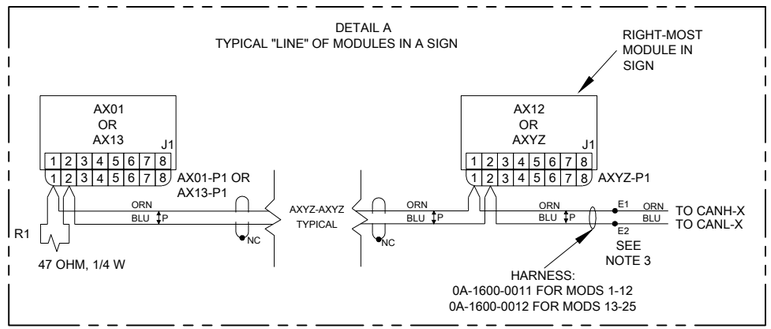
DC HARNESS

W1 0A-1600-5000
HARN, BRKR TO MOD, 312"

NOTES:
1. FOR DETAILED POWER SUPPLY AND A51 DC RAIL WIRING SEE DC POWER SYSTEM SCHEMATIC.

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ:				
TITLE: SCHEM, DC POWER, VF-24X0, 66MM, 18 AND 27 HIGH				
DESIGN: ASTREIE		DRAWN: ASTREIE		DATE: 25 MAY 11
SCALE: NONE				
SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	1054885
	00	P1626	F-03-B	



NTCIP VERSION
1

PERIPHERAL NAME	QTY	M/A	TB"X"	PIN	PERIPHERAL NAME	QTY	M/A	TB"X"	PIN
REAR LIGHT SENSOR	1	A	--	--	RPM SENSOR(S)	6	A	--	--
AMBIENT TEMP SENSOR	1	A	--	--	AIR FLOW SENSOR(S)	--	A	--	--
AMBIENT LIGHT SENSOR	1	A	--	--	# OF BEACON RELAYS USED (SEE NOTE 6)	--	A	--	--
FRONT LIGHT SENSOR	1	A	--	--	MINI CAN BOARD 1 ADDRESS 5	--	?	--	--
INTERNAL TEMP SENSOR	1	A	--	--	MINI CAN BOARD 2 ADDRESS 1	--	?	--	--
HUMIDITY SENSOR	1	A	--	--	MINI CAN BOARD 3 ADDRESS 6	--	?	--	--
POWER SUPPLIES	3	A	--	--	MINI CAN BOARD 4 ADDRESS 2	--	?	--	--
VENTILATION FAN RELAY	1	A	--	--	MINI CAN BOARD 5 ADDRESS 7	--	?	--	--
DEFOG HEATER RELAY	1	A	--	--	MINI CAN BOARD 6 ADDRESS 3	--	?	--	--
DOOR DETECTION	6	A	--	--					
SURGE SUPRESSOR(S)	1	A	--	--					

NOTES:
1. FIBER OPTIC CABLE TERMINATIONS ARE "ST" CONNECTORS WHERE USED.
2. R11 TERMINATING RESISTOR IS LOCATED ON THE LAST DEVICE ON THE END OF THE WIRING DAISY CHAIN. THERE CAN BE NO MORE THAN 1 NETWORK TERMINATING RESISTOR.
3. E1-E3 ARE DAK PART# E-1178. F101 IS DAK PART# F-1071.
4. FOR DETAILED VENTILATION FAN RPM SENSOR WIRING SEE DWG-1050829.
5. FOR DETAILED AIR FLOW SENSOR WIRING SEE DWG-1050828.
6. ONE RELAY FOR SIMULTANEOUS FLASH TWO RELAYS FOR ALTERNATING FLASH.
7. USE PT-1014 TUBING TO INSULATE RESISTOR LEADS.

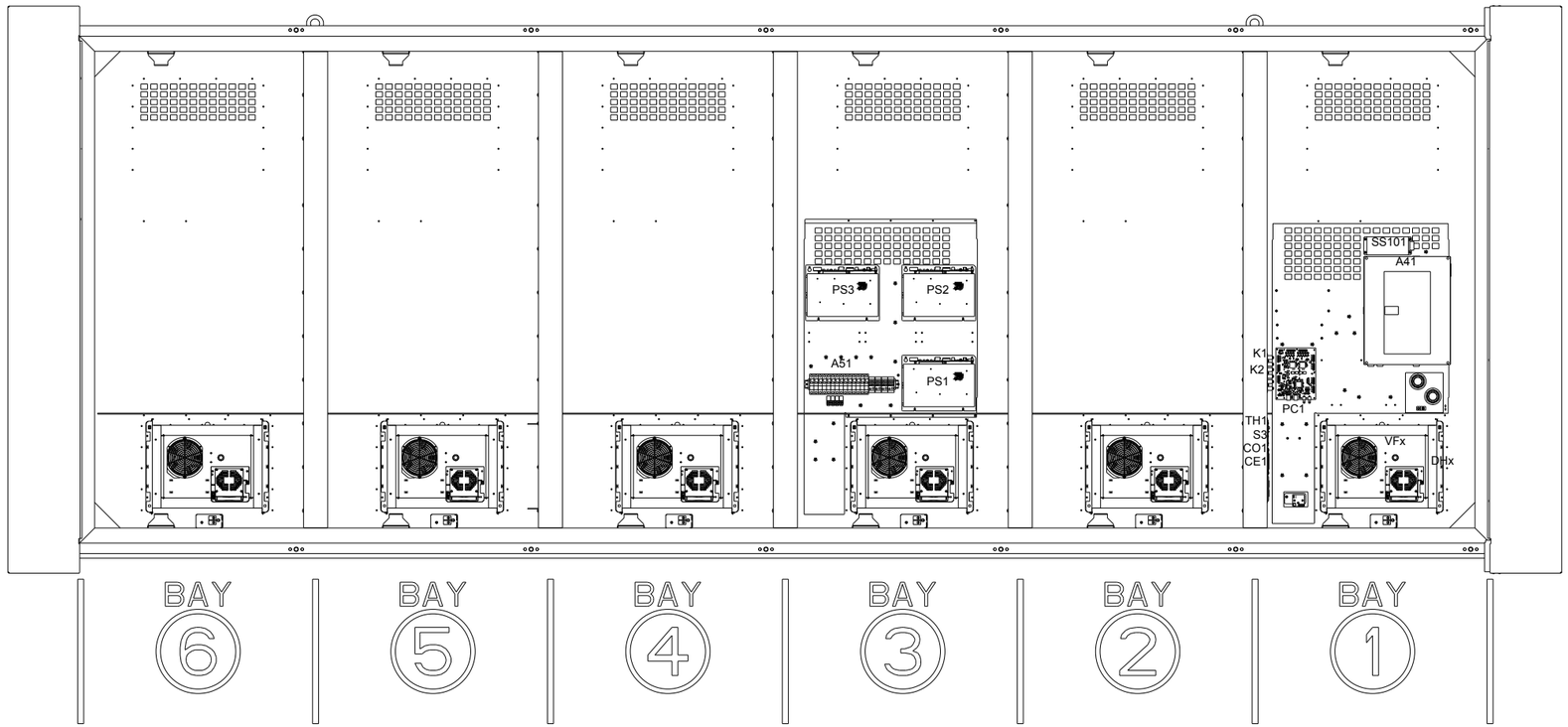
DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ:			
TITLE: SIGN SIGNAL SCHEMATIC, VF-2420-27X90-66-A			
DESIGN: JDILLON	DRAWN: JDILLON	DATE: 02 JAN 13	
SCALE: NONE			

SHEET	REV	JOB NO:	FUNC - TYPE - SIZE	
	00	C 19554	F - 03 - B	1122972

REFERENCE NO.	PART NUMBER	QTY	PER DWG-0	NOTES
S3 CO1 CE1	0A-1626-0320	1	1050751	SEE BAY 1 FOR LOCATIONS
PC1	0P-1248-0022	1	1056281	SEE BAY 1 FOR LOCATION
SS10x	0A-1589-0101	1	1050741	SEE BAY 1 FOR LOCATIONS. REFER TO SS LOCATION FOR "x"
PSx	0A-1589-0501	3	1050741	SEE BAY 3 FOR LOCATIONS. REFER TO PS LOCATION FOR "x" USE 0M-xxxxxxx FOR PS4. SEE BAY X.
A51	A-2887	1	1050741	SEE BAY 3 FOR LOCATIONS
VFx	0A-1589-0200	6	1050926	ALL BAYS. REFER TO BAY NUMBER FOR POSITION "x"
DHx	0A-1589-0203	6	0944799	ALL BAYS. REFER TO BAY NUMBER FOR POSITION "x"
Kx	0A-1626-0205	1	1050962	SEE BAY 1 FOR PLACEMENT

APPLY PR-175003-02 2" REFLECTIVE TAPE PER DWG-01122873



FRONT VIEW

FACEPANEL INSTALLATION PER: DWG-01050917
END SHROUD INSTALLATION PER: DWG-01050947
GAP FILLER INSTALLATION PER: DWG-01051011
GENERAL INSTALLATION: DWG-01050926

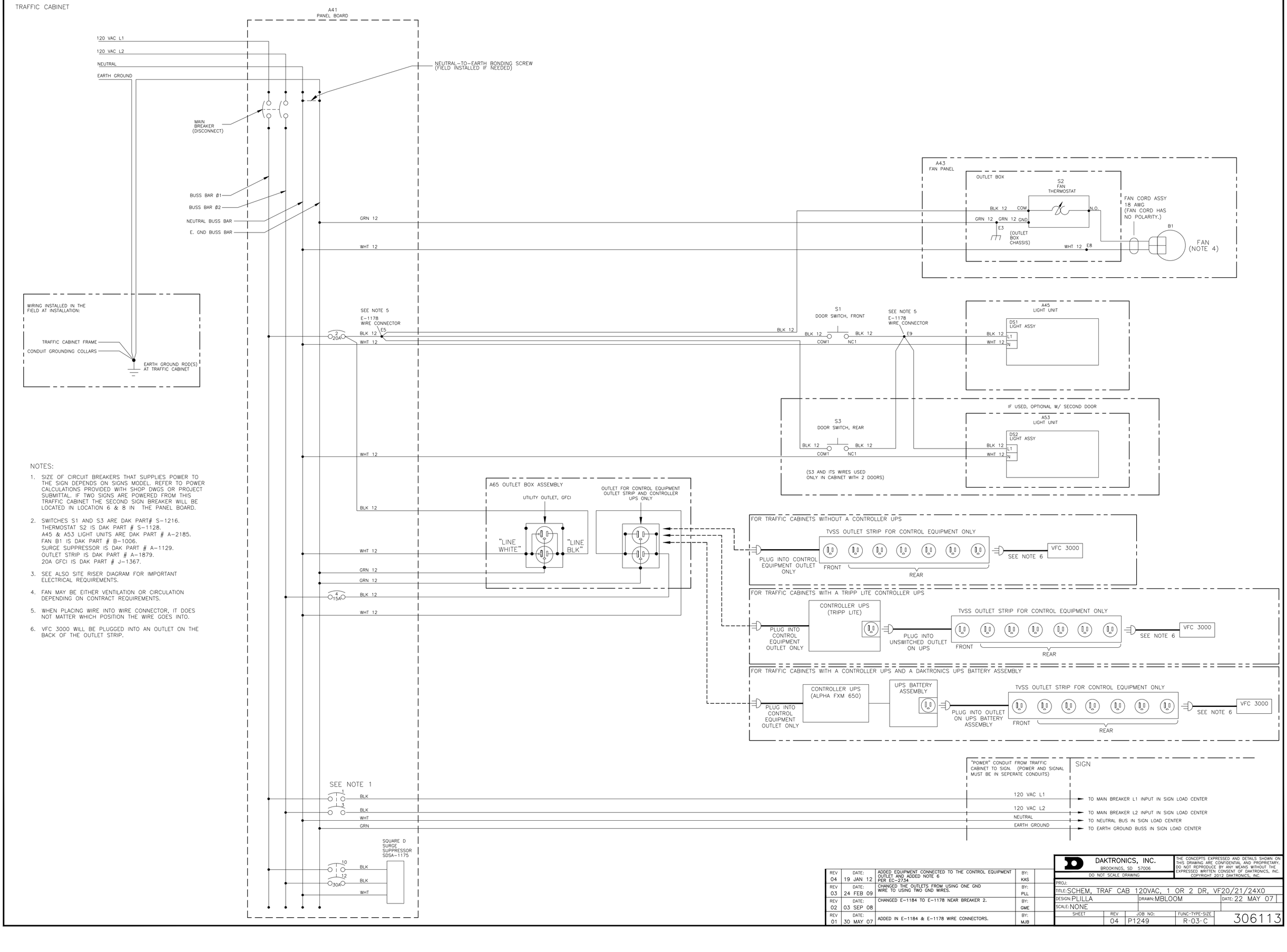
BAY	FACEPANEL PN	QTY	HARNESS PN	QTY
1-6	0A-1626-1322	6	0A-1600-4000	6

REV	DATE:		BY:

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ: VANGUARD					
TITLE: REAR ELEC, VF-24**-27X90-66-A					
DESIGN: DREITZ		DRAWN: DREITZ		DATE: 03-JAN-13	
SCALE: 1/25					
SHEET:	REV	JOB NO:	FUNC-TYPE-SIZE	1123039	
1 OF 1	00	C 19554	E _ 10 _ B		

TRAFFIC CABINET



NOTES:

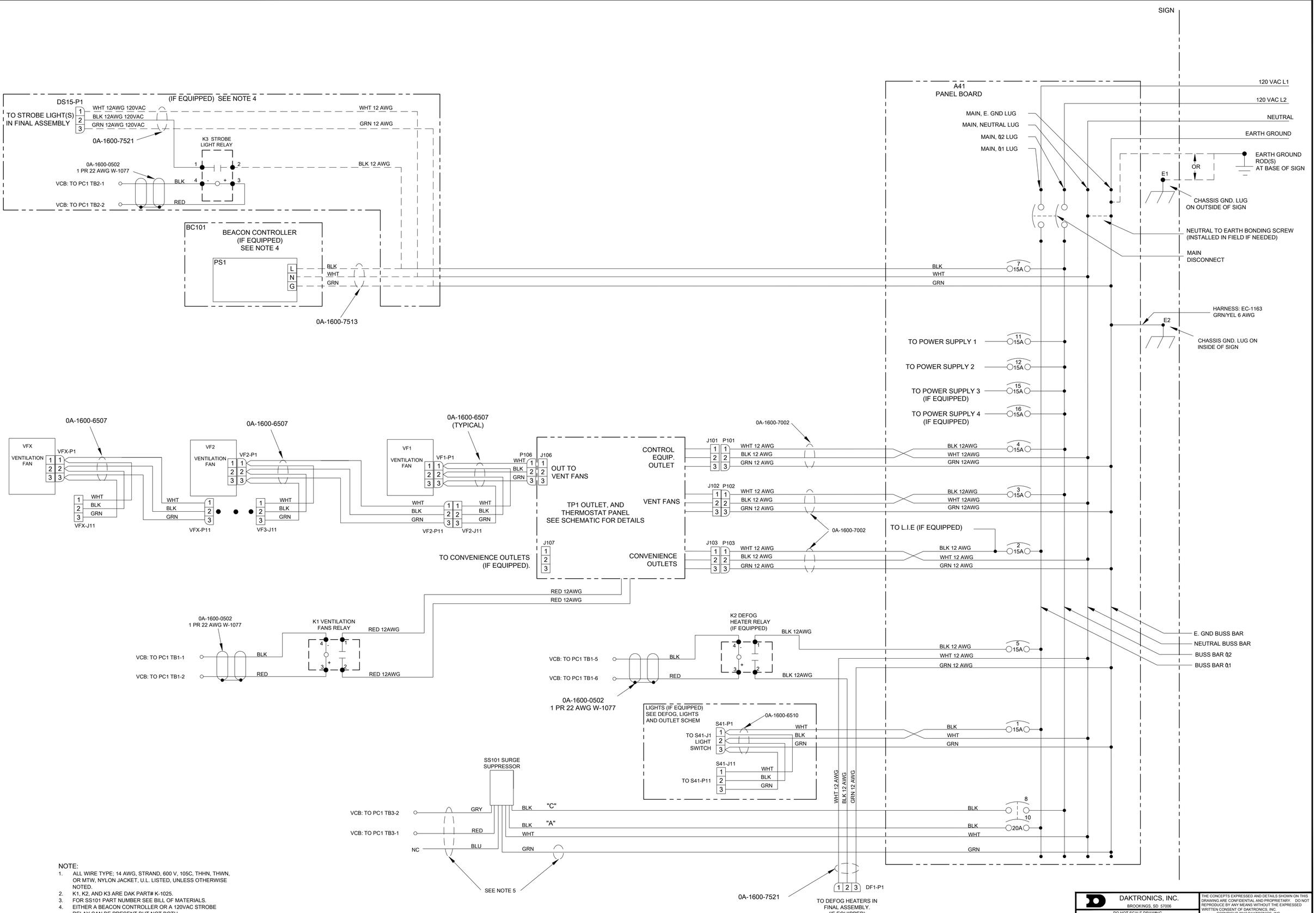
1. SIZE OF CIRCUIT BREAKERS THAT SUPPLIES POWER TO THE SIGN DEPENDS ON SIGNS MODEL. REFER TO POWER CALCULATIONS PROVIDED WITH SHOP DWGS OR PROJECT SUBMITTAL. IF TWO SIGNS ARE POWERED FROM THIS TRAFFIC CABINET THE SECOND SIGN BREAKER WILL BE LOCATED IN LOCATION 6 & 8 IN THE PANEL BOARD.
2. SWITCHES S1 AND S3 ARE DAK PART# S-1216.
   THERMOSTAT S2 IS DAK PART # S-1128.
   A45 & A53 LIGHT UNITS ARE DAK PART # A-2185.
   FAN B1 IS DAK PART # B-1006.
   SURGE SUPPRESSOR IS DAK PART # A-1129.
   OUTLET STRIP IS DAK PART # A-1879.
   20A GFCI IS DAK PART # J-1367.
3. SEE ALSO SITE RISER DIAGRAM FOR IMPORTANT ELECTRICAL REQUIREMENTS.
4. FAN MAY BE EITHER VENTILATION OR CIRCULATION DEPENDING ON CONTRACT REQUIREMENTS.
5. WHEN PLACING WIRE INTO WIRE CONNECTOR, IT DOES NOT MATTER WHICH POSITION THE WIRE GOES INTO.
6. VFC 3000 WILL BE PLUGGED INTO AN OUTLET ON THE BACK OF THE OUTLET STRIP.

REV	DATE:		BY:
04	19 JAN 12	ADDED EQUIPMENT CONNECTED TO THE CONTROL EQUIPMENT OUTLET AND ADDED NOTE 6 PER EC-2734	KAS
03	24 FEB 09	CHANGED THE OUTLETS FROM USING ONE GND WIRE TO USING TWO GND WIRES.	PLL
02	03 SEP 08	CHANGED E-1184 TO E-1178 NEAR BREAKER 2.	GME
01	30 MAY 07	ADDED IN E-1184 & E-1178 WIRE CONNECTORS.	MJB

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

PROJ:
TITLE: SCHEM, TRAF CAB 120VAC, 1 OR 2 DR, VF20/21/24X0
DESIGN: PLILLA | DRAWN: MBLOOM | DATE: 22 MAY 07
SCALE: NONE

SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	
	04	P1249	R-03-C	306113



NOTE:

1. ALL WIRE TYPE; 14 AWG, STRAND, 600 V, 105C, THHN, THWN, OR MTW, NYLON JACKET, U.L. LISTED, UNLESS OTHERWISE NOTED.
2. K1, K2, AND K3 ARE DAK PART# K-1025.
3. FOR SS101 PART NUMBER SEE BILL OF MATERIALS.
4. EITHER A BEACON CONTROLLER OR A 120VAC STROBE RELAY CAN BE PRESENT BUT NOT BOTH.
5. WHEN SQUARE D SURGE SUPPRESSOR, DAK PART# A-1129 IS USED THESE WIRES ARE NOT PRESENT. ALSO WIRE LABELS A AND C WILL NOT BE PRESENT.

