SECTION 1. GENERAL

1.1 Introduction

This report presents the results of our geotechnical engineering exploration performed for the "Freeway Management System, Phase 2, Federal Aid Project No. NH-0300(160), Districts of Honolulu and Ewa, Island of Oahu" project from Waipahu to Honolulu on the Island of Oahu, Hawaii. The project locations and general vicinities are shown on the Project Location Map, Plate 1.

This report summarizes the findings and presents our geotechnical engineering recommendations derived from our field exploration, laboratory testing, and engineering analyses. These recommendations are only intended for the design of closed circuit television (CCTV), variable message sign (VMS), and speed reader foundations only. The findings and recommendations presented herein are subject to the limitations noted at the end of this report.

1.2 Project Considerations

The project consists of the installation of closed circuit television (CCTV) camera and variable message sign (VMS) structures generally along Interstate Route H-1 and H-2 Freeways and Farrington Highway in the Districts of Honolulu and Ewa on the Island of Oahu, Hawaii. Five CCTV cameras will be mounted on independent poles 50 to 60 feet high. The CCTV locations are presented in the following table.

CCTV Identification	Location	Interstate Route
Palailai CCTV	Palailai Interchange	H-1 Freeway
Kualakai CCTV	Kualakai Parkway Interchange	H-1 Freeway
Waipio CCTV	Waipio Interchange	H-2 Freeway
H-2 CCTV	South of Waipio Interchange	H-2 Freeway
Kunia West CCTV	West of Kunia Interchange	H-1 Freeway

Three VMS structures will be installed for the project. The VMS locations are presented in the following table.

VMS Identification	Location	Route	Structure Type
Farrington VMS	West of Palailai Interchange	Farrington Highway	Butterfly Offset
Kualakai VMS	East of Kualakai Parkway Interchange	H-1 Freeway	Butterfly Offset
H-2 VMS	South of Waipio Interchange	H-2 Freeway	Monotube Bridge

In addition, four spot speed readers are planned for the project. The speed readers will be installed between Palailai Interchange and Honokai Hale. Based on the information provided, two speed readers will be installed on existing traffic/overhead sign structures, and two will be installed on 25-foot high pole structures.

The following structural load information acting at the base of the poles were provided by the project structural engineer for our analysis of the new CCTV, VMS, and speed reader foundation design.

CCTV AND SPEED READER STRUCTURAL LOAD INFORMATION					
Structure	**Loading Condition**	**Vertical Load** (kips)	**Lateral Loads** (kips)	**Overturning Moments** (kip-feet)	**Torsion** (kip-feet)
CCTV	Service	F_y = -20 (compression)	F_x = 1.5 F_z = 5	M_x = 150 M_z = 45	M_y = 1.5
	Strength	F_y = 4 (uplift)	F_x = 0 F_z = 0	M_x = 0 M_z = 0	M_y = 0
	Extreme Event	F_y = 4 (uplift)	F_x = 3 F_z = 3	M_x = 83 M_z = -81	M_y = -1
Speed Reader	Service	F_y = -2.6 (compression)	F_x = 1.3 F_z = 1.3	M_x = 23 M_z = 23	M_y = -0.7
	Strength	F_y = 3 (uplift)	F_x = 0 F_z = 0	M_x = 0 M_z = 0	M_y = 0
	Extreme Event	F_y = 3 (uplift)	F_x = 2 F_z = 2	M_x = 28 M_z = -25	M_y = -1

VMS STRUCTURAL LOAD INFORMATION					
Identification	**Loading Condition**	**Vertical Load** (kips)	**Lateral Loads** (kips)	**Overturning Moments** (kip-feet)	**Torsion** (kip-feet)
Farrington VMS and Kualakai VMS	Service	F_y = -40 (compression)	F_x = -2 F_z = -25	M_x = 300 M_z = 625	M_y = -150
	Strength	F_y = 72 (uplift)	F_x = 0 F_z = 0	M_x = -57 M_z = -216	M_y = 0
	Extreme Event 1	F_y = 36 (uplift)	F_x = 0 F_z = 36	M_x = 865 M_z = -60	M_y = 134
	Extreme Event 2	F_y = 36 (uplift)	F_x = 0 F_z = 25	M_x = 577 M_z = -60	M_y = 219
H-2 VMS	Service	F_y = -40 (compression)	F_x = 35 F_z = -35	M_x = 350 M_z = 825	M_y = -425
	Strength	F_y = 57 (uplift)	F_x = 50 F_z = 0	M_x = -71 M_z = -376	M_y = -2
	Extreme Event	F_y = 42 (uplift)	F_x = 37 F_z = 122	M_x = 2779 M_z = -285	M_y = -1,274

1.3 Purpose and Scope

The purpose of our exploration was to obtain an overview of the subsurface conditions to develop an idealized soil/rock data set to formulate geotechnical