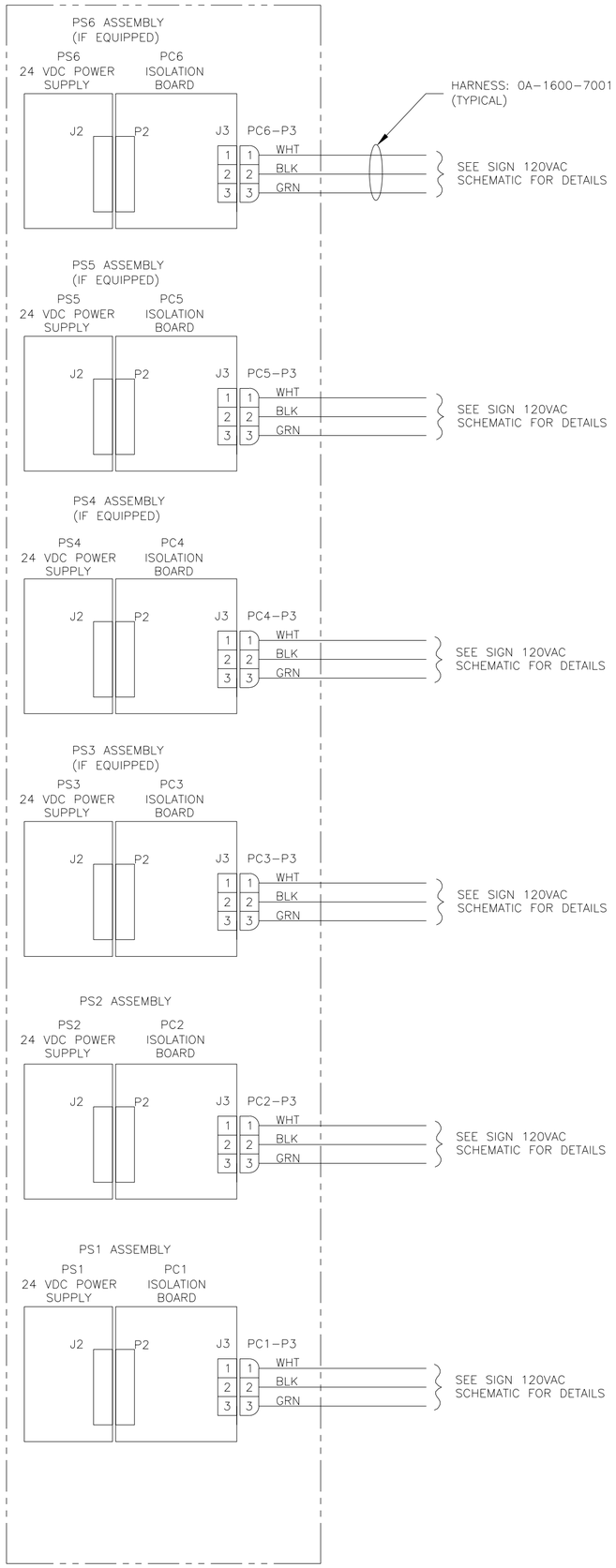
REV	DATE:		BY:
02	02 APR 12	UPDATED HARNESS FOR LIGHTS, 0A-1600-6507 REPLACED WITH 0A-1600-6510. PER EC-3953	AJS
01	19 JUL 11	REVISED TEXT	KAS

DAKTRONICS, INC.
BROOKINGS, SD 57006
DO NOT SCALE DRAWING

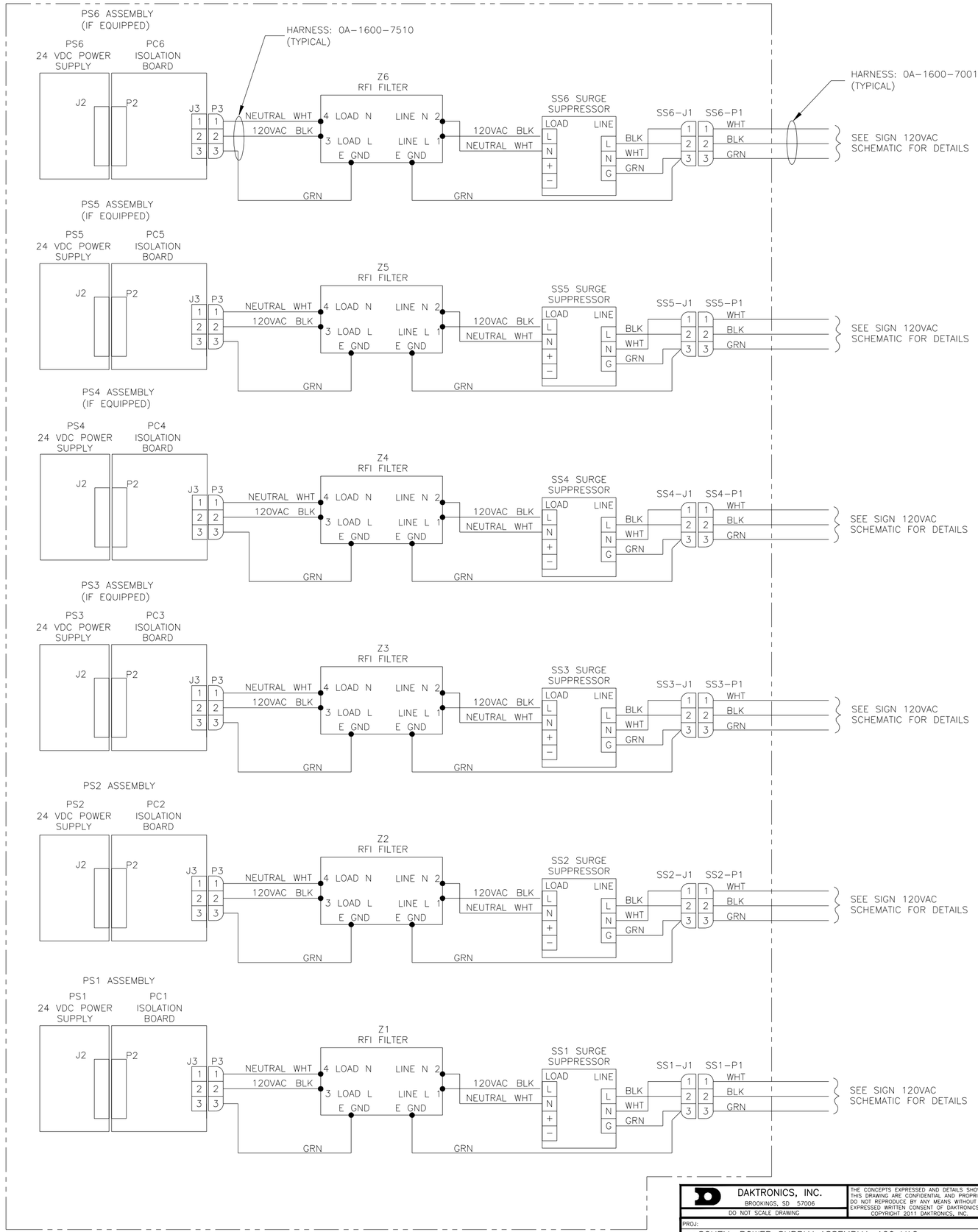
PROJ:			
TITLE: SCHEM, VF-24X0, 120 VAC			
DESIGN: ASTREIE	DRAWN: ASTREIE	DATE: 07 JUN 11	
SCALE: NONE			

SHEET	REV	JOB NO:	FUNC · TYPE · SIZE	
	02	P1626	F · 03 · C	1056399

WITHOUT FILTERS AND SURGE SUPPRESSORS



WITH FILTERS AND SURGE SUPPRESSORS



PROJ:

TITLE: SCHEM, POWER SUPPLY ASSEMBLY, 120 VAC

DESIGN: ASTREIE	DRAWN: ASTREIE	DATE: 11 JUL 11
SCALE: NONE		

SHEET	REV	JOB NO:	FUNC-TYPE-SIZE	
	00	P1626	F-03-C	1061148

Appendix B: VFC-3000 Controller Operation Manual (ED-14480)

Appendix C: Daktronics Warranty and Limitation of Liability (SL-02374)

GEOTECHNICAL EVALUATION

FOR

PROPOSED FOUNDATION REHABILITATION OF SIX CHANGEABLE MESSAGE SIGNS
PORTIONS OF SR-91 AND SR-55 FREEWAYS
ORANGE AND RIVERSIDE COUNTIES, CALIFORNIA

PREPARED FOR

TRC SOLUTIONS, INC.
9685 RESEARCH DRIVE
IRVINE, CALIFORNIA 92618

PREPARED BY

GEOTEK, INC.
710 EAST PARKRIDGE AVENUE, SUITE 105
CORONA, CALIFORNIA 92879

PROJECT NO. 1397-CR **FEBRUARY 19, 2016**

GEOTEK

GeoTek, Inc.
710 E. Parkridge Avenue, Suite 105, Corona, California 92879-1097
(951) 710-1160 Office (951) 710-1167 Fax www.geotekusa.com

February 19, 2016
Project No. 1397-CR

TRC Solutions, Inc.
9685 Research Drive
Irvine, California 92618

Attention: Mr. Norman Suydam

Subject: Geotechnical Evaluation
Proposed Foundation Rehabilitation of Six Changeable Message Signs
Portions of SR-91 and SR-55 Freeways
Orange and Riverside Counties, California

Dear Mr. Suydam:

We are pleased to provide the results of our geotechnical evaluation for the project located along portions of the SR-91 and SR-55 freeways in Orange and Riverside Counties. This report presents the results of our evaluation, discussion of our findings, and provides geotechnical recommendations for foundation design and construction. In our opinion, site improvements appears feasible from a geotechnical viewpoint provided that the recommendations included in this report are incorporated into the design and construction phases of the project.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to contact our office.

Respectfully submitted,
GeoTek, Inc.

REGISTERED GEOLOGIST
EDWARD H. LaMONT
No. 1892
Exp. _____
Certified Engineering Geologist
STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER
GLENN S. FRASER
No. GE 002381
Exp. 9/30/17
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Edward H. LaMont
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Principal Geologist

Glenn S. Fraser
GE 2381, Exp. 09/30/17
Senior Project Engineer

Distribution: (1) Addressee via email (one PDF file)
G:\Projects\1351 to 1400\1397CR TRC Companies, Inc. Message Signs\SR91-55 CMS Report.doc

TABLE OF CONTENTS

ENCLOSURES

1. PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to evaluate the geotechnical conditions in the immediate vicinity of the proposed footings that will support six existing changeable message signs (CMS) along California State Route (SR) 91 and California State Route 55. Services provided for this study included the following:

- Research and review of available geologic data and general information pertinent to the site;
- Site exploration consisting of the excavation, logging, and sampling of six exploratory borings;
- Laboratory testing of soil samples collected during the field investigation;
- Review and evaluation of site seismicity; and
- Compilation of this geotechnical report which presents our findings, conclusions, and recommendations for the proposed footings.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 SITE DESCRIPTION

The sites are located along the center divider of California SR-91 and SR-55 freeways in the eastern portion of Orange County and western perimeter of Riverside County. The existing CMS signs that will be rehabilitated are located at the coordinates presented below:

CMS #	Latitude	Longitude
CMS #1	33° 50' 57.92" N	117° 50' 58.25" W
CMS #2	33° 51' 0.01" N	117° 50' 8.99" W
CMS #3	33° 49' 36.44" N	117° 49' 56.85" W
CMS #4	33° 50' 14.04" N	117° 50' 6.11" W

CMS #5	33° 52' 8.14" N	117° 40' 30.25" W
CMS #6	33° 52' 50.70" N	117° 39' 7.34" W

The ground surface at the locations of the signs is covered by asphalt concrete pavement with a thickness ranging from seven inches to 15 inches, or Portland cement concrete with a thickness of 14 inches. It is our understanding the existing signs are supported by drilled piles. The ground surface at each CMS is relatively level with surface elevations ranging from 231 to 494 feet above mean sea level (MSL) based on Google earth images.

2.2 PROPOSED DEVELOPMENT

The project consists of the replacement of existing foundations supporting six changeable message signs. Based on information provided by TRC Companies, Inc., the proposed foundations will consist of drilled piles with a diameter of five feet. The structural loads on the signs provided to this office by TRC Solutions, Inc. are itemized below:

	Axial (kips)	Maximum Moment (kips-ft)	Shear (kips)	Torsion (kips-ft)
Maximum Allowable Loads	19	193.8	9.8	185.8

Remedial earthwork will not be conducted on the sites. If the structural loads are different from the information presented in this report, our recommendations should be subject to further review and evaluation.

3. FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION

The field exploration for this investigation was conducted on December 20, 2015, January 19 and 20, 2016 and February 1, 2016 and consisted of excavating six exploratory soil borings with a truck mounted drill rig to depths ranging from 32 feet to 53 feet below the existing ground surface. The borings were drilled near the existing changeable message signs as shown on Figures 2 through 7. An engineer or geologist from our firm logged the excavations and obtained soil samples for subsequent laboratory testing. A hollow-stem auger with an outside diameter of 8.5 inches was utilized. The inside diameter of the auger was 4.5 inches. The soils

encountered were examined and visually classified by one of our field personnel. Relatively undisturbed soil samples were recovered at various intervals in the borings with a California sampler. The California sampler is a 2.9-inch outside diameter, 2.5-inch inside diameter, split barrel sampler lined with brass rings. The sampler was 18 inches long. The sampler conformed to the requirements of ASTM D 3550. A 140-pound automatic trip hammer was utilized, dropping 30 inches for each blow. The relatively undisturbed samples, together with bulk samples of representative soil types, were returned to the laboratory for testing and evaluation. Standard penetration tests were performed at selected intervals as the borings were advanced. The standard penetration test data are presented on the boring logs. Standard penetration testing was performed with a 2.0-inch outside diameter, 1.5-inch inside diameter, split-barrel sampler. The sampler was 18 inches long. The inside diameter of the sampler shoe was 1.4 inches. The sampler was unlined. The sampler conformed to the requirements of ASTM D 1586. A 140-pound automatic trip hammer was utilized, dropping 30 inches for each blow. An efficiency value of 1.0 was used for the automatic trip hammer. The logs of the exploratory test borings are presented in Appendix A.

3.2 LABORATORY TESTING

Laboratory testing was performed on selected bulk and relatively undisturbed samples obtained during the field explorations. The purpose of the laboratory testing was to confirm the field classification of the materials encountered and to evaluate their physical properties for use in engineering design and analysis. Results of the laboratory testing program are included in Appendix A.

A corrosivity analysis is being performed by our subcontractor, HDR, Inc. When completed, their test results will be presented under a separate cover.

4. GEOLOGIC AND SOILS CONDITIONS

4.1 REGIONAL SETTING

The site is situated in the Peninsular Ranges province, which is one of the largest geomorphic units in western North America. It extends from the Transverse Ranges geomorphic province and the Los Angeles Basin, approximately 900 miles south to the tip of Baja California. This province varies in width from about 30 to 100 miles. It is bounded on the west by the Pacific

Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province.

The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks. Three major fault zones are found in this province. The Elsinore Fault zone and the San Jacinto Fault zone trend northwest-southeast and are found near the middle of the province. The San Andreas Fault zone borders the northeasterly margin of the province.

The subject freeways are generally underlain by alluvial deposits derived from the Santa Ana River. Towards the eastern portion of the SR-91 freeway, conglomerate as part of the Ladd Formation, micaceous siltstone with sandy sediments as part of the Silverado Formation, claystone with sand and silt and conglomerate within the Santiago Formation and Santiago Peak volcanics are mapped south of the freeway.

4.2 GENERAL SOIL CONDITIONS

A brief description of the soils encountered is presented in this section. The soils within SR-55 generally consist of sandy and silty clay to clayey sand and gravel. Boring R-12-103 was terminated at a depth of 32 feet due to refusal on gravel. The soils below the western portion of the SR-91 in the vicinity of R-12-101 and R-12-102 generally consisted of sands and silty sands with varying amounts of gravel and cobbles. The soils below the eastern portion of SR-91 in the vicinity of Borings R-12-105 and R-8-106 generally consisted of sands to clayey sands with varying amounts of gravel and occasional cobbles. Sandy silt was observed within the deeper portions of Boring R-12-105.

4.3 SURFACE WATER AND GROUNDWATER

4.3.1 Groundwater

Water was encountered in Borings R-12-102 and R-12-105 at depths of 46 feet and 28.3 feet, respectively.

It is possible that seasonal variations will cause fluctuations in the groundwater level. Additionally, perched water may be encountered in discontinuous zones within the soils. The groundwater levels presented in this report are the levels that were measured at the time of our field activities. It is recommended that the contractor determine the actual groundwater levels at the site at the time of the construction activities to determine the impact, if any, on the construction procedures.

4.4 FAULTING AND SEISMICITY

4.4.1 Faulting

The geologic structure of the entire southern California area is dominated mainly by northwest-trending faults associated with the San Andreas system. The sites are in a seismically active region. No active or potentially active fault is known to exist at these sites nor are the sites situated within a State of California designated *"Alquist-Priolo"* Earthquake Fault Zone. The nearest zoned faults to the respective CMS locations are provided below:

CMS #	AP Fault	Approximate Distance to Zoned Fault
CMS #1	Whittier Fault	5.1 miles to the northeast
CMS #2	Whittier Fault	4.7 miles to the northeast
CMS #3	Whittier Fault	6.1 miles to the northeast
CMS #4	Whittier Fault	5.5 miles to the northeast
CMS #5	Whittier Fault	1.2 miles to the west
CMS #6	Chino Fault	0.9 miles to the east

A geologic map is presented on Figure 8.

4.4.2 Seismic Design Parameters

Based on the various latitudes and longitudes, spectral accelerations (Ss and S_1) for 0.2 and 1.0 second periods for a Class "D" site, were determined for the sites from the USGS Website, Earthquake Hazards Program, U.S. Seismic Design Maps for Risk-Targeted Maximum Considered Earthquake (MCE_R) Ground Motion Response Accelerations for the Conterminous 48 States by Latitude/Longitude. The results are presented in the following table:

SITE SEISMIC PARAMETERS*									
CMS #	Period	Mapped MCE Spectral Response Acceleration (g)		Site Coefficients		Adjusted MCE Spectral Response Acceleration (g)		Design Spectral Response Acceleration (g)	
CMS #1	0.2	S_S	1.554	F_a	1.0	S_{MS}	1.554	S_{DS}	1.036
	1.0	S_1	0.600	F_v	1.5	S_{M1}	0.900	S_{D1}	0.600
CMS #2	0.2	S_S	1.526	F_a	1.0	S_{MS}	1.526	S_{DS}	1.017
	1.0	S_1	0.600	F_v	1.5	S_{M1}	0.900	S_{D1}	0.600
CMS #3	0.2	S_S	1.500	F_a	1.0	S_{MS}	1.500	S_{DS}	1.000
	1.0	S_1	0.587	F_v	1.5	S_{M1}	0.880	S_{D1}	0.587
CMS #4	0.2	S_S	1.500	F_a	1.0	S_{MS}	1.500	S_{DS}	1.000
	1.0	S_1	0.597	F_v	1.5	S_{M1}	0.896	S_{D1}	0.597
CMS #5	0.2	S_S	2.404	F_a	1.0	S_{MS}	2.404	S_{DS}	1.603
	1.0	S_1	0.886	F_v	1.5	S_{M1}	1.328	S_{D1}	0.886
CMS #6	0.2	S_S	2.455	F_a	1.0	S_{MS}	2.455	S_{DS}	1.637
	1.0	S_1	0.917	F_v	1.5	S_{M1}	1.375	S_{D1}	0.917

**2% Probability of Exceedance in 50 years*

Final selection of the appropriate seismic design coefficients should be made by the project structural engineer based upon the local practices and ordinances, expected structure response and desired level of conservatism.

4.4.3 Liquefaction

Liquefaction describes a phenomenon in which cyclic stresses, produced by earthquake-induced ground motion, create excess pore pressures in relatively cohesionless soils. These soils may thereby acquire a high degree of mobility, which can lead to lateral movement, sliding, settlement of loose sediments, sand boils and other damaging deformations. This phenomenon occurs only below the water table, but, after liquefaction has developed, the effects can propagate upward into overlying non-saturated soil as excess pore water dissipates.

The factors known to influence liquefaction potential include soil type and grain size, relative density, groundwater level, confining pressures, and both intensity and duration of ground shaking. In general, materials that are susceptible to liquefaction are loose, saturated granular soils having low fines content under low confining pressures.

GeoTek evaluated the liquefaction potential at the six sign locations using the computer program LiquefyPro Version 5. An earthquake magnitude of M7.0 was used for all the sites. The table presented below itemizes the boring numbers and associated peak horizontal ground acceleration, historic high groundwater depth, and the potential liquefaction-induced settlement.

BORING NO.	PEAK HORIZONTAL GROUND ACCELERATION (g's)	HISTORIC HIGH GROUNDWATER DEPTH (ft.)	POTENTIAL SEISMIC SETTLEMENT (in.)
R-12-101	0.60	10	0.84
R-12-102	0.59	10	1.38
R-12-103	0.51	40	0.05
R-12-104	0.54	40	0.02
R-12-105	0.95	20	1.20
R-8-106	0.97	Ground Surface	0

The liquefaction analyses are presented in Appendix C. In accordance with Caltrans requirements, our liquefaction analysis has incorporated a safety factor of 1.0. Liquefaction potential exists at the locations of Borings R-12-101, R-12-102, and R-12-105. Liquefaction potential does not exist at the locations of Borings R-12-103, R-12-104, and R-8-106.

4.4.4 OTHER SEISMIC HAZARDS

The sites of the changeable message signs are not mapped within an area subject to potential seismic-induced slope instability.

Evidence of ancient landslides or slope instabilities at these sites was not observed during our investigation. Thus, the potential for landslides is considered negligible.

The potential for secondary seismic hazards such as a seiche and tsunami are considered to be negligible due to site elevation and distance from an open body of water.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

The anticipated development appears feasible from a geotechnical viewpoint provided that the following recommendations, and those provided by this firm at a later date, if necessary, are incorporated into the design and construction phases of development. Development plans should be reviewed by GeoTek, Inc. when they become available.

5.2 DESIGN RECOMMENDATIONS

5.2.1 Deep Foundation Design

Drilled, Cast-in-Place Friction Piles: The changeable message signs will be supported by drilled, cast-in-place friction piles. The anticipated pile depths are based on the loading conditions provided to this office. The following table itemizes the pile depths:

BORING NUMBER	PILE DEPTH BELOW EXISTING GRADE (ft.)
R-12-101	25
R-12-102	25
R-12-103	20
R-12-104	25
R-12-105	25
R-8-106	25

The vertical and lateral pile capacity analyses are presented in Appendix C. The allowable depths include a factor of safety of 2.0 for skin friction. A representative of the geotechnical engineer should be present during excavation of the piles to verify the embedment depth and diameter, and to verify that the soil conditions are consistent with the material encountered in our explorations.

Each pile should be drilled and concrete placed the same day. Surface run-off water should be drained away from the excavations and not be allowed to pond. If it is required that foundation excavations be left open for more than one day, they should be properly covered to prevent personal injury and fall hazards, and be protected to reduce evaporation or entry of moisture.

The portion of the pile above the water table, if encountered, should be reamed out the following day prior to placement of reinforcement and concrete.

If groundwater is encountered during excavation of the pile foundations, the concrete should be placed from the bottom of the excavation using a tremie or similar method. This is intended to allow the concrete to displace groundwater as it is placed.

Caving of the sidewalls may occur during excavation of the drilled piles at the locations of Borings R-12-101 and R-12-102 and possibly others due to the presence of cohesionless soils. Caving may also occur due to the presence of groundwater. If caving occurs during the drilling procedure, temporary casing should be utilized. The temporary casing may be removed as concrete is placed within the piles keeping at least two feet of concrete head above the bottom of the casing as it is being removed.

5.2.2 Excavation Characteristics

Due to the presence of gravel and cobbles at various depths, drilling may be problematic at different levels.

5.3 CONCRETE CONSTRUCTION

5.3.1 General

Concrete construction should follow the 2013 CBC and ACI guidelines regarding design, mix placement and curing of the concrete. If desired, we can provide quality control testing of the concrete during construction.

6. INTENT

It is the intent of this report to aid in the design and construction of the proposed improvements. Implementation of the advice presented in this report is intended to reduce risk associated with construction projects. The professional opinions and geotechnical advice contained in this report are not intended to imply total performance of the project or guarantee that unusual or variable conditions will not be discovered during or after construction.

The scope of our evaluation is limited to the area explored that is shown on Figures 2 through 7. This evaluation does not and should in no way be construed to encompass any areas

beyond the specific areas of the proposed construction as indicated to us by our client. Further, no evaluation of any existing site improvements is included.

7. LIMITATIONS

Our findings are based on site conditions observed and the stated sources. Thus, our comments are professional opinions that are limited to the extent of the available data.

GeoTek has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report.

Since our recommendations are based on the site conditions observed and encountered, and laboratory testing, our conclusions and recommendations are professional opinions that are limited to the extent of the available data. Observations during construction are important to allow for any change in recommendations found to be warranted. These opinions have been derived in accordance with current standards of practice and no warranty of any kind is expressed or implied. Standards of care/practice are subject to change with time.

8. SELECTED REFERENCES

American Concrete Institute (ACI), 2010, Publications 360R-10, Guide to Design of Slabs-On-Ground.

Bryant, W.A., and Hart, E.W., 2007, Fault Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps, California Geological Survey: Special Publication 42.

California Code of Regulations, Title 24, 2013 "California Building Code," 3 volumes.

California Division of Mines and Geology, 2006, Seismic Hazard Zone Report for the Black Star Canyon Quadrangle, Orange County, Califonria, SHZR-046.

California Division of Mines and Geology, 2006, Seismic Hazard Zone Report for the Orange Quadrangle, Orange County, Califonria, SHZR-011.

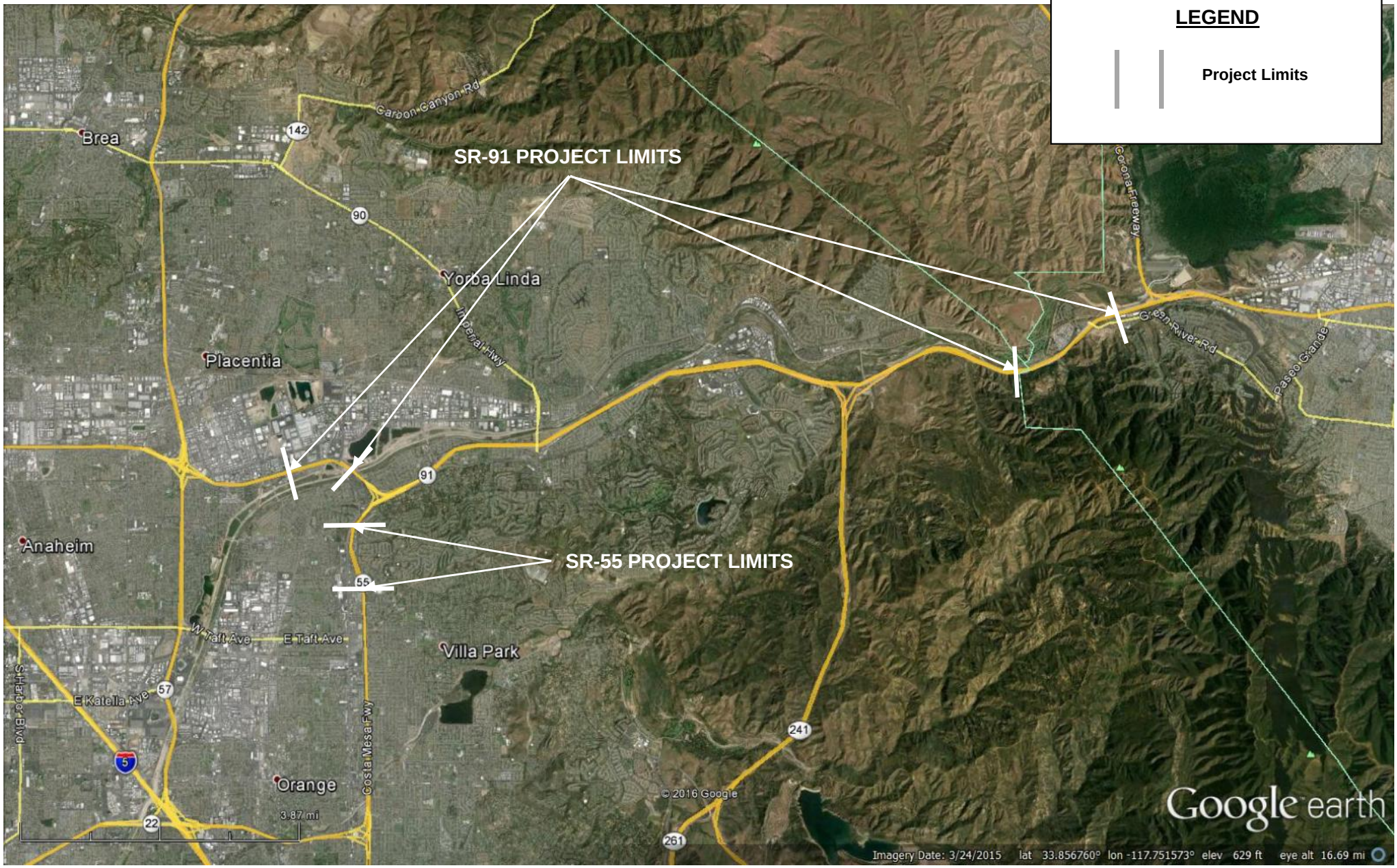
California Division of Mines and Geology, 2006, Seismic Hazard Zone Report for the Prado Dam Quadrangle, Orange County, Califonria, SHZR-045.

Dibblee, 2001, Geologic Map of the Yorba Lindo and Prado Dam Quadrangles (eastern Puente Hills), Los Angeles, Orange, San Bernardino and Riverside Quadrangels, Dibblee Geological Foundation Map, DF-75, Scale 1:24,000.

GeoTek, Inc., In-house proprietary information.

Morton and Miller, 2006, Geologic Map of the San Bernardino and Santa Ana 30' x 60' Quadrangles, U.S. Geologic Survey OF-2006-1217, Scale 1:100,000.

Seismic Design Values for Buildings (http://geohazards.usgs.gov/designmaps/us/application.php).



TRC Solutions, Inc.
Rehabilitation of Six Changeable Message Signs
Portions of SR-91 and SR-55 Freeways
Orange and Riverside County, California

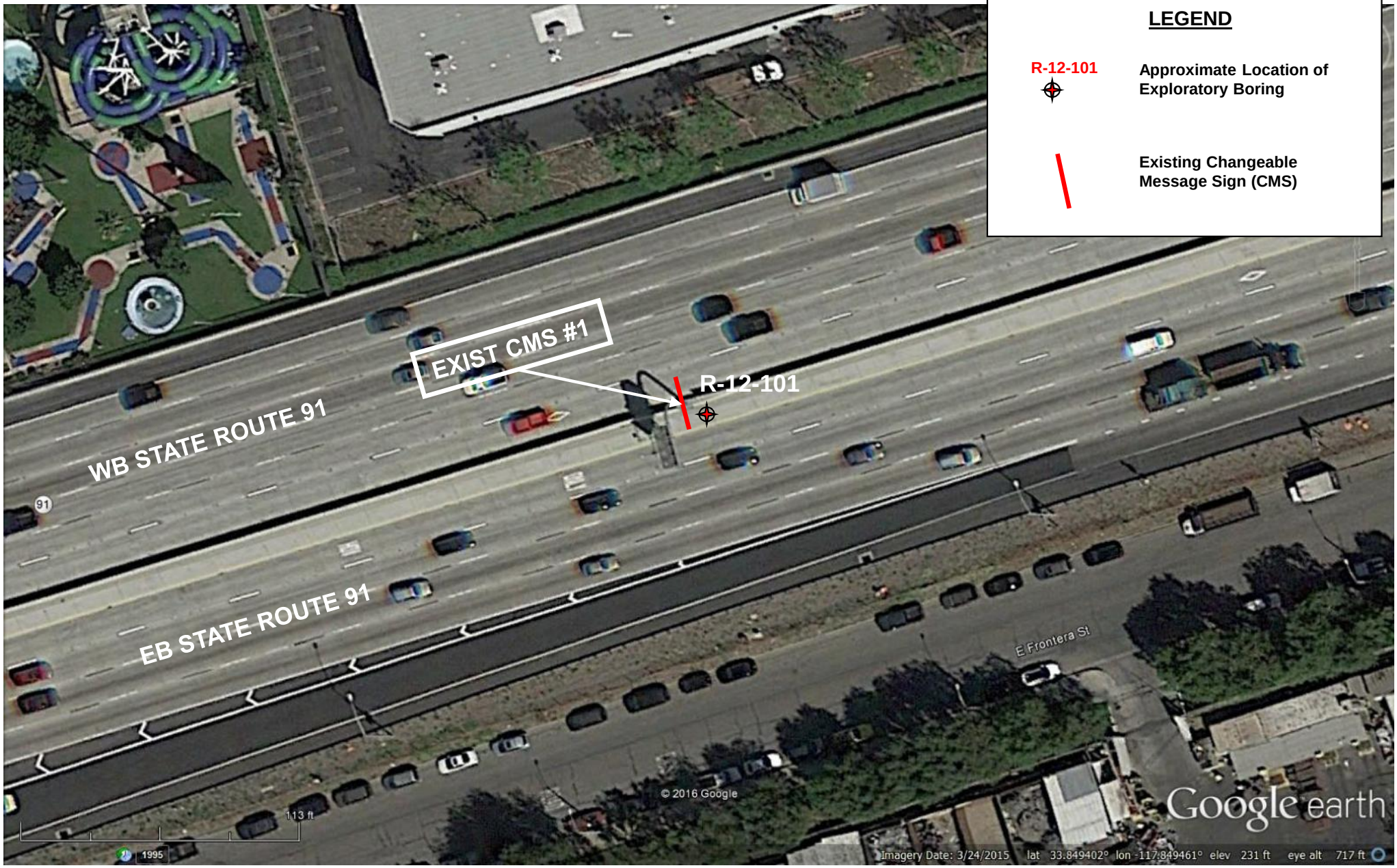
GeoTek Project No. 1397-CR

N

Figure 1

Project Vicinity Map

GEOTEK



TRC Solutions, Inc.
Rehabilitation of Six Changeable Message Signs
Portions of SR-91 and SR-55 Freeways
Orange and Riverside County, California

GeoTek Project No. 1397-CR

N

Figure 2

Boring Location Map
R-12-101

GEOTEK

TRC Solutions, Inc.
Rehabilitation of Six Changeable Message Signs
Portions of SR-91 and SR-55 Freeways
Orange and Riverside County, California

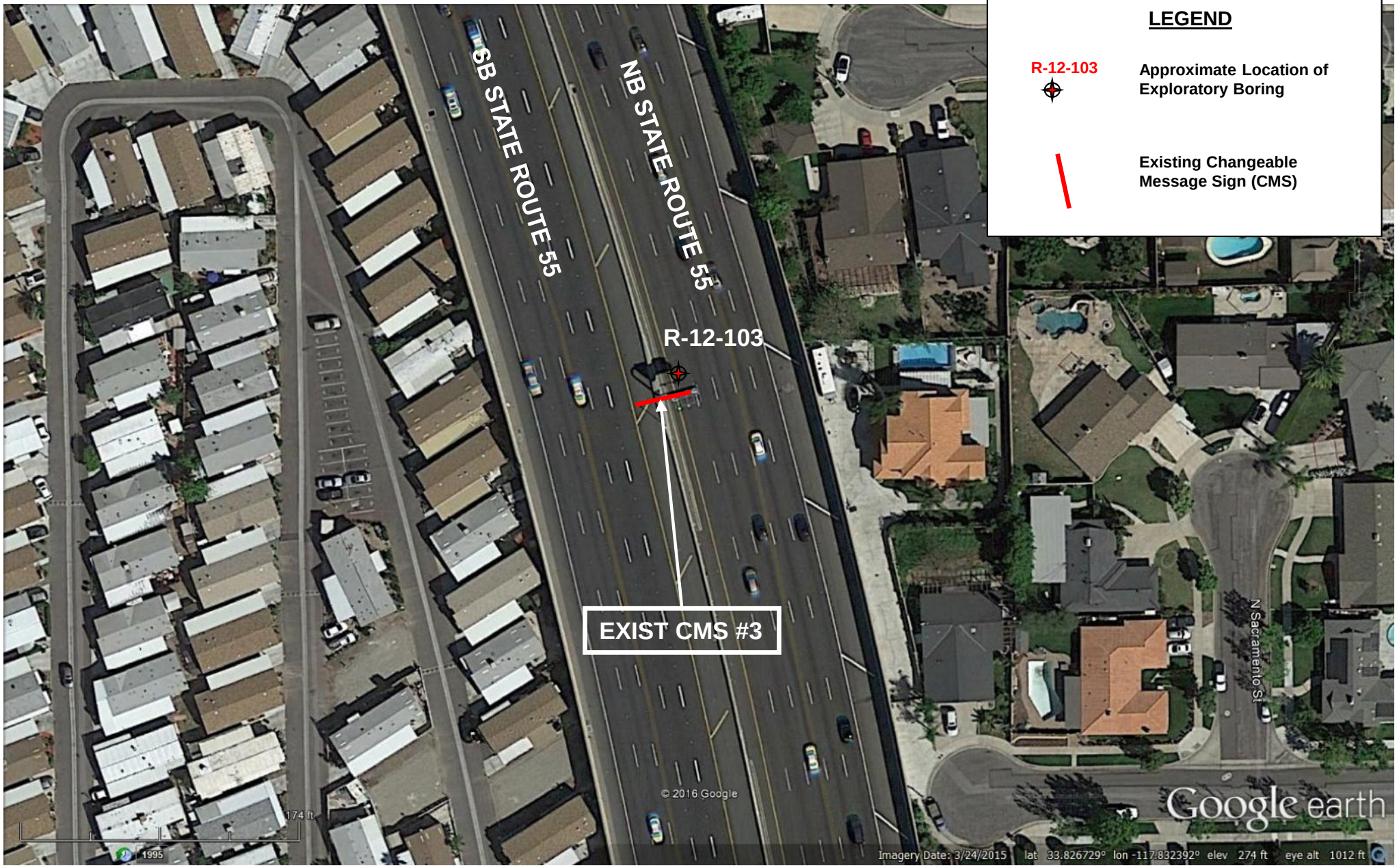
GeoTek Project No. 1397-CR

N

Figure 3

Boring Location Map
R-12-102

GEOTEK



TRC Solutions, Inc.
Rehabilitation of Six Changeable Message Signs
Portions of SR-91 and SR-55 Freeways
Orange and Riverside County, California

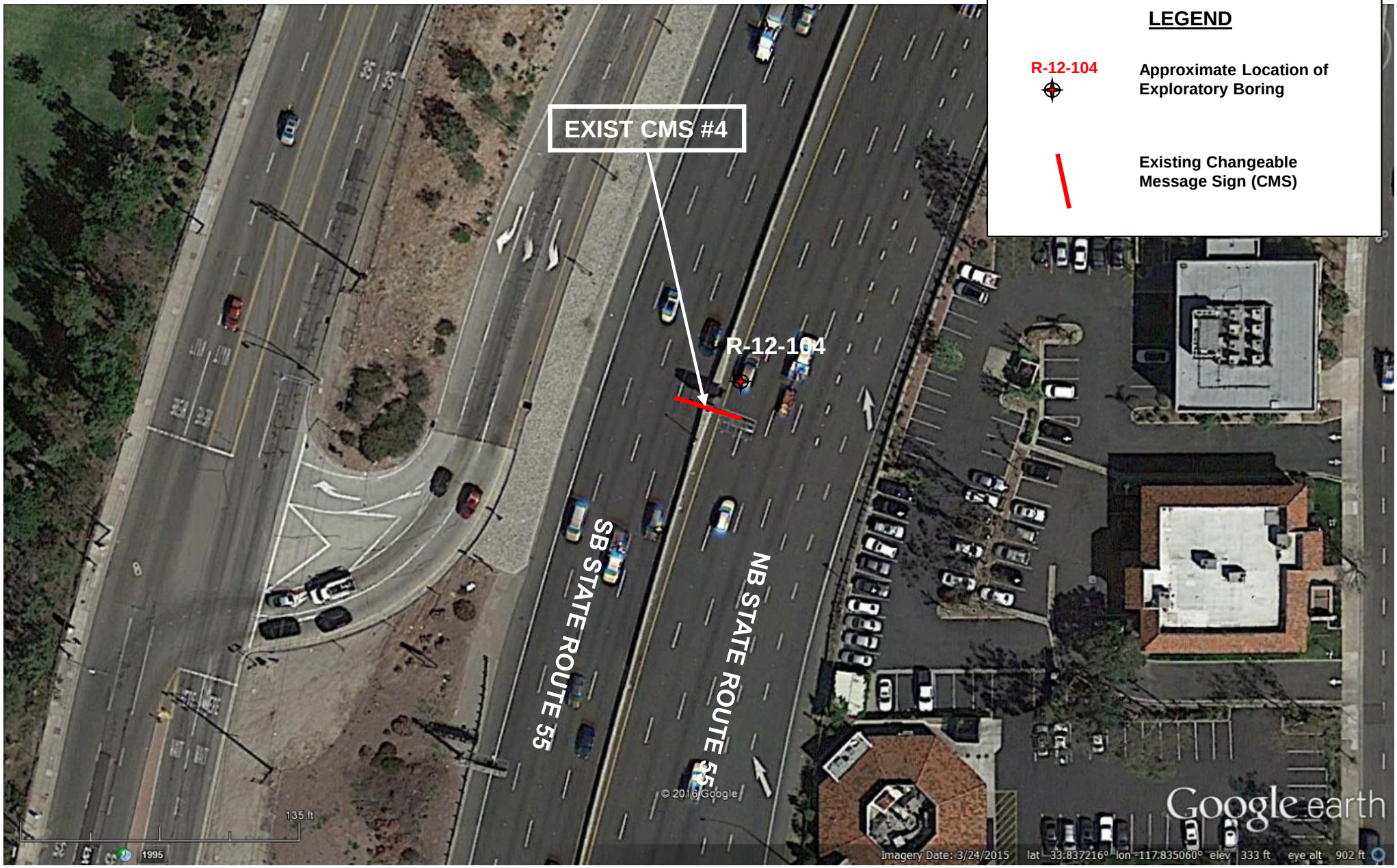
GeoTek Project No. 1397-CR

N

Figure 4

Boring Location Map
R-12-103

GEOTEK



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Rehabilitation of Six Changeable Message Signs
Portions of SR-91 and SR-55 Freeways
Orange and Riverside County, California

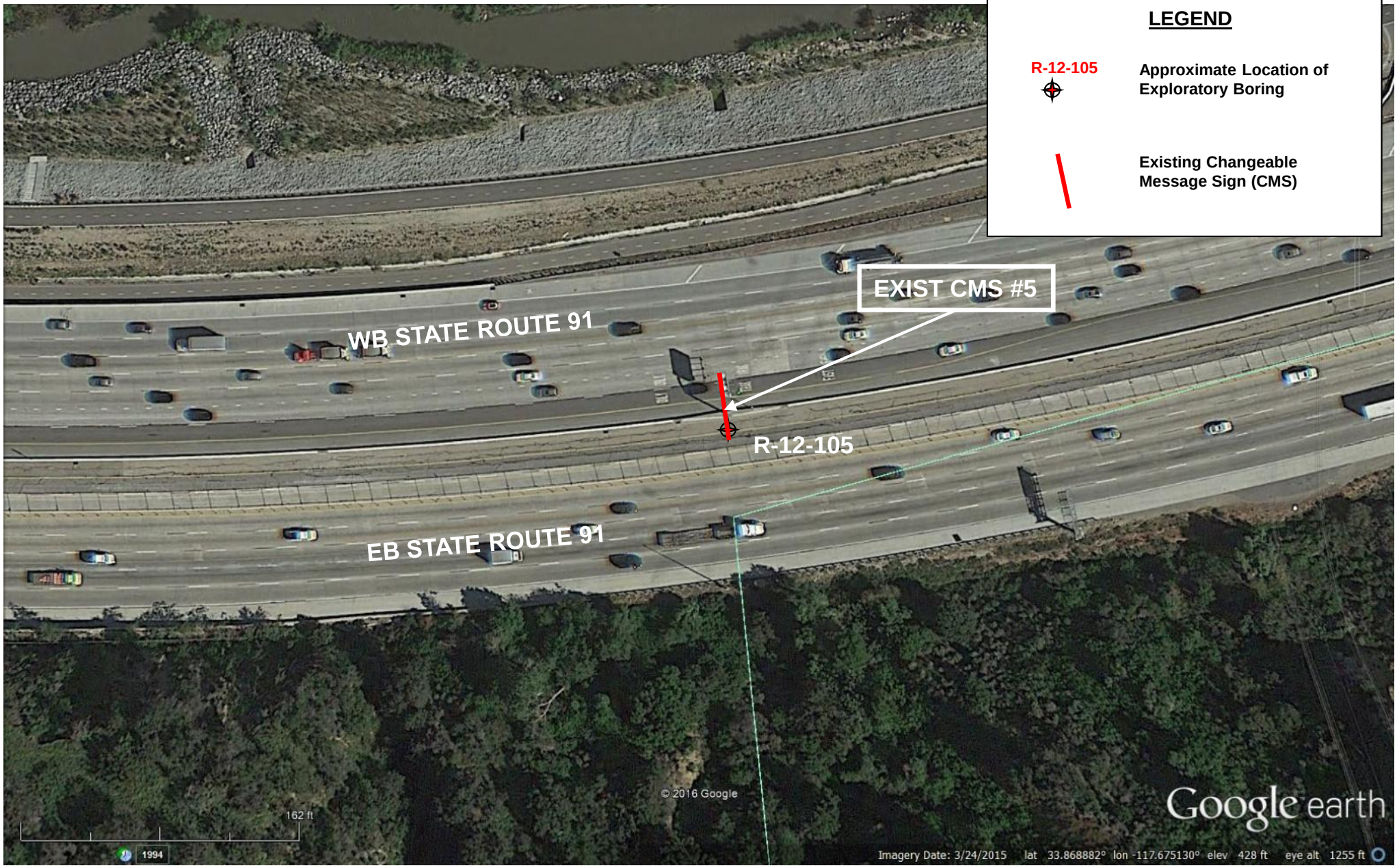
GeoTek Project No. 1397-CR

N

Figure 5

Boring Location Map
R-12-104

GEOTEK



TRC Solutions, Inc.
Rehabilitation of Six Changeable Message Signs
Portions of SR-91 and SR-55 Freeways
Orange and Riverside County, California

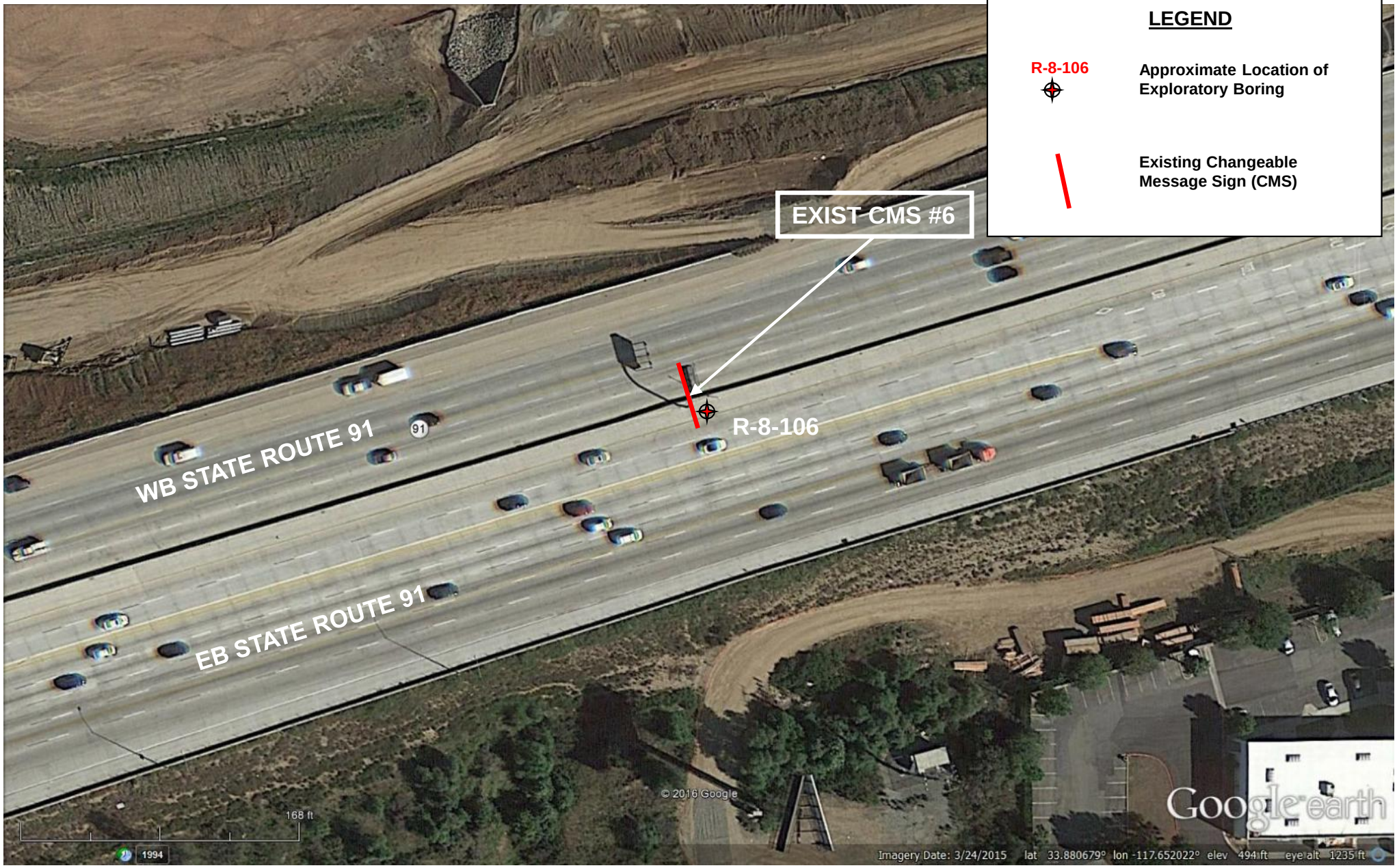
GeoTek Project No. 1397-CR

N

Figure 6

Boring Location Map
R-12-105

GEOTEK



TRC Solutions, Inc.
Rehabilitation of Six Changeable Message Signs
Portions of SR-91 and SR-55 Freeways
Orange and Riverside County, California

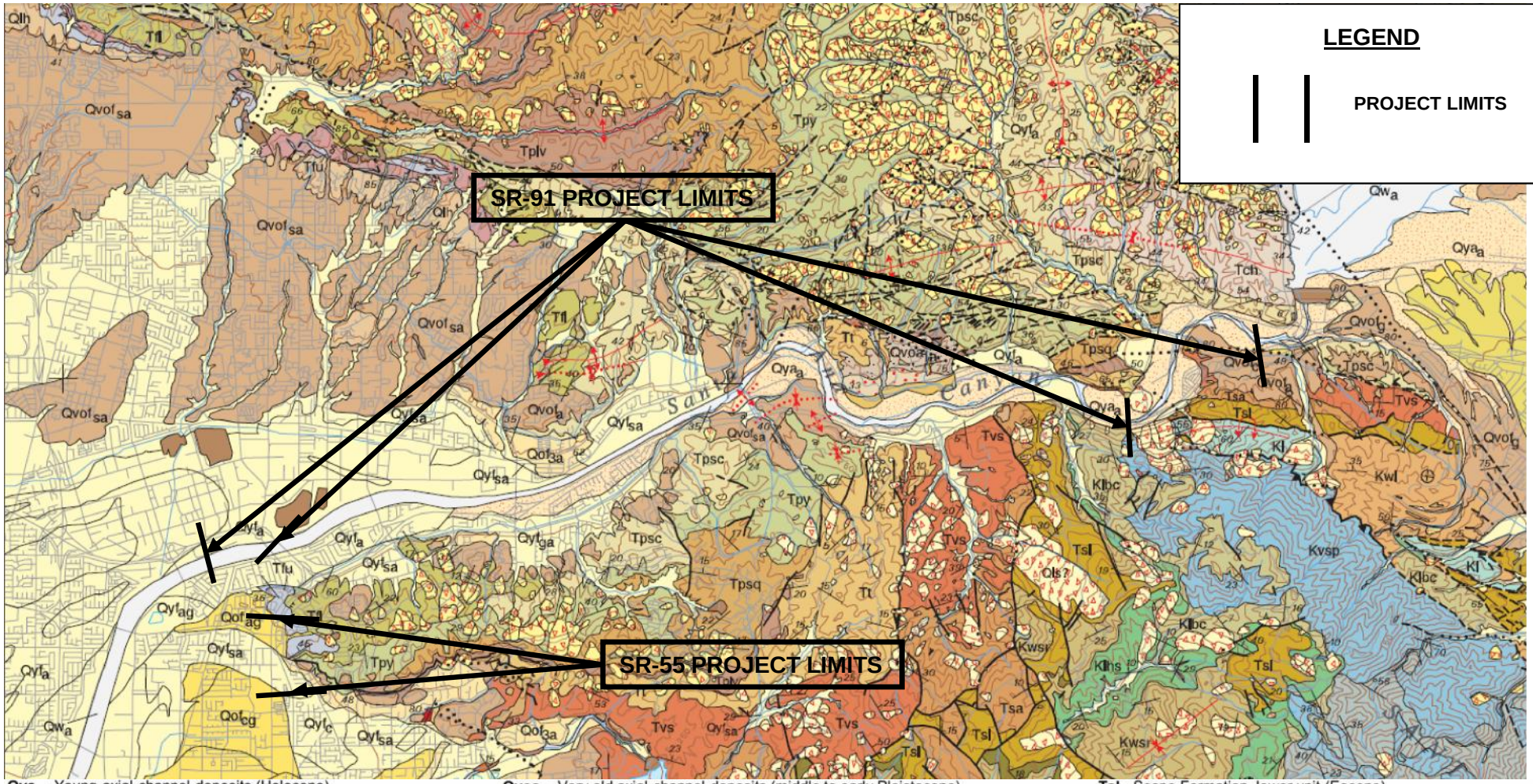
GeoTek Project No. 1397-CR

N

Figure 7

Boring Location Map
R-8-106

GEOTEK



Qya_a - Young axial-channel deposits (Holocene)
Qyf_{1g} - Young alluvial-fan deposits (Holocene and late Pleistocene)
Qyf_g - Young alluvial-fan deposits (Holocene and late Pleistocene)
Qof_{3a} - Old alluvial-fan deposits (late to middle Pleistocene)
Qof_3 - Old alluvial-fan deposits (late to middle Pleistocene)
Qof_{1g} - Old alluvial-fan deposits (late to middle Pleistocene)
Qof_g - Old alluvial-fan deposits (late to middle Pleistocene)
Qof_a - Old alluvial-fan deposits (late to middle Pleistocene)
$Qvof_{sa}$ - Very old alluvial-fan deposits (middle to early Pleistocene)
$Qvof_g$ - Very old alluvial-fan deposits (middle to early Pleistocene)
$Qvof_c$ - Very old alluvial-fan deposits (middle to early Pleistocene)
$Qvof_a$ - Very old alluvial-fan deposits (middle to early Pleistocene)

$Qvoa_a$ - Very old axial-channel deposits (middle to early Pleistocene)
Qtn - Sedimentary rocks of the Norco area (early Pleistocene to latest Pliocene)
Qls - Landslide
Tch - Mount Eden Formation, Sandstone and Conglomerate Member (early Pliocene and Miocene)
Tpsc - Puente Formation, Sycamore Canyon Member (early Pliocene and Miocene)
Tpy - Puente Formation, Yorba Member (late Miocene)
Tpsq - Puente Formation, Soquel Member (Miocene)
Tplv - Puente Formation, La Vida Member (Miocene)
Tt - Topanga Group, undifferentiated (early Miocene)
Tvs - Sespe and Vaqueros Formations, undifferentiated (early Miocene, Oligocene and late Eocene)

Tsl - Sespe Formation, lower unit (Eocene)
Tsa - Santiago Formation (Eocene)
Klhs - Ladd Formation, Holz Shale Member (Late Cretaceous)
Klbc - Ladd Formation, Baker Canyon Member (Late Cretaceous)
Kl - Ladd Formation (Late Cretaceous)
Kwl - Williams and Ladd Formations, undifferentiated (Late Cretaceous)
Kd - Diorite, undifferentiated (Cretaceous)
Kmp - Micropegmatite granite (Cretaceous)
Kvsp - Santiago Peak Volcanics (Cretaceous)

1 0 1 2 3 4 5 6 7 MILES

TRC Solutions, Inc.
Rehabilitation of Six Changeable Message Signs
Portions of SR-91 and SR-55 Freeways
Orange and Riverside County, California

GeoTek Project No. 1397-CR

N

Figure 8

Regional Geologic Map

GEOTEK

APPENDIX A

LOGS OF TEST BORINGS

Portions of the SR-91 and SR-55 Freeways
Orange and Riverside County, California
Project No. 1397-CR

GEOTEK

A - FIELD TESTING AND SAMPLING PROCEDURES

The Modified Split-Barrel Sampler (Ring)

The Ring sampler is driven into the ground in accordance with ASTM Test Method D 3550. The sampler, with an external diameter of 3.0 inches, is lined with 1-inch high, thin brass rings with an inside diameter of approximately 2.4 inches. The sampler is typically driven into the ground 12 or 18 inches with a 140-pound hammer free falling from a height of 30 inches. Blow counts are recorded for every 6 inches of penetration as indicated on the log of boring. The samples are removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

The Split-Spoon Sampler (SPT)

During the sampling procedure, Standard Penetration Tests (SPT) were performed in accordance with ASTM D1586. The SPT for soil borings is performed by driving a split-spoon sampler with an outside diameter of 2 inches into the undisturbed formation located at the bottom of the advanced borehole with repeated blows of a 140-pound hammer falling a vertical distance of 30 inches. The number of blows required to drive the sampler for three consecutive 6-inch intervals were recorded, and the sum of the blow counts for the last 12 inches of penetration is a measure of the soil consistency. Samples were identified in the field, placed in sealed containers and transported to the laboratory for further classification and testing.

Bulk Samples (Large)

These samples are normally large bags of earth materials over 20 pounds in weight collected from the field by means of hand digging or exploratory cuttings.

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12, 08	Ora, Riv	55, 91	14.7/R17.9, 7.5/18.9, R0.0/R1.6	214	251

Glenn S. Fraser — REGISTERED CIVIL ENGINEER — 02-19-16 DATE

02-19-16 PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GLENN S. FRASER — No. GE 2381 — EXP. 9/30/17 — GEOTECHNICAL — STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

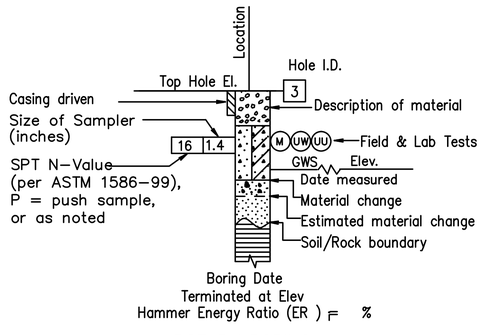
GEOTEK, INC.
710 E PARKRIDGE AVE
STE 105
CORONA, CA 92879

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

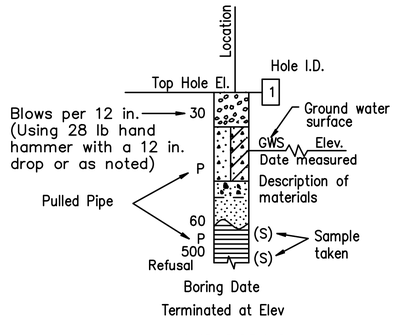
CEMENTATION	
Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure.
Moderate	Crumbles or breaks with considerable finger pressure.
Strong	Will not crumble or break with finger pressure.

BOREHOLE IDENTIFICATION		
Symbol	Hole Type	Description
Size	A	Auger Boring (hollow or solid stem bucket)
Size	R RW RC P	Rotary drilled boring (conventional) Rotary drilled with self-casing wire-line Rotary core with continuously-sampled, self-casing wire-line Rotary percussion boring (air)
Size	R	Rotary drilled diamond core
Size	HD HA	Hand driven (1-inch soil tube) Hand Auger
	D	Dynamic Cone Penetration Boring
	CPT	Cone Penetration Test (ASTM D 5778)
	O	Other (note on LOTB)
Note: Size in inches.		

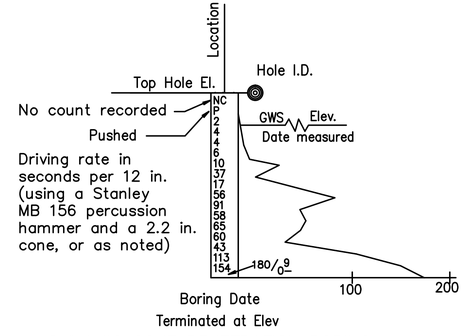
CONSISTENCY OF COHESIVE SOILS				
Description	Shear Strength (tsf)	Pocket Penetrometer Measurement, PP, (tsf)	Torvane Measurement, TV, (tsf)	Vane Shear Measurement, VS, (tsf)
Very Soft	Less than 0.12	Less than 0.25	Less than 0.12	Less than 0.12
Soft	0.12 – 0.25	0.25 – 0.5	0.12 – 0.25	0.12 – 0.25
Medium Stiff	0.25 – 0.5	0.5 – 1	0.25 – 0.5	0.25 – 0.5
Stiff	0.5 – 1	1 – 2	0.5 – 1	0.5 – 1
Very Stiff	1 – 2	2 – 4	1 – 2	1 – 2
Hard	Greater than 2	Greater than 4	Greater than 2	Greater than 2



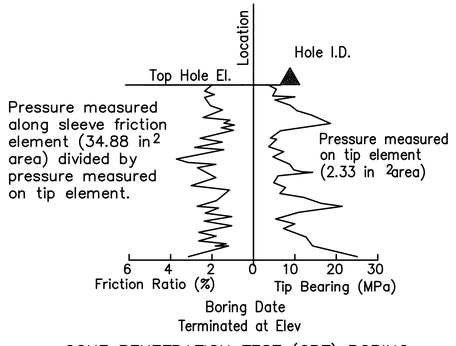
ROTARY BORING



HAND BORING



DYNAMIC CONE PENETRATION BORING



CONE PENETRATION TEST (CPT) BORING

LOG OF TEST BORING

NO SCALE

LOTB– 1

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION
Caltrans
CONSULTANT FUNCTIONAL SUPERVISOR: GLENN FRASER
CALCULATED–DESIGNED BY
CHECKED BY
ARMANDO ROA
NOELLE TONEY
REVISED BY
DATE REVISED

LAST REVISION 02–08–16
DATE PLOTTED => $DATE
TIME PLOTTED => $TIME

BORDER LAST REVISED 7/2/2010
USERNAME => $USER
DGN FILE => $REQUEST
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 2998
PROJECT NUMBER & PHASE 12130000931

REFERENCE: CALTRANS SOIL & ROCK LOGGING, CLASSIFICATION, AND PRESENTATION MANUAL (2010)

GROUP SYMBOLS AND NAMES

Graphic/Symbol	Group Names	Graphic/Symbol	Group Names
GW	Well–graded GRAVEL Well–graded GRAVEL with SAND	CL	Lean CLAY Lean CLAY with SAND Lean CLAY with GRAVEL SANDY lean CLAY SANDY lean CLAY with GRAVEL GRAVELLY lean CLAY GRAVELLY lean CLAY with SAND
GP	Poorly–graded GRAVEL Poorly–graded GRAVEL with SAND		
GW–GM	Well–graded GRAVEL with SILT Well–graded GRAVEL with SILT and SAND	CL–ML	SILTY CLAY SILTY CLAY with SAND SILTY CLAY with GRAVEL SANDY SILTY CLAY SANDY SILTY CLAY with GRAVEL GRAVELLY SILTY CLAY GRAVELLY SILTY CLAY with SAND
GW–GC	Well–graded GRAVEL with CLAY (or SILTY CLAY) Well–graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GP–GM	Poorly–graded GRAVEL with SILT Poorly–graded GRAVEL with SILT and SAND	ML	SILT SILT with SAND SILT with GRAVEL SANDY SILT SANDY SILT with GRAVEL GRAVELLY SILT GRAVELLY SILT with SAND
GP–GC	Poorly–graded GRAVEL with CLAY (or SILTY CLAY) Poorly–graded GRAVEL with CLAY and SAND (or SILTY CLAY and SAND)		
GM	SILTY GRAVEL SILTY GRAVEL with SAND	OL	ORGANIC lean CLAY ORGANIC lean CLAY with SAND ORGANIC lean CLAY with GRAVEL SANDY ORGANIC lean CLAY SANDY ORGANIC lean CLAY with GRAVEL GRAVELLY ORGANIC lean CLAY GRAVELLY ORGANIC lean CLAY with SAND
GC	CLAYEY GRAVEL CLAYEY GRAVEL with SAND		
GC–GM	SILTY, CLAYEY GRAVEL SILTY, CLAYEY GRAVEL with SAND	OL	ORGANIC SILT ORGANIC SILT with SAND ORGANIC SILT with GRAVEL SANDY ORGANIC SILT SANDY ORGANIC SILT with GRAVEL GRAVELLY ORGANIC SILT GRAVELLY ORGANIC SILT with SAND
SW	Well–graded SAND Well–graded SAND with GRAVEL		
SP	Poorly–graded SAND Poorly–graded SAND with GRAVEL	CH	Fat CLAY Fat CLAY with SAND Fat CLAY with GRAVEL SANDY fat CLAY SANDY fat CLAY with GRAVEL GRAVELLY fat CLAY GRAVELLY fat CLAY with SAND
SW–SM	Well–graded SAND with SILT Well–graded SAND with SILT and GRAVEL		
SW–SC	Well–graded SAND with CLAY (or SILTY CLAY) Well–graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	MH	Elastic SILT Elastic SILT with SAND Elastic SILT with GRAVEL SANDY elastic SILT SANDY elastic SILT with GRAVEL GRAVELLY elastic SILT GRAVELLY elastic SILT with SAND
SP–SM	Poorly–graded SAND with SILT Poorly–graded SAND with SILT and GRAVEL		
SP–SC	Poorly–graded SAND with CLAY (or SILTY CLAY) Poorly–graded SAND with CLAY and GRAVEL (or SILTY CLAY and GRAVEL)	OH	ORGANIC fat CLAY ORGANIC fat CLAY with SAND ORGANIC fat CLAY with GRAVEL SANDY ORGANIC fat CLAY SANDY ORGANIC fat CLAY with GRAVEL GRAVELLY ORGANIC fat CLAY GRAVELLY ORGANIC fat CLAY with SAND
SM	SILTY SAND SILTY SAND with GRAVEL		
SC	CLAYEY SAND CLAYEY SAND with GRAVEL	OH	ORGANIC elastic SILT ORGANIC elastic SILT with SAND ORGANIC elastic SILT with GRAVEL SANDY ORGANIC elastic SILT SANDY ORGANIC elastic SILT with GRAVEL GRAVELLY ORGANIC elastic SILT GRAVELLY ORGANIC elastic SILT with SAND
SC–SM	SILTY, CLAYEY SAND SILTY, CLAYEY SAND with GRAVEL		
PT	PEAT	OL/OH	ORGANIC SOIL ORGANIC SOIL with SAND ORGANIC SOIL with GRAVEL SANDY ORGANIC SOIL SANDY ORGANIC SOIL with GRAVEL GRAVELLY ORGANIC SOIL GRAVELLY ORGANIC SOIL with SAND
	COBBLES COBBLES and BOULDERS BOULDERS		

FIELD AND LABORATORY TESTING

- (C) Consolidation (ASTM D 2435)
- (CL) Collapse Potential (ASTM D 5333)
- (CP) Compaction Curve (CTM 216)
- (CR) Corrosivity Testing (CTM 643, CTM 422, CTM 417)
- (CU) Consolidated Undrained Triaxial (ASTM D 4767)
- (DS) Direct Shear (ASTM D 3080)
- (EI) Expansion Index (ASTM D 4829)
- (M) Moisture Content (ASTM D 2216)
- (OC) Organic Content–% (ASTM D 2974)
- (P) Permeability (CTM 220)
- (PA) Particle Size Analysis (ASTM D 422)
- (PI) Plasticity Index (AASHTO T 90) Liquid Limit (AASHTO T 89)
- (PL) Point Load Index (ASTM D 5731)
- (PM) Pressure Meter
- (R) R–Value (CTM 301)
- (SE) Sand Equivalent (CTM 217)
- (SG) Specific Gravity (AASHTO T 100)
- (SL) Shrinkage Limit (ASTM D 427)
- (SW) Swell Potential (ASTM D 4546)
- (UC) Unconfined Compression–Soil (ASTM D 2166) Unconfined Compression–Rock (ASTM D 2938)
- (UU) Unconsolidated Undrained Triaxial (ASTM D 2850)
- (UW) Unit Weight (ASTM D 4767)

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12, 08	Ora, Riv	55, 91	14.7/R17.9, 7.5/18.9, R0.0/R1.6	215	251

Glenn S. Fraser — 02–19–16
REGISTERED CIVIL ENGINEER — DATE

02–19–16
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GLENN S. FRASER — No. GE 2381 — EXP. 9/30/17 — GEOTECHNICAL — STATE OF CALIFORNIA

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GEOTEK, INC.
710 E PARKRIDGE AVE
STE 105
CORONA, CA 92879

APPARENT DENSITY OF COHESIONLESS SOILS

Description	SPT N_{60} (Blows / 12 in.)
Very Loose	0 – 5
Loose	5 – 10
Medium Dense	10 – 30
Dense	30 – 50
Very Dense	Greater than 50

MOISTURE

Description	Criteria
Dry	No discernable moisture
Moist	Moisture present, but no free water
Wet	Visible free water

PERCENT OR PROPORTION OF SOILS

Description	Criteria
Trace	Particles are present but estimated to be less than 5%
Few	5% – 10%
Little	15% – 25%
Some	30% – 45%
Mostly	50% – 100%

PARTICLE SIZE

Description		Size (in.)
Boulder		Greater than 12
Cobble		3 – 12
Gravel	Coarse	3/4 – 3
	Fine	1/5 – 3/4
Sand	Coarse	1/16 – 1/5
	Medium	1/64 – 1/16
	Fine	1/300 – 1/64
Silt and Clay		Less than 1/300

LOG OF TEST BORING
NO SCALE

LOTB– 2

	REVISED BY	DATE REVISED
CALCULATED–DESIGNED BY	ARMANDO ROA	NOELLE TONEY
CHECKED BY		
CONSULTANT FUNCTIONAL SUPERVISOR	GLENN FRASER	
STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION	Caltrans	

LAST REVISION 02–08–16
DATE PLOTTED => $DATE
TIME PLOTTED => $TIME

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER, DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 2998 | PROJECT NUMBER & PHASE 12130000931

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12, 08	Ora, Riv	55, 91	14.7/R17.9, 7.5/18.9, R0.0/R1.6	216	251

Glenn S. Fraser — REGISTERED CIVIL ENGINEER — 02-19-16 DATE

02-19-16 PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GLENN S. FRASER — No. GE 2381 — EXP. 9/31/17 GEOTECHNICAL — STATE OF CALIFORNIA

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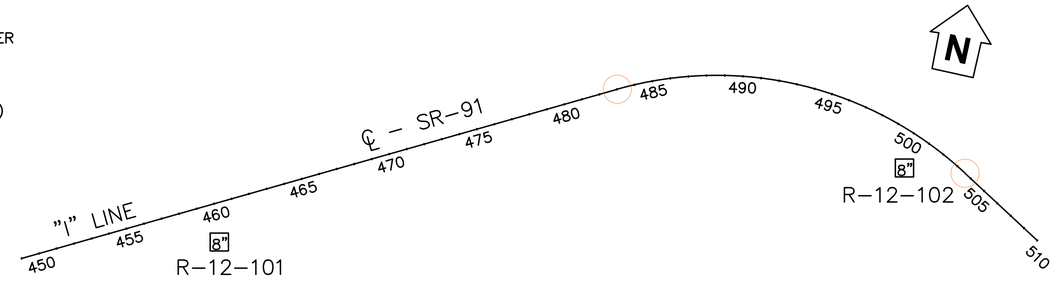
GEOTEK, INC.
710 E PARKRIDGE AVE
STE 105
CORONA, CA 92879

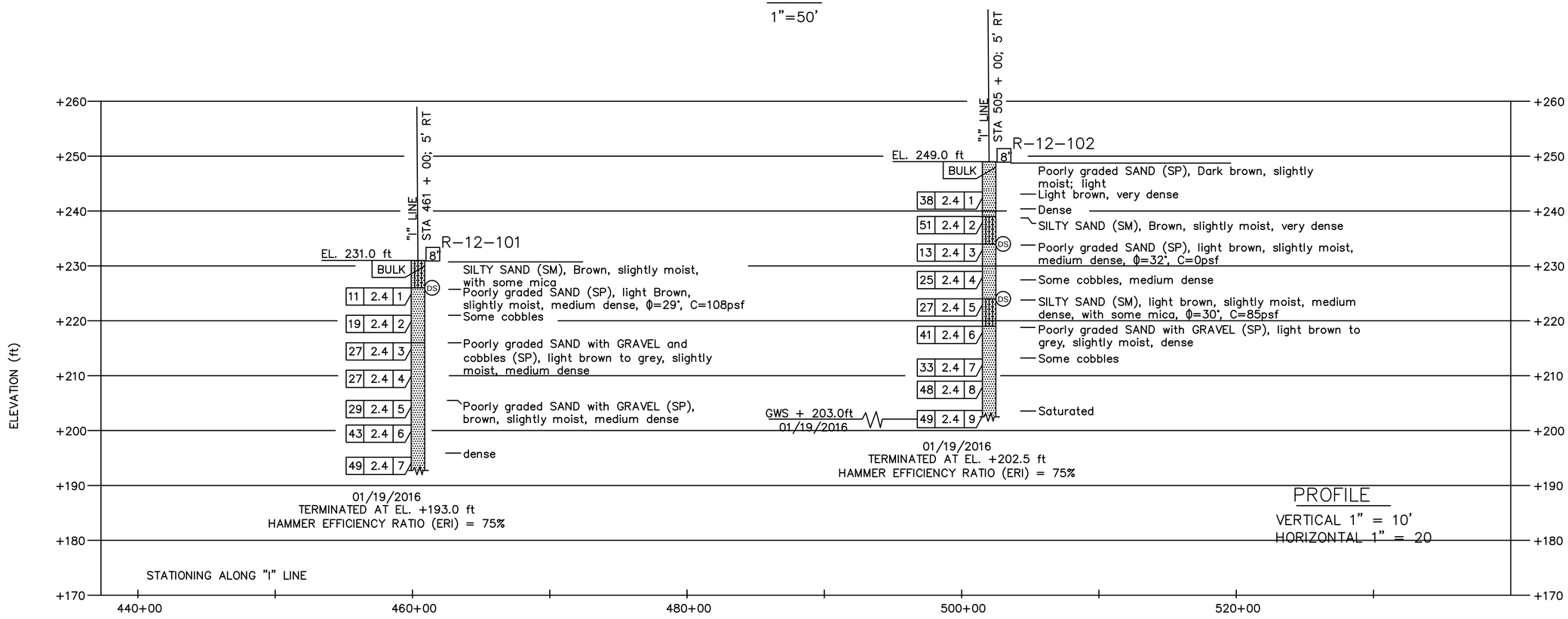
ORANGE COUNTY TRANSPORTATION AUTHORITY
550 S. MAIN STREET
ORANGE, CA 92863-1584

NOTES:

(1) THIS LOTB SHEET WAS PREPARED IN ACCORDANCE WITH THE CALTRANS SOIL AND ROCK LOGGING, CLASSIFICATION AND PRESENTATION MANUAL (JUNE 2010).
(2) 2.4" SAMPLES WERE TAKEN USING A CALIFORNIA MODIFIED SAMPLER.
(3) AN AUTOMATIC TRIP HAMMER SYSTEM CONSISTING OF A HAMMER WEIGHT OF 140LBS FALLING A DISTANCE OF 30" WAS USED TO ADVANCE THE DRIVE SAMPLER.
(4) CONVERSION FACTOR FROM 2.4" MODIFIED CALIFORNIA RING SAMPLER BLOWCOUNTS TO STANDARD PENETRATION TEST (SPT) BLOWCOUNTS IS 0.65.



PLAN
1"=50'



PROFILE
VERTICAL 1" = 10'
HORIZONTAL 1" = 20

LOG OF TEST BORING
NO SCALE

LOTB– 3

CALCULATED–DESIGNED BY	ARMANDO ROA
CHECKED BY	NOELLE TONEY
CONSULTANT FUNCTIONAL SUPERVISOR	GLENN FRASER
STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION	Caltrans

REVISED BY	DATE REVISED

LAST REVISION 02–08–16 — DATE PLOTTED => $DATE — TIME PLOTTED => $TIME

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER, DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 2998 | PROJECT NUMBER & PHASE 12130000931

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12, 08	Ora, Riv	55, 91	14.7/R17.9, 7.5/18.9, R0.0/R1.6	217	251

Glenn S. Fraser — 02-19-16
REGISTERED CIVIL ENGINEER — DATE

02-19-16
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GLENN S. FRASER — No. GE 2381 — EXP. 9/31/17 — GEOTECHNICAL — STATE OF CALIFORNIA

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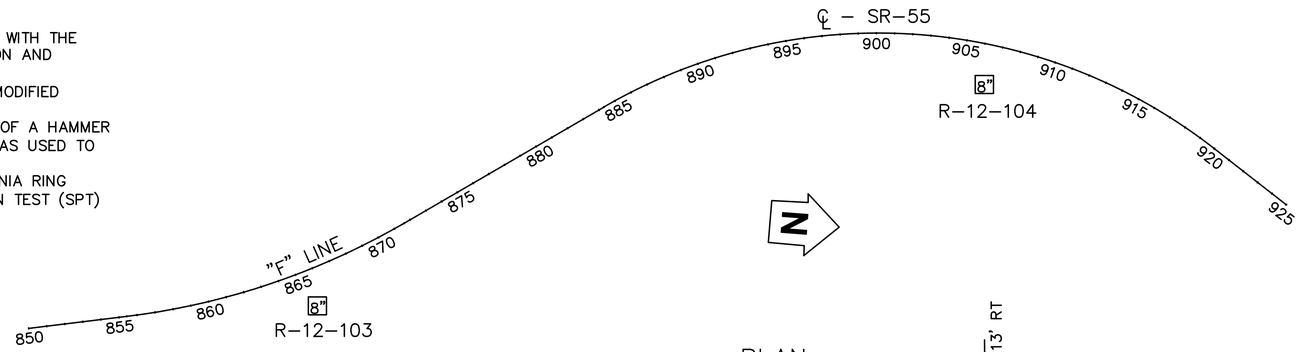
710 E PARKRIDGE AVE
STE 105
CORONA, CA 92879

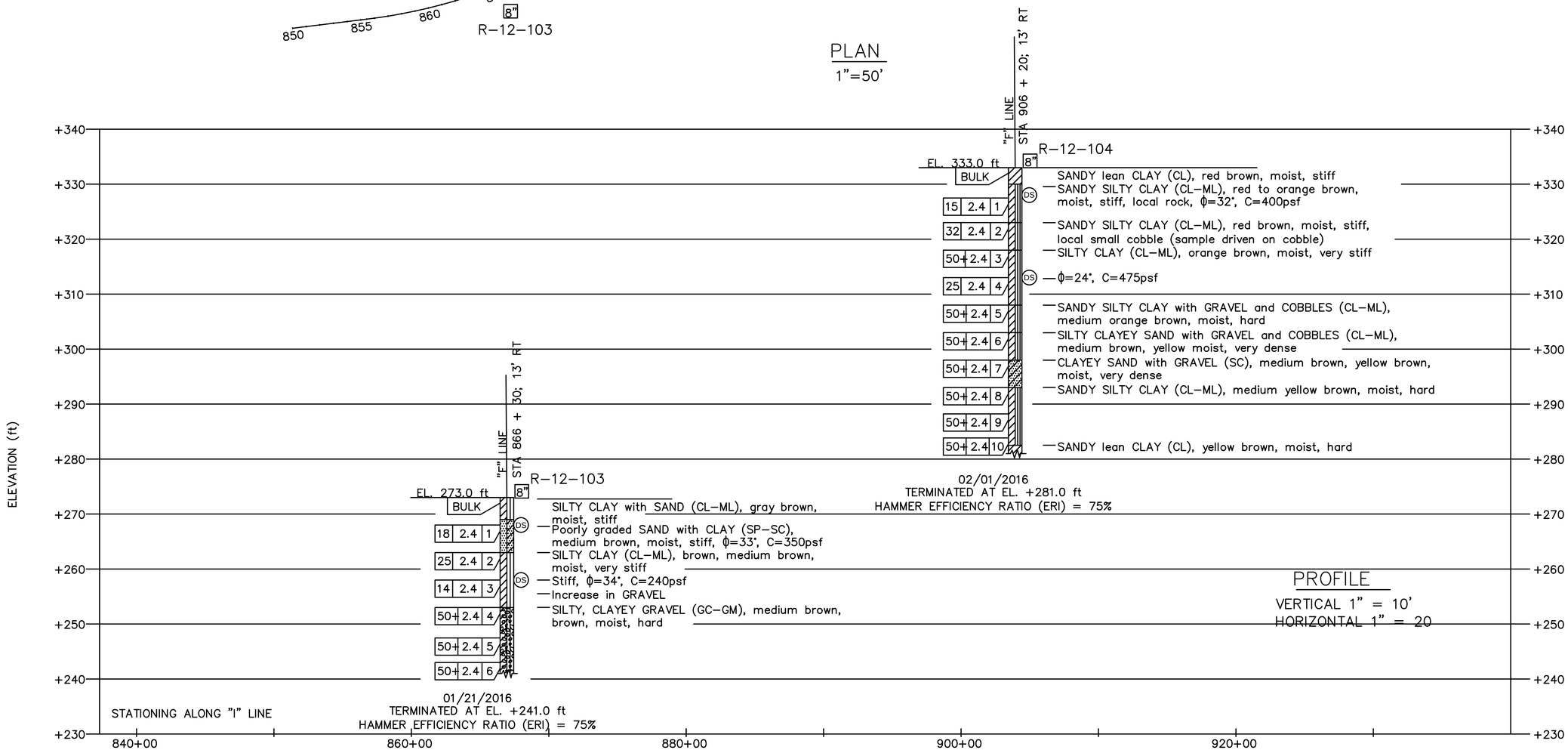
ORANGE COUNTY
TRANSPORTATION AUTHORITY
550 S. MAIN STREET
ORANGE, CA 92863-1584

NOTES:

(1) THIS LOTB SHEET WAS PREPARED IN ACCORDANCE WITH THE CALTRANS SOIL AND ROCK LOGGING, CLASSIFICATION AND PRESENTATION MANUAL (JUNE 2010).
(2) 2.4" SAMPLES WERE TAKEN USING A CALIFORNIA MODIFIED SAMPLER.
(3) AN AUTOMATIC TRIP HAMMER SYSTEM CONSISTING OF A HAMMER WEIGHT OF 140LBS FALLING A DISTANCE OF 30" WAS USED TO ADVANCE THE DRIVE SAMPLER.
(4) CONVERSION FACTOR FROM 2.4" MODIFIED CALIFORNIA RING SAMPLER BLOWCOUNTS TO STANDARD PENETRATION TEST (SPT) BLOWCOUNTS IS 0.65.



PLAN
1"=50'



PROFILE
VERTICAL 1" = 10'
HORIZONTAL 1" = 20

LOG OF TEST BORING
NO SCALE

LOTB– 4

REVISED BY	DATE REVISED
ARMANDO ROA	NOELLE TONEY

CALCULATED–DESIGNED BY
CHECKED BY

CONSULTANT FUNCTIONAL SUPERVISOR: GLENN FRASER

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION

LAST REVISION 02-08-16 — DATE PLOTTED => $DATE — TIME PLOTTED => $TIME

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER, DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 2998 | PROJECT NUMBER & PHASE 12130000931

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
12, 08	Ora, Riv	55, 91	14.7/R17.9, 7.5/18.9, R0.0/R1.6	218	251

Glenn S. Fraser — 02-19-16
REGISTERED CIVIL ENGINEER — DATE

02-19-16
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — GLENN S. FRASER — No. GE 2381 — EXP. 9/31/17 GEOTECHNICAL — STATE OF CALIFORNIA

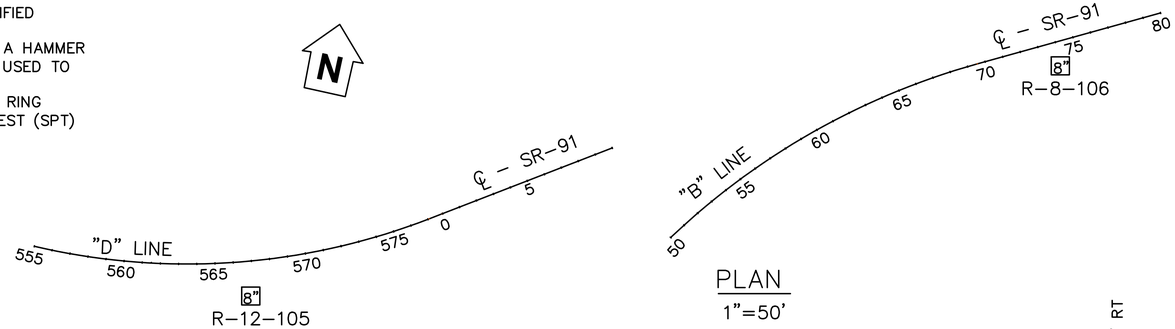
THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

GEOTEK, INC.
710 E PARKRIDGE AVE
STE 105
CORONA, CA 92879

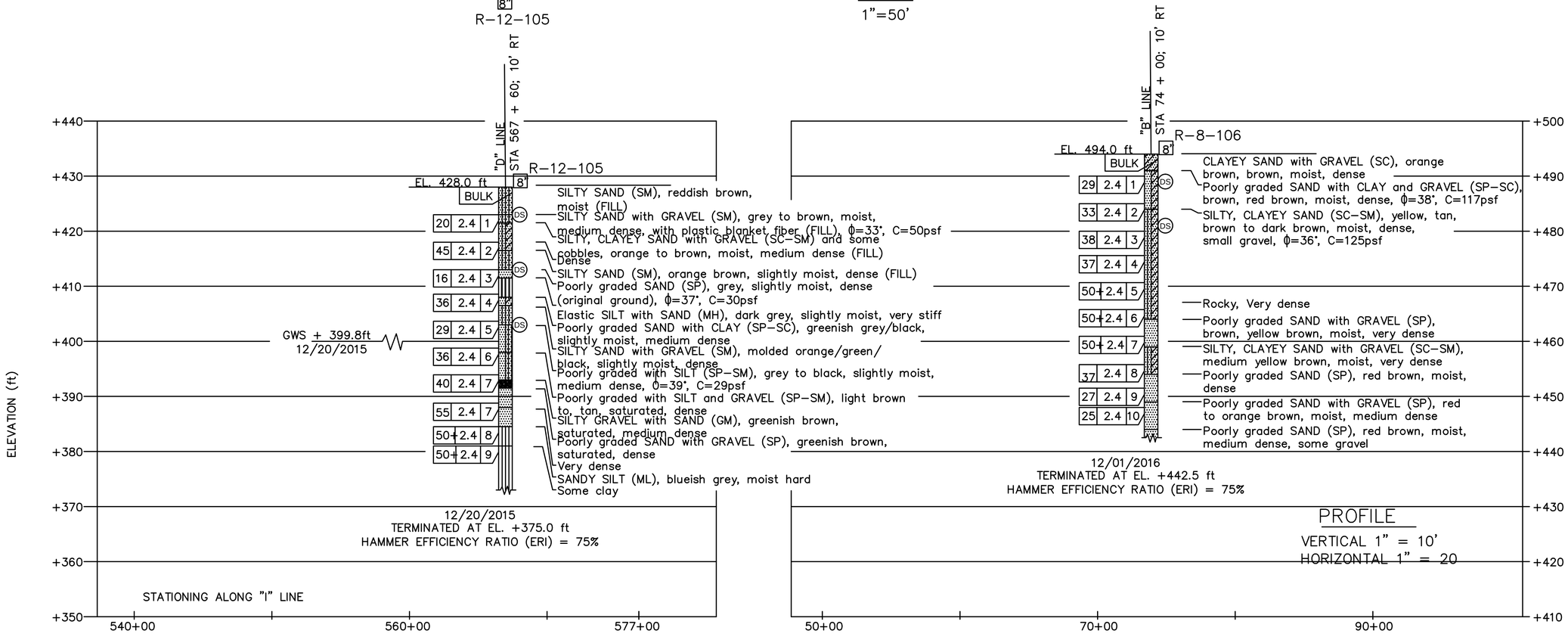
ORANGE COUNTY
TRANSPORTATION AUTHORITY
550 S. MAIN STREET
ORANGE, CA 92863-1584

NOTES:

(1) THIS LOTB SHEET WAS PREPARED IN ACCORDANCE WITH THE CALTRANS SOIL AND ROCK LOGGING, CLASSIFICATION AND PRESENTATION MANUAL (JUNE 2010).
(2) 2.4" SAMPLES WERE TAKEN USING A CALIFORNIA MODIFIED SAMPLER.
(3) AN AUTOMATIC TRIP HAMMER SYSTEM CONSISTING OF A HAMMER WEIGHT OF 140LBS FALLING A DISTANCE OF 30" WAS USED TO ADVANCE THE DRIVE SAMPLER.
(4) CONVERSION FACTOR FROM 2.4" MODIFIED CALIFORNIA RING SAMPLER BLOWCOUNTS TO STANDARD PENETRATION TEST (SPT) BLOWCOUNTS IS 0.65.



PLAN
1"=50'



PROFILE
VERTICAL 1" = 10'
HORIZONTAL 1" = 20

LOG OF TEST BORING
NO SCALE

LOTB– 5

CALCULATED–DESIGNED BY	CHECKED BY	REVISED BY	DATE REVISED
ARMANDO ROA	NOELLE TONEY		

CONSULTANT FUNCTIONAL SUPERVISOR: GLENN FRASER

STATE OF CALIFORNIA – DEPARTMENT OF TRANSPORTATION — Caltrans

LAST REVISION 02–08–16 | DATE PLOTTED => $DATE | TIME PLOTTED => $TIME

BORDER LAST REVISED 7/2/2010 | USERNAME =>$USER | DGN FILE => $REQUEST | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 2998 | PROJECT NUMBER & PHASE 12130000931

APPENDIX B

LIQUEFACTION ANALYSES

Portions of the SR-91 and SR-55 Freeways
Orange and Riverside County, California
Project No. 1397-CR

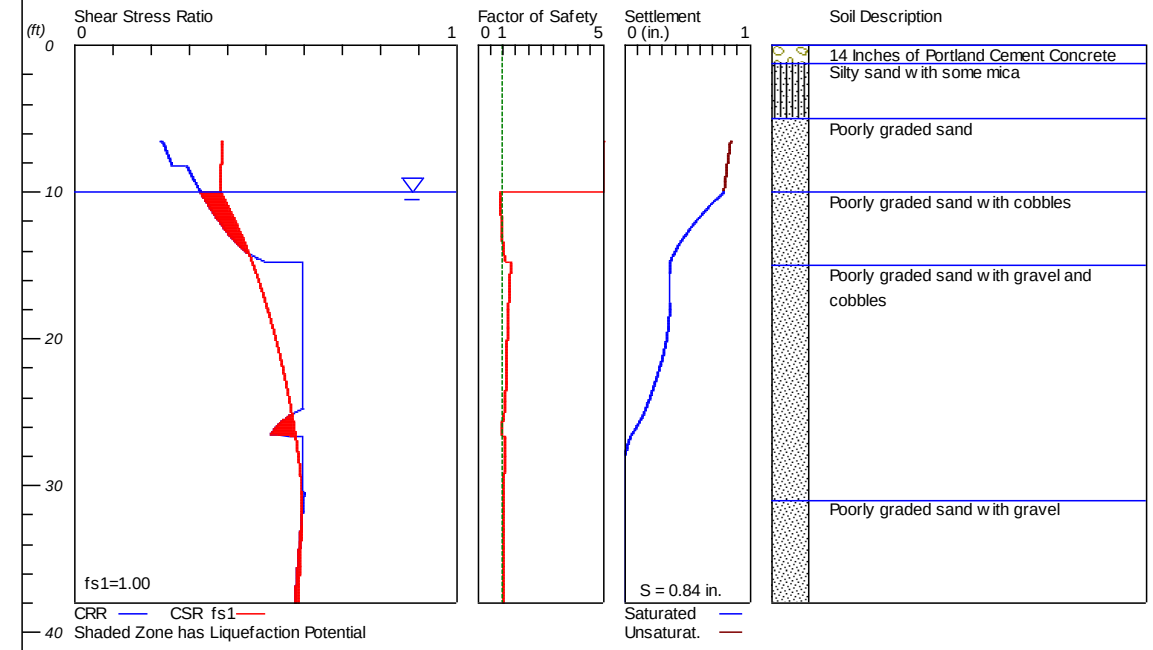
GEOTEK

LIQUEFACTION ANALYSIS

FOUNDATION REHABILITATION OF SIX CHANGEABLE MESSAGE SIGNS

Hole No.=R-12-101 Water Depth=10 ft

Magnitude=7.0
Acceleration=0.60g



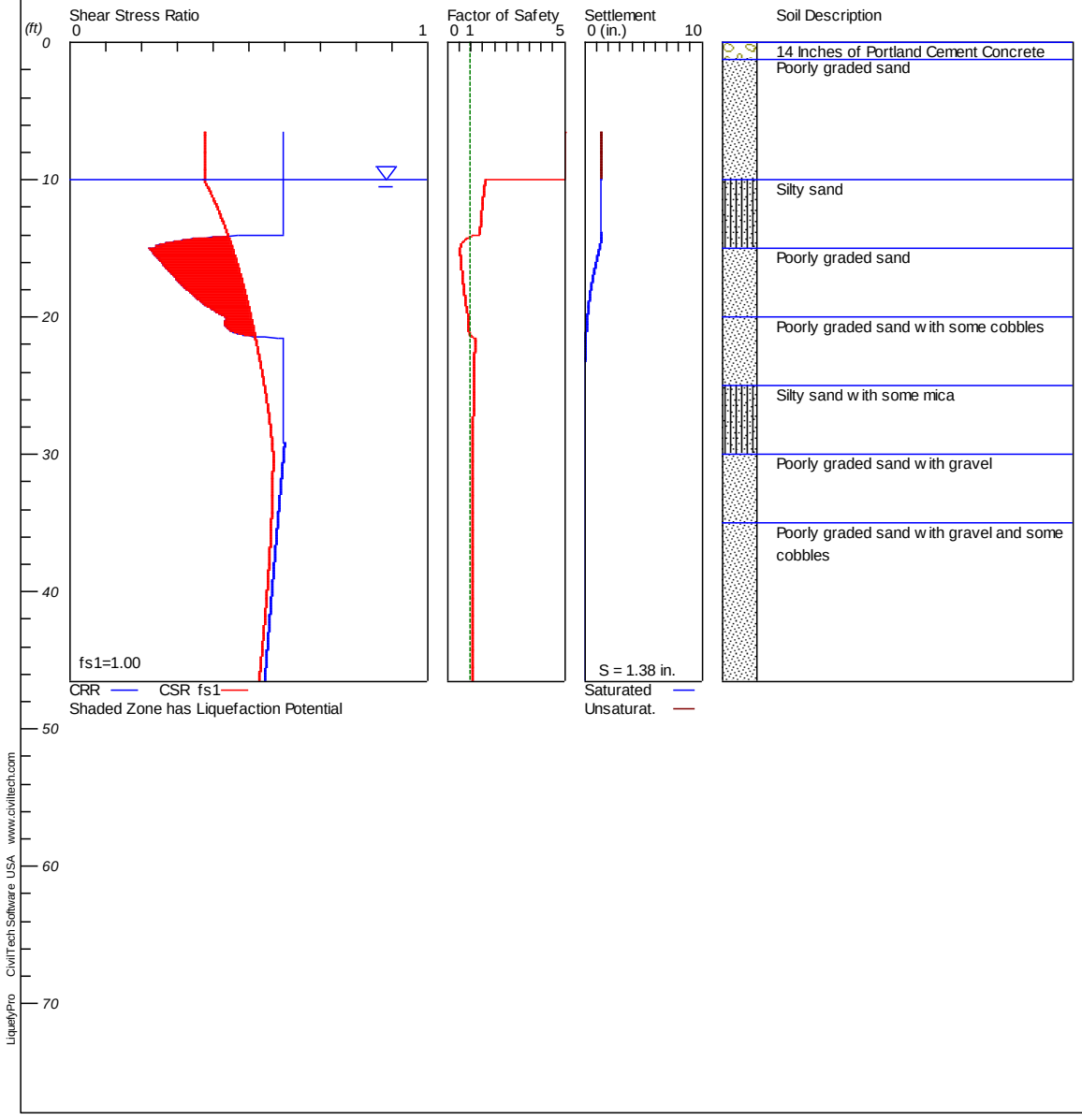
GeoTek, Inc.

LIQUEFACTION ANALYSIS

FOUNDATION REHABILITATION OF SIX CHANGEABLE MESSAGE SIGNS

Hole No.=R-12-102 Water Depth=10 ft

Magnitude=7.0
Acceleration=0.59g



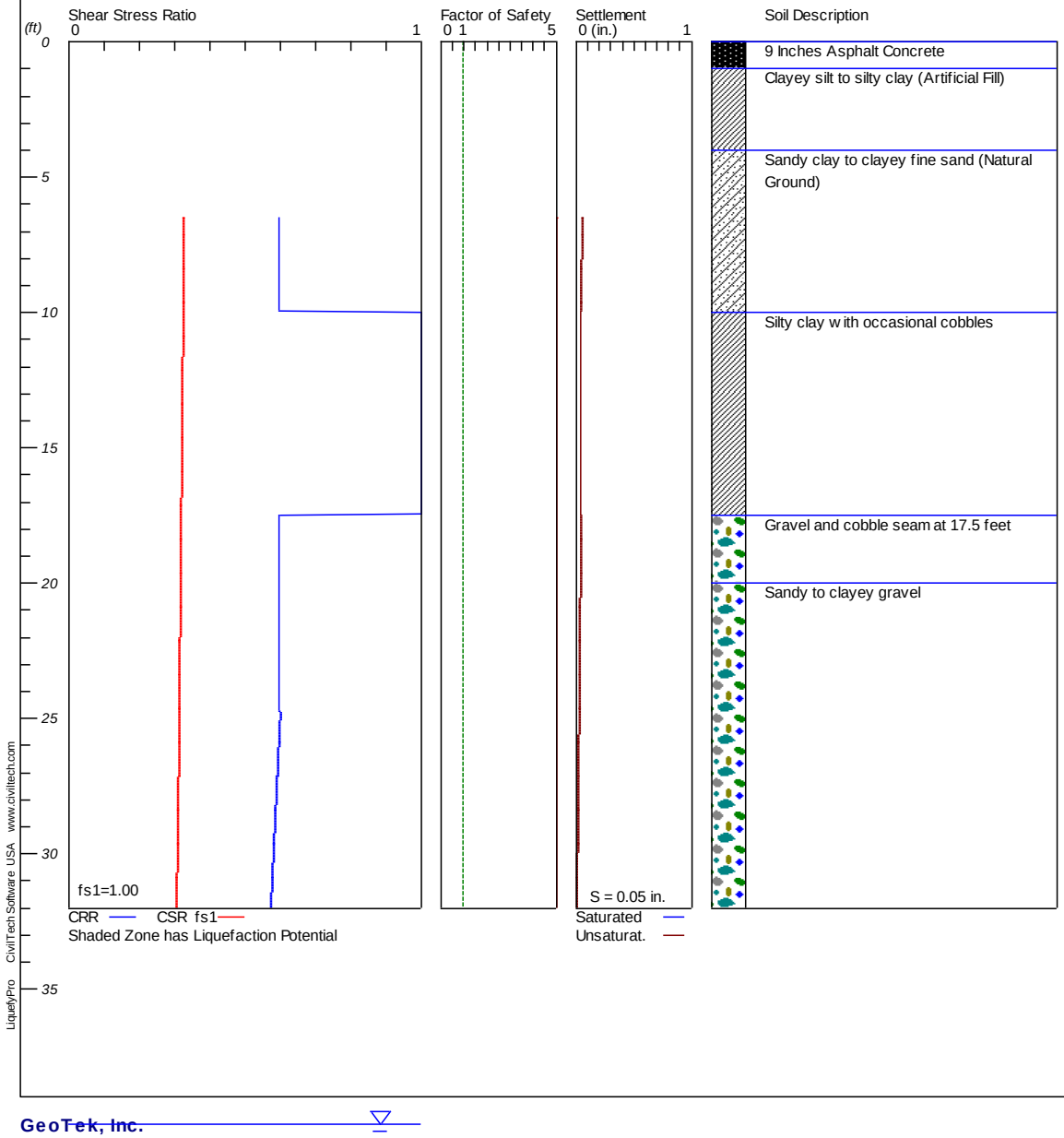
GeoTek, Inc.

LIQUEFACTION ANALYSIS

FOUNDATION REHABILITATION OF SIX CHANGEABLE MESSAGE SIGNS

Hole No.=R-12-103 Water Depth=40 ft

Magnitude=7.0
Acceleration=0.51g



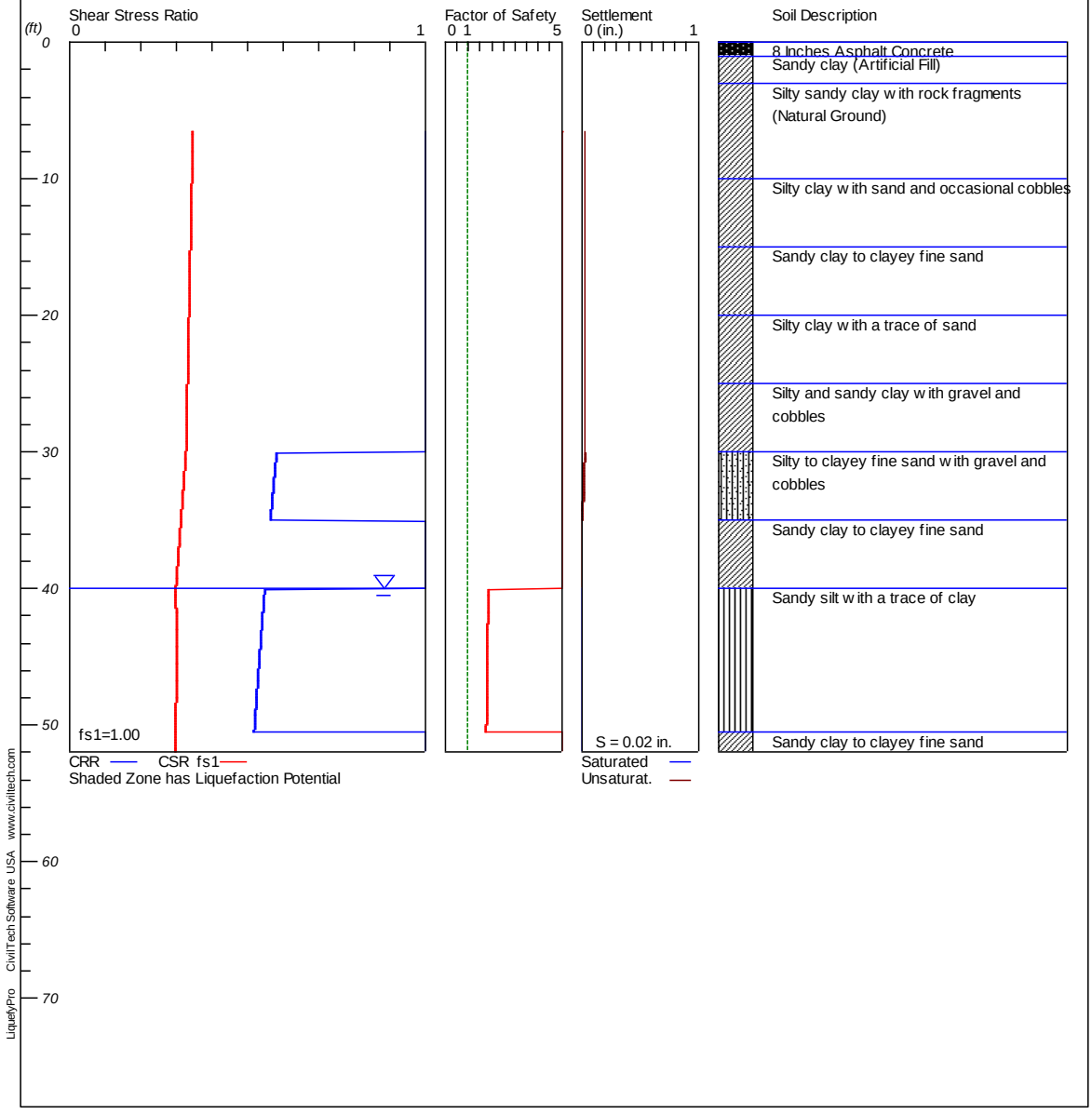
GeoTek, Inc.

LIQUEFACTION ANALYSIS

FOUNDATION REHABILITATION OF SIX CHANGEABLE MESSAGE SIGNS

Hole No.=R-12-104 Water Depth=40 ft

Magnitude=7.0
Acceleration=0.54g



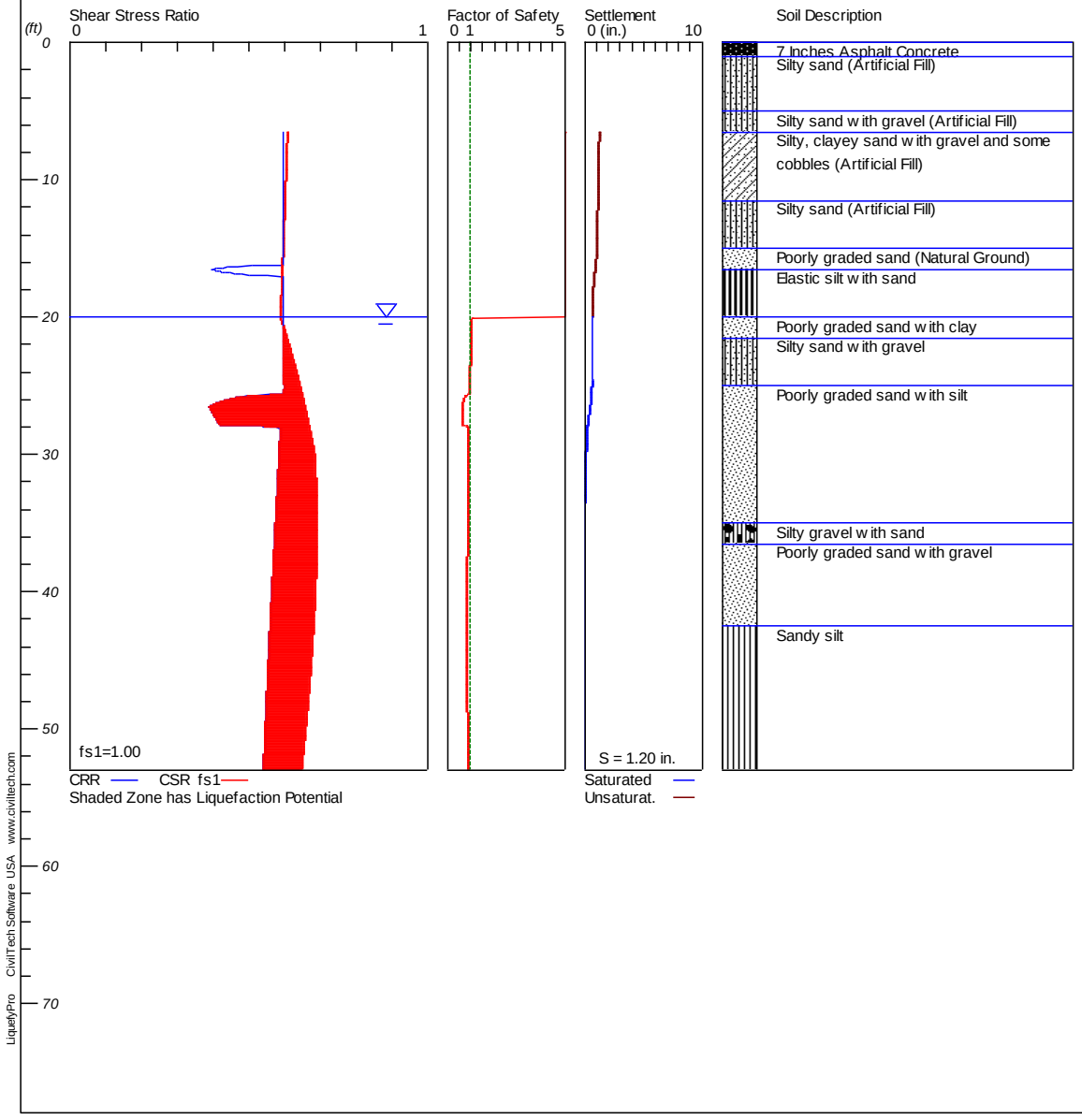
GeoTek, Inc.

LIQUEFACTION ANALYSIS

FOUNDATION REHABILITATION OF SIX CHANGEABLE MESSAGE SIGNS

Hole No.=R-12-105 Water Depth=20 ft

Magnitude=7.0
Acceleration=0.95g



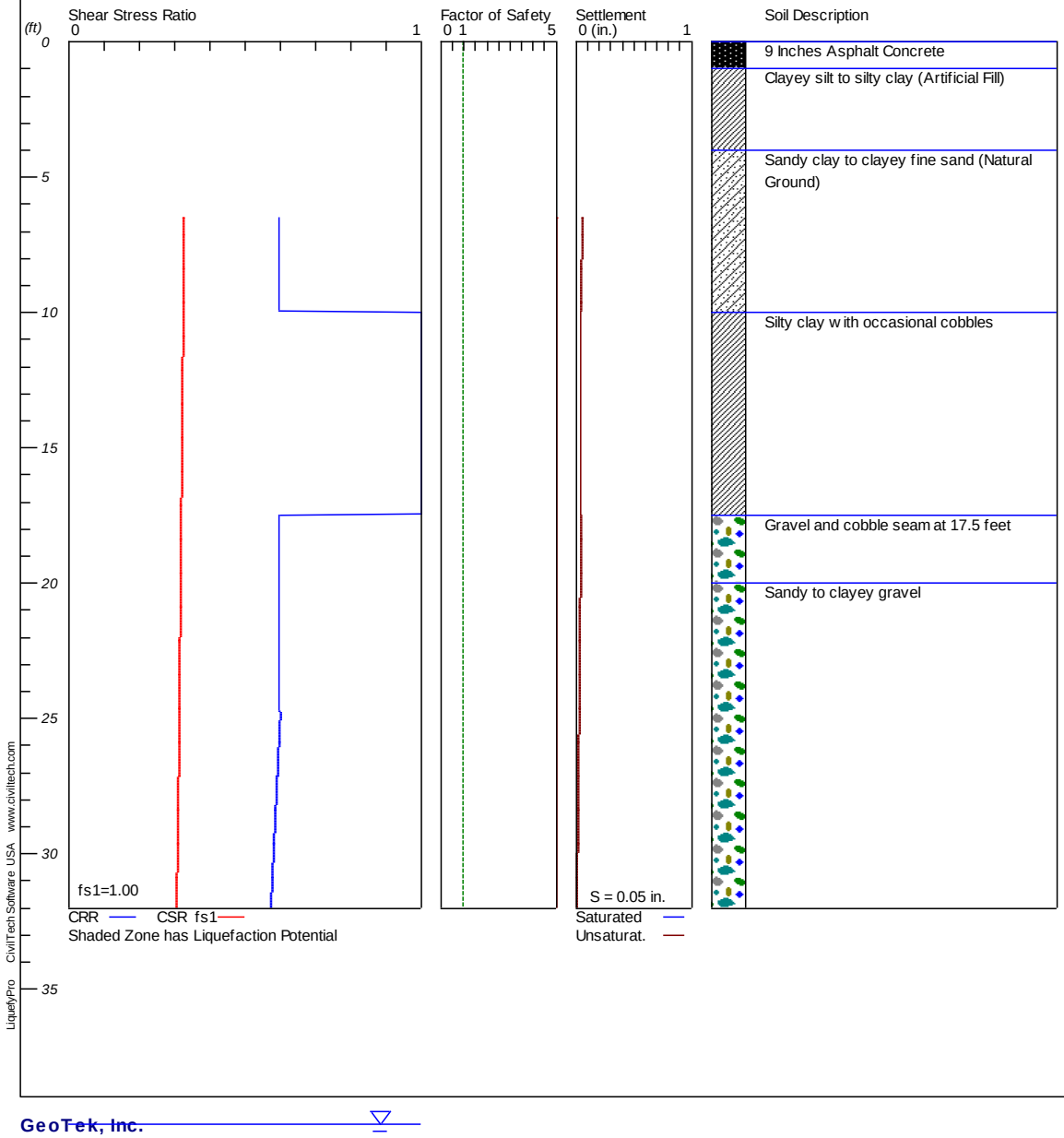
GeoTek, Inc.

LIQUEFACTION ANALYSIS

FOUNDATION REHABILITATION OF SIX CHANGEABLE MESSAGE SIGNS

Hole No.=R-12-103 Water Depth=40 ft

Magnitude=7.0
Acceleration=0.51g



GeoTek, Inc.

APPENDIX C

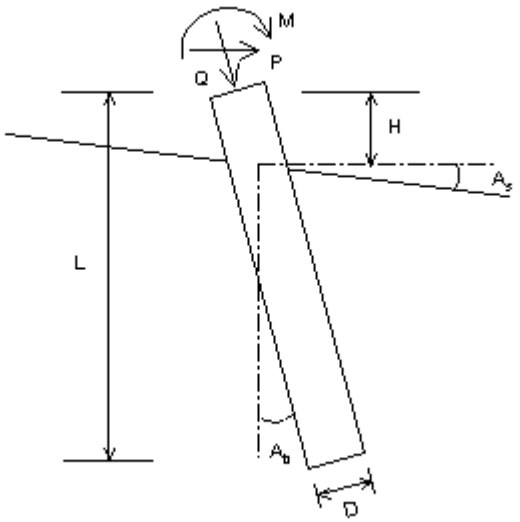
PILE DESIGN ANALYSES

Portions of the SR-91 and SR-55 Freeways
Orange and Riverside County, California
Project No. 1397-CR

GEOTEK

VERTICAL ANALYSIS

Figure 1



Drilled Shaft (dia >24 in. or 61 cm)

Loads:

Load Factor for Vertical Loads= 1.0
Load Factor for Lateral Loads= 1.0
Loads Supported by Pile Cap= 0 %
Shear Condition: Static

(with Load Factor)
Vertical Load, Q= 19.0 -kp
Torsion Load with Load Factor, T= 185.8 -kp-f

Profile:

Pile Length, L= 25.0 -ft
Top Height, H= 0 -ft
Slope Angle, As= 0
Batter Angle, Ab= 0

Soil Data:

Depth -ft	Gamma -lb/f3	Phi	C -kp/f2	K -lb/i3	e50 or Dr %	Nspt
0	116.1	29.0	0.10	52.2	37.48	11
10	121.0	36.2	0.00	100.8	52.15	19
30	60.8	38.1	0.00	97.6	66.59	31

Pile Data:

Depth -ft	Width -in	Area -in2	Per. -in	I -in4	E -kp/i2	Weight -kp/f
0.0	60	2827.4	188.5	636172.5	3000	2.945
25.0	60	2827.4	188.5	636172.5	3000	2.945

Vertical Capacity:

Weight above Ground= 0.00 Total Weight= 73.62-kp *Soil Weight is not included
Side Resistance (Down)= 231.850-kp Side Resistance (Up)= 139.231-kp
Tip Resistance (Down)= 0.000-kp Tip Resistance (Up)= 0.000-kp
Total Ultimate Capacity (Down) Qult= 231.850-kp Total Ultimate Capacity (Up)= 212.856-kp
Total Allowable Capacity (Down) Qallow= 105.386-kp Total Allowable Capacity (Up) Qallow= 145.092-kp
OK! Qallow > Q

Torsion Capacity:

Total Ultimate Torsion Capacity (single pile), T= 463.862-kp-f
Total Allowable Capacity (single pile), Tallow= 210.846-kp-f
OK! Tallow > T (Torsion Load)

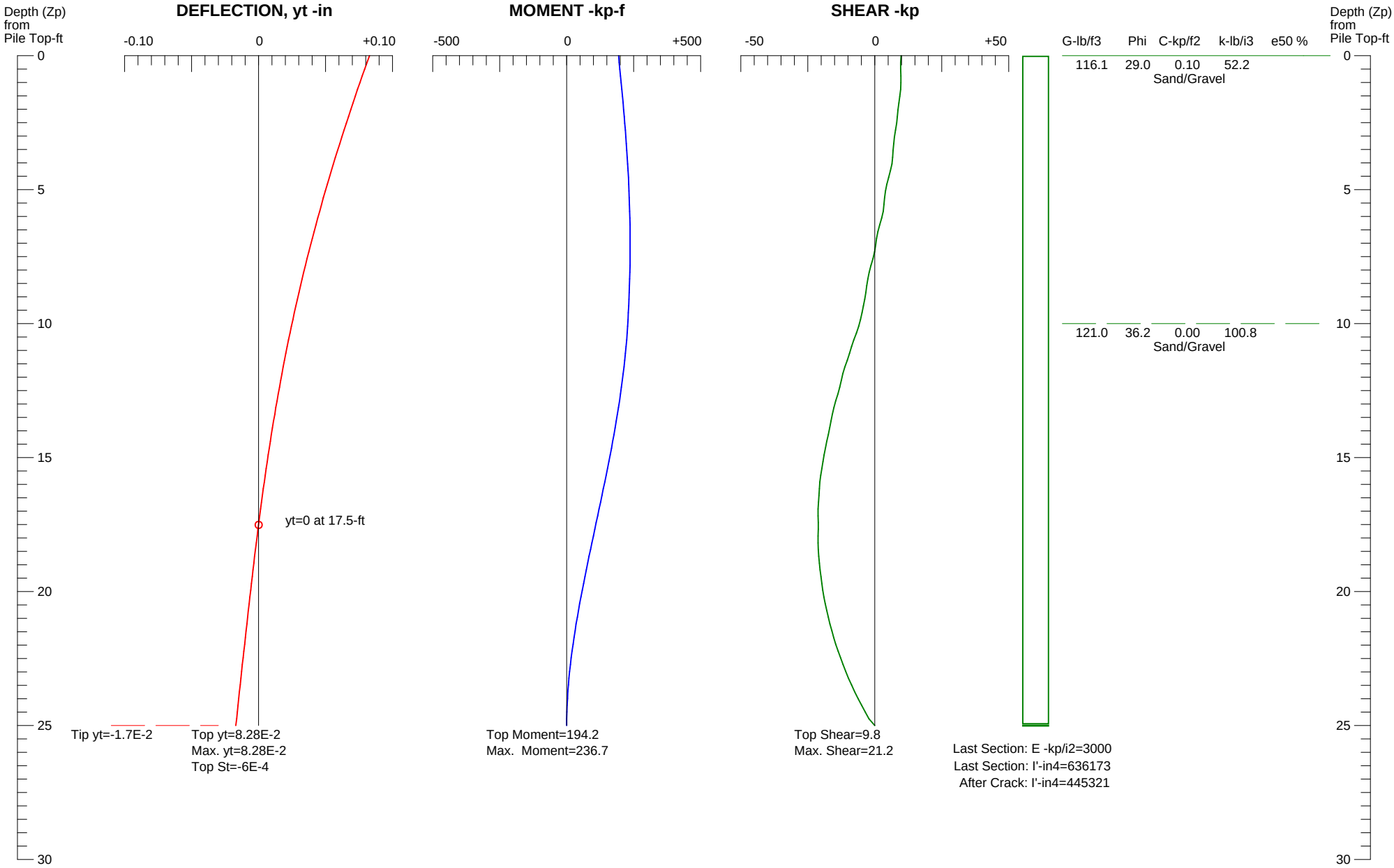
Settlement Calculation:

At Q= 18.96-kp Settlement= 0.01440-in
At Xallow= 0.30-in Q= 209.69731-kp

Note: If the program cannot find a result or the result exceeds the upper limit. The result will be displayed as 99999.

PILE DEFLECTION & FORCE vs DEPTH

Single Pile, Khead=1, Kbc=1



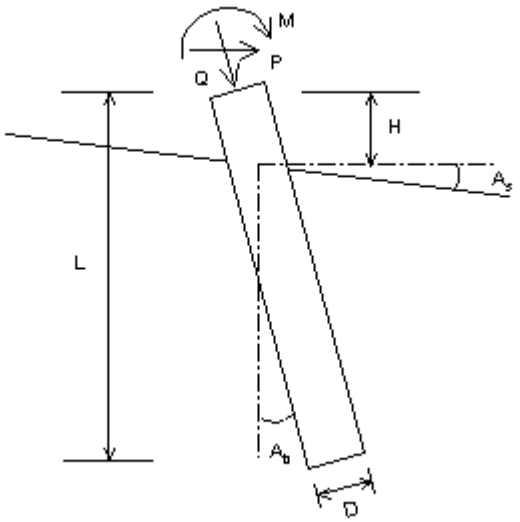
CivilTech Software

TRC/1397-CR
R-12-101

Figure 2

VERTICAL ANALYSIS

Figure 1



Drilled Shaft (dia >24 in. or 61 cm)

Loads:

Load Factor for Vertical Loads= 1.0
Load Factor for Lateral Loads= 1.0
Loads Supported by Pile Cap= 0 %
Shear Condition: Static

(with Load Factor)
Vertical Load, Q= 19.0 -kp
Torsion Load with Load Factor, T= 185.8 -kp-f

Profile:

Pile Length, L= 25.0 -ft
Top Height, H= 0 -ft
Slope Angle, As= 0
Batter Angle, Ab= 0

Soil Data:

Depth -ft	Gamma -lb/f3	Phi	C -kp/f2	K -lb/i3	e50 or Dr %	Nspt
0	124.4	32.0	0.00	198.7	72.92	38
10	130.4	30.0	0.08	280.9	86.04	51
15	121.5	32.0	0.00	110.0	54.49	20
25	123.3	30.0	0.08	169.4	67.47	32
30	125.1	32.0	0.00	211.9	75.23	40

Pile Data:

Depth -ft	Width -in	Area -in2	Per. -in	I -in4	E -kp/i2	Weight -kp/f
0.0	60	2827.4	188.5	636172.5	3000	2.945
25.0	60	2827.4	188.5	636172.5	3000	2.945

Vertical Capacity:

Weight above Ground= 0.00 Total Weight= 73.62-kp *Soil Weight is not included
Side Resistance (Down)= 209.380-kp Side Resistance (Up)= 122.344-kp
Tip Resistance (Down)= 0.000-kp Tip Resistance (Up)= 0.000-kp
Total Ultimate Capacity (Down) Qult= 209.380-kp Total Ultimate Capacity (Up)= 195.969-kp
Total Allowable Capacity (Down) Qallow= 95.173-kp Total Allowable Capacity (Up) Qallow= 137.417-kp
OK! Qallow > Q

Torsion Capacity:

Total Ultimate Torsion Capacity (single pile), T= 414.666-kp-f
Total Allowable Capacity (single pile), Tallow= 188.484-kp-f
OK! Tallow > T (Torsion Load)

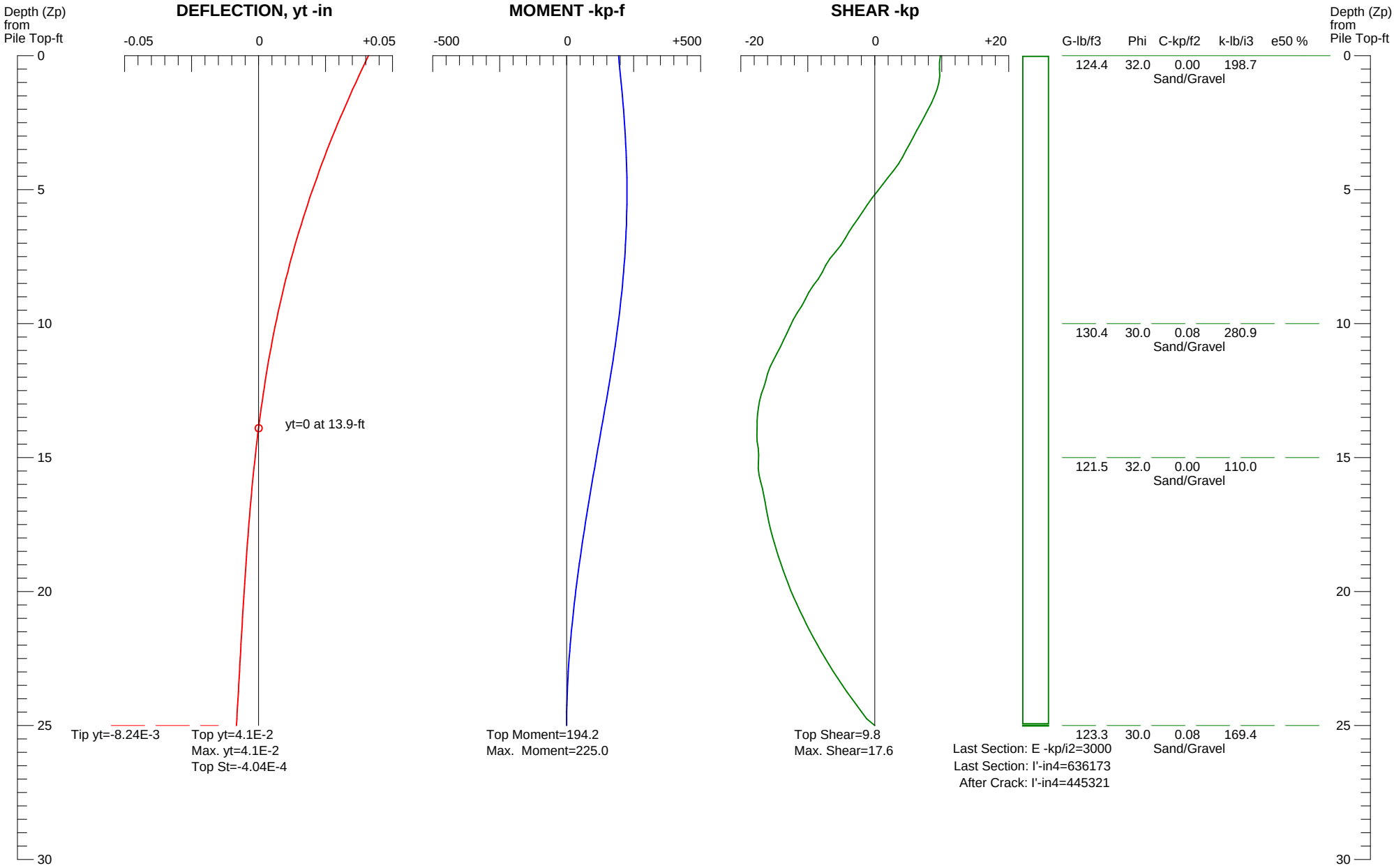
Settlement Calculation:

At Q= 18.96-kp Settlement= 0.01604-in
At Xallow= 0.30-in Q= 189.44377-kp

Note: If the program cannot find a result or the result exceeds the upper limit. The result will be displayed as 99999.

PILE DEFLECTION & FORCE vs DEPTH

Single Pile, Khead=1, Kbc=1



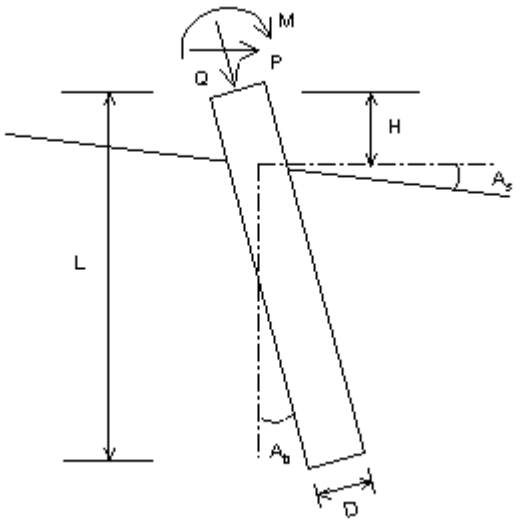
CivilTech Software

TRC/1397-CR
R-12-102

Figure 2

VERTICAL ANALYSIS

Figure 1



Drilled Shaft (dia >24 in. or 61 cm)

Loads:

Load Factor for Vertical Loads= 1.0
Load Factor for Lateral Loads= 1.0
Loads Supported by Pile Cap= 0 %
Shear Condition: Static

(with Load Factor)
Vertical Load, Q= 19.0 -kp
Torsion Load with Load Factor, T= 185.8 -kp-f

Profile:

Pile Length, L= 20.0 -ft
Top Height, H= 0.0 -ft
Slope Angle, As= 0
Batter Angle, Ab= 0

Soil Data:

Depth -ft	Gamma -lb/f3	Phi	C -kp/f2	K -lb/i3	e50 or Dr %	Nspt
0	132.3	33.1	0.35	677.1	0.62	17
15	131.4	34.0	0.24	474.9	0.73	13
20	136.9	42.1	0.00	355.1	95.94	60
30	136.9	42.1	0.00	355.1	95.94	60

Pile Data:

Depth -ft	Width -in	Area -in2	Per. -in	I -in4	E -kp/i2	Weight -kp/f
0.0	60	2827.4	188.5	636172.5	3000	2.945
20.0	60	2827.4	188.5	636172.5	3000	2.945

Vertical Capacity:

Weight above Ground= 0.00 Total Weight= 58.90-kp *Soil Weight is not included
Side Resistance (Down)= 248.242-kp Side Resistance (Up)= 185.297-kp
Tip Resistance (Down)= 0.000-kp Tip Resistance (Up)= 0.000-kp
Total Ultimate Capacity (Down) Qult= 248.242-kp Total Ultimate Capacity (Up)= 244.197-kp
Total Allowable Capacity (Down) Qallow= 112.837-kp Total Allowable Capacity (Up) Qallow= 149.670-kp
OK! Qallow > Q

Torsion Capacity:

Total Ultimate Torsion Capacity (single pile), T= 541.937-kp-f
Total Allowable Capacity (single pile), Tallow= 246.335-kp-f
OK! Tallow > T (Torsion Load)

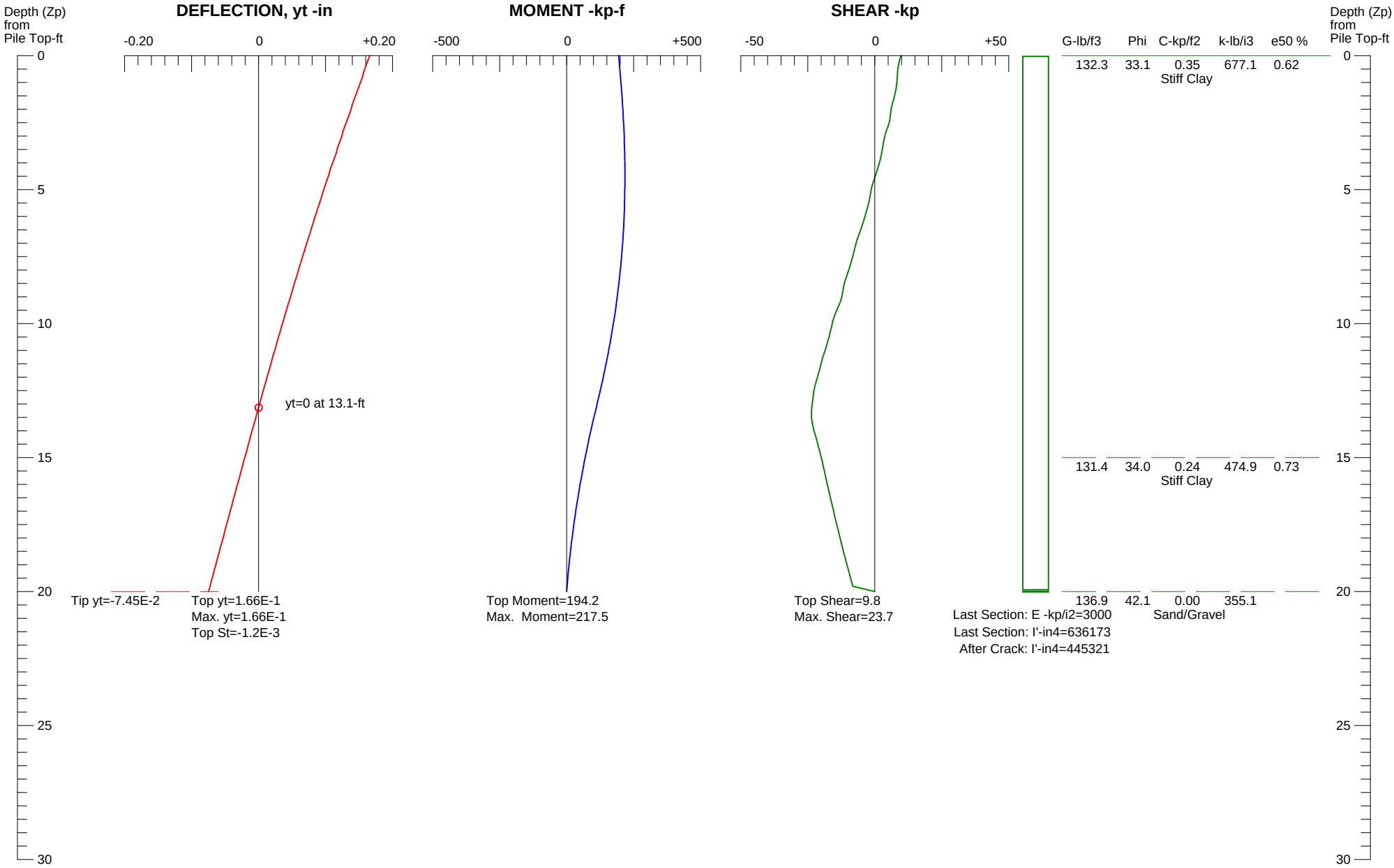
Settlement Calculation:

At Q= 18.96-kp Settlement= 0.01818-in
At Xallow= 0.30-in Q= 201.98708-kp

Note: If the program cannot find a result or the result exceeds the upper limit. The result will be displayed as 99999.

PILE DEFLECTION & FORCE vs DEPTH

Single Pile, Khead=1, Kbc=1



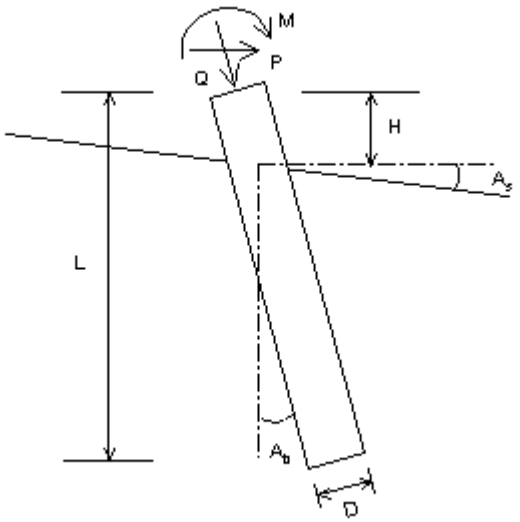
CivilTech Software

TRC/1397-CR
R-12-103

Figure 2

VERTICAL ANALYSIS

Figure 1



Drilled Shaft (dia >24 in. or 61 cm)

Loads:

Load Factor for Vertical Loads= 1.0
Load Factor for Lateral Loads= 1.0
Loads Supported by Pile Cap= 0 %
Shear Condition: Static

(with Load Factor)
Vertical Load, Q= 19.0 -kp
Torsion Load with Load Factor, T= 185.8 -kp-f

Profile:

Pile Length, L= 25.0 -ft
Top Height, H= 0.0 -ft
Slope Angle, As= 0
Batter Angle, Ab= 0

Soil Data:

Depth -ft	Gamma -lb/f3	Phi	C -kp/f2	K -lb/i3	e50 or Dr %	Nspt
0	130.6	32.0	0.40	392.7	0.79	12
10	133.9	0.0	.31	1086.8	0.50	25
20	132.6	24.0	0.46	814.1	0.57	20
30	134.3	41.1	0.00	325.2	92.13	56
35	140.2	0.0	.75	2906.0	0.29	60
40	136.7	35.5	.2	1508.4	0.43	33

Pile Data:

Depth -ft	Width -in	Area -in2	Per. -in	I -in4	E -kp/i2	Weight -kp/f
0.0	60	2827.4	188.5	636172.5	3000	2.945
25.0	60	2827.4	188.5	636172.5	3000	2.945

Vertical Capacity:

Weight above Ground= 0.00 Total Weight= 73.62-kp *Soil Weight is not included
Side Resistance (Down)= 238.712-kp Side Resistance (Up)= 199.660-kp
Tip Resistance (Down)= 0.000-kp Tip Resistance (Up)= 0.000-kp
Total Ultimate Capacity (Down) Qult= 238.712-kp Total Ultimate Capacity (Up)= 273.285-kp
Total Allowable Capacity (Down) Qallow= 108.505-kp Total Allowable Capacity (Up) Qallow= 172.560-kp
OK! Qallow > Q

Torsion Capacity:

Total Ultimate Torsion Capacity (single pile), T= 547.979-kp-f
Total Allowable Capacity (single pile), Tallow= 249.081-kp-f
OK! Tallow > T (Torsion Load)

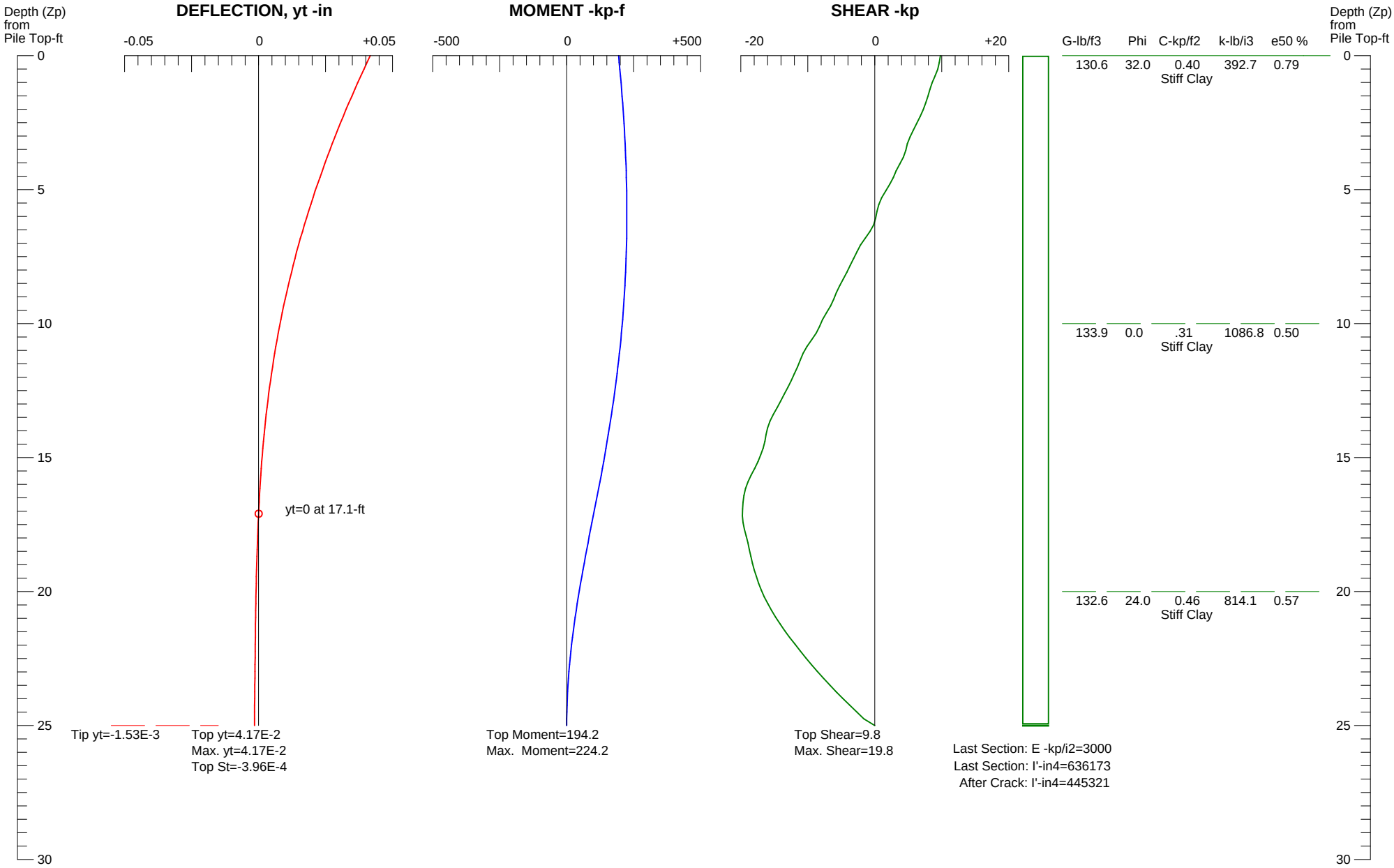
Settlement Calculation:

At Q= 18.96-kp Settlement= 0.00747-in
At Xallow= 0.30-in Q= 238.70236-kp

Note: If the program cannot find a result or the result exceeds the upper limit. The result will be displayed as 99999.

PILE DEFLECTION & FORCE vs DEPTH

Single Pile, Khead=1, Kbc=1



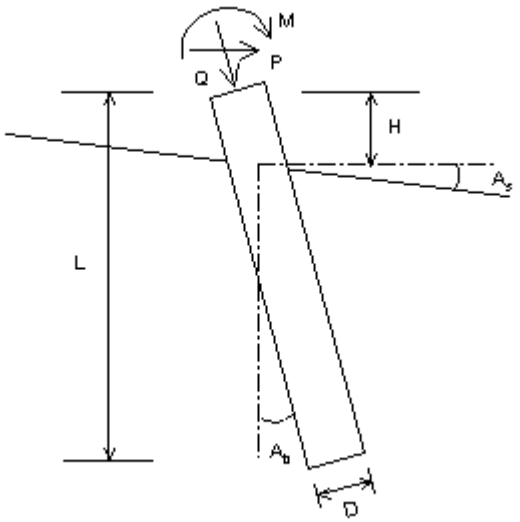
CivilTech Software

TRC/1397-CR
R-12-104

Figure 2

VERTICAL ANALYSIS

Figure 1



Drilled Shaft (dia >24 in. or 61 cm)

Loads:

Load Factor for Vertical Loads= 1.0
Load Factor for Lateral Loads= 1.0
Loads Supported by Pile Cap= 0 %
Shear Condition: Static

(with Load Factor)
Vertical Load, Q= 19.0 -kp
Torsion Load with Load Factor, T= 185.8 -kp-f

Profile:

Pile Length, L= 25.0 -ft
Top Height, H= 0 -ft
Slope Angle, As= 0
Batter Angle, Ab= 0

Soil Data:

Depth -ft	Gamma -lb/f3	Phi	C -kp/f2	K -lb/i3	e50 or Dr %	Nspt
0	131.1	33.0	0.05	440.8	0.75	13
15	123.1	37.0	0.02	161.0	65.80	30
16.5	131.9	31.7	0.30	579.6	0.67	16
20	122.8	37.8	0.00	150.1	63.56	28
25	117.3	32.0	0.02	60.7	40.45	12
27.5	54.6	32.0	0.02	40.4	39.78	12
30	60.3	37.7	0.00	87.6	62.72	27
36.5	55.2	34.2	0.00	42.6	41.10	13
42.5	77.5	37.7	3.43	2684.4	0.31	55

Pile Data:

Depth -ft	Width -in	Area -in2	Per. -in	I -in4	E -kp/i2	Weight -kp/f
0.0	60	2827.4	188.5	636172.5	3000	2.945
25.0						

Vertical Capacity:

Weight above Ground= 0.00 Total Weight= 73.62-kp *Soil Weight is not included
Side Resistance (Down)= 265.551-kp Side Resistance (Up)= 164.088-kp
Tip Resistance (Down)= 0.000-kp Tip Resistance (Up)= 0.000-kp
Total Ultimate Capacity (Down) Qult= 265.551-kp Total Ultimate Capacity (Up)= 237.713-kp
Total Allowable Capacity (Down) Qallow= 120.705-kp Total Allowable Capacity (Up) Qallow= 156.391-kp
OK! Qallow > Q

Torsion Capacity:

Total Ultimate Torsion Capacity (single pile), T= 537.061-kp-f
Total Allowable Capacity (single pile), Tallow= 244.119-kp-f
OK! Tallow > T (Torsion Load)

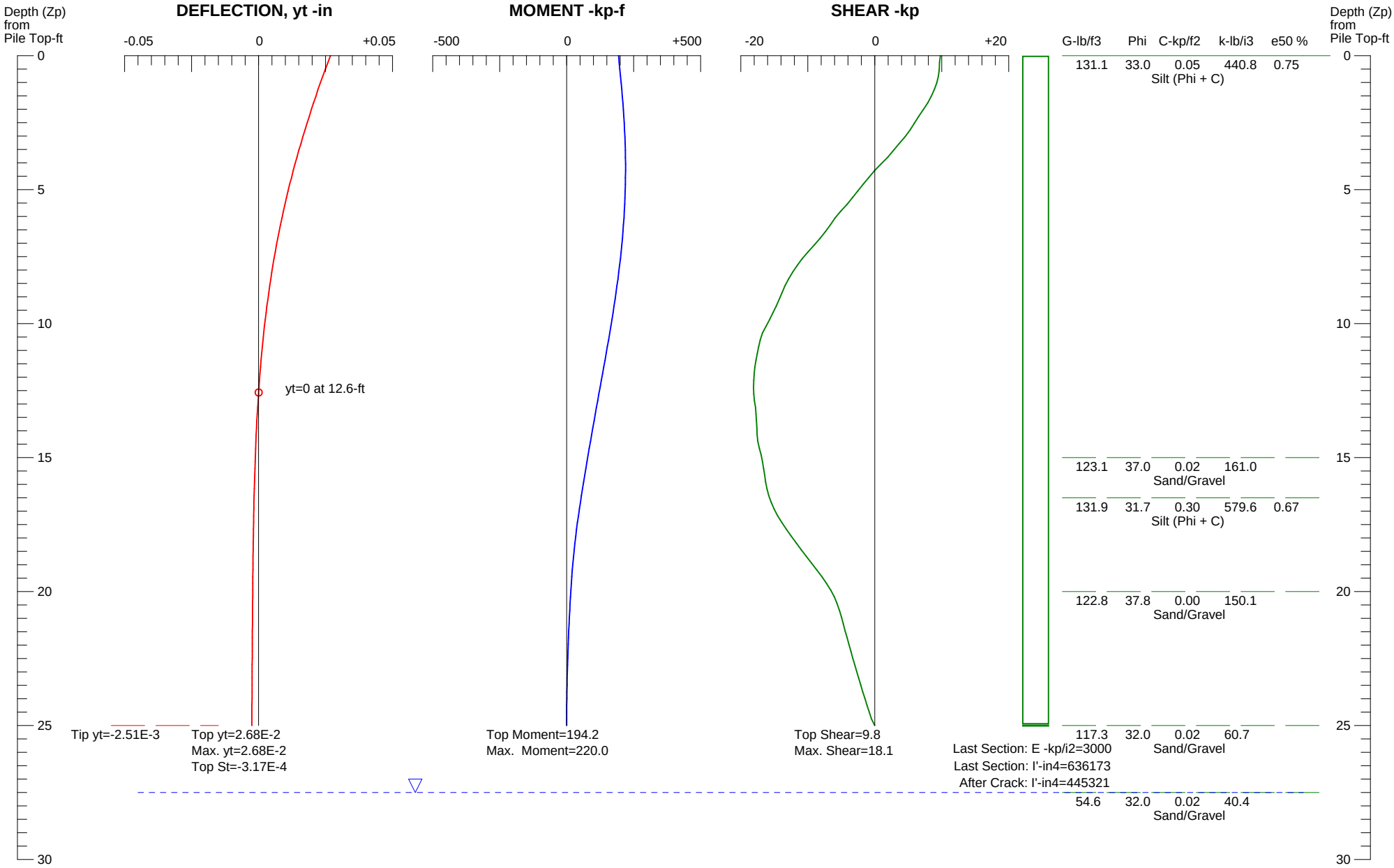
Settlement Calculation:

At Q= 18.96-kp Settlement= 0.01311-in
At Xallow= 0.30-in Q= 238.29904-kp

Note: If the program cannot find a result or the result exceeds the upper limit. The result will be displayed as 99999.

PILE DEFLECTION & FORCE vs DEPTH

Single Pile, Khead=1, Kbc=1



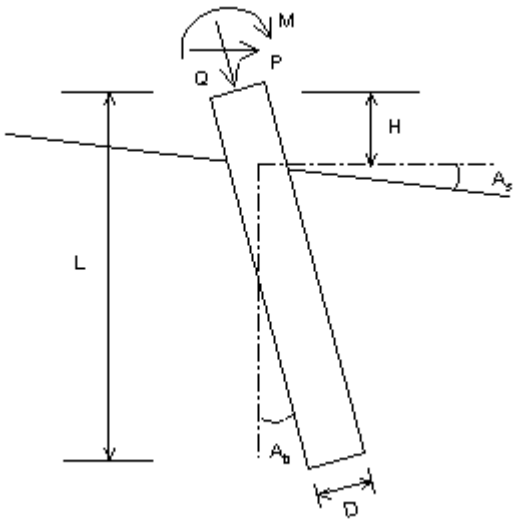
CivilTech Software

TRC/1397-CR
R-12-105

Figure 2

VERTICAL ANALYSIS

Figure 1



Drilled Shaft (dia >24 in. or 61 cm)

Loads:

Load Factor for Vertical Loads= 1.0
Load Factor for Lateral Loads= 1.0
Loads Supported by Pile Cap= 0 %
Shear Condition: Static

(with Load Factor)
Vertical Load, Q= 19.0 -kp
Torsion Load with Load Factor, T= 185.8 -kp-f

Profile:

Pile Length, L= 25.0 -ft
Top Height, H= 0 -ft
Slope Angle, As= 0
Batter Angle, Ab= 0

Soil Data:

Depth -ft	Gamma -lb/f3	Phi	C -kp/f2	K -lb/i3	e50 or Dr %	Nspt
0	121.8	38.0	0.11	115.6	55.85	21
10	124.9	36.4	0.12	208.6	74.65	39
20	125.2	39.0	0.00	213.6	75.52	40
30	74.5	42.1	0.00	197.2	95.94	60
40	62.8	39.0	0.00	123.1	75.52	40
45	59.7	37.0	0.00	75.3	57.53	23
50	60.0	37.4	0.00	81.7	60.29	25

Pile Data:

Depth -ft	Width -in	Area -in2	Per. -in	I -in4	E -kp/i2	Weight -kp/f
0.0	60	2827.4	188.5	636172.5	3000	2.945
25.0	60	2827.4	188.5	636172.5	3000	2.945

Vertical Capacity:

Weight above Ground= 0.00 Total Weight= 73.62-kp *Soil Weight is not included
Side Resistance (Down)= 280.853-kp Side Resistance (Up)= 176.002-kp
Tip Resistance (Down)= 0.000-kp Tip Resistance (Up)= 0.000-kp
Total Ultimate Capacity (Down) Qult= 280.853-kp Total Ultimate Capacity (Up)= 249.627-kp
Total Allowable Capacity (Down) Qallow= 127.660-kp Total Allowable Capacity (Up) Qallow= 161.807-kp
OK! Qallow > Q

Torsion Capacity:

Total Ultimate Torsion Capacity (single pile), T= 571.083-kp-f
Total Allowable Capacity (single pile), Tallow= 259.583-kp-f
OK! Tallow > T (Torsion Load)

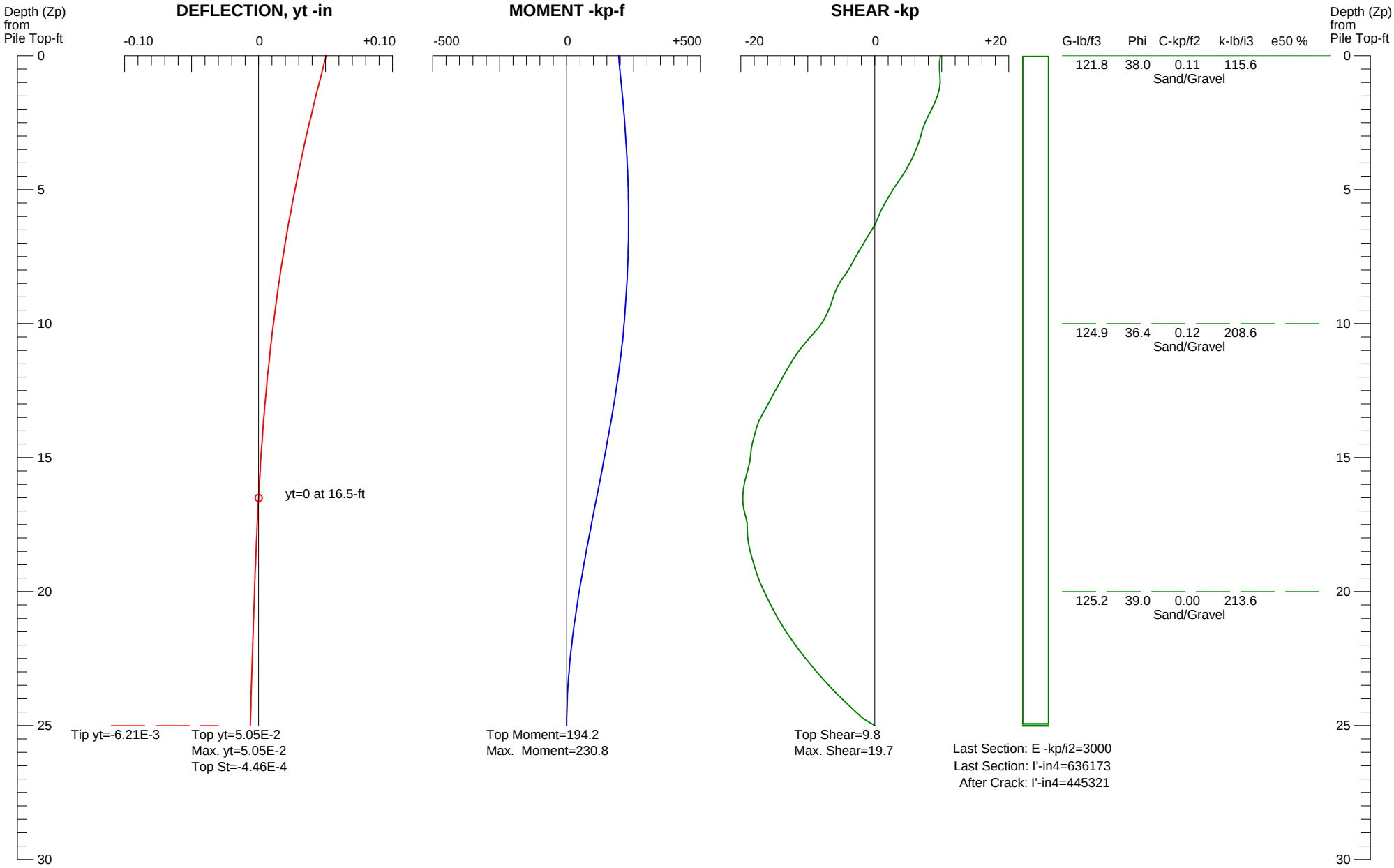
Settlement Calculation:

At Q= 18.96-kp Settlement= 0.01174-in
At Xallow= 0.30-in Q= 253.81714-kp

Note: If the program cannot find a result or the result exceeds the upper limit. The result will be displayed as 99999.

PILE DEFLECTION & FORCE vs DEPTH

Single Pile, Khead=1, Kbc=1



CivilTech Software

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Figure 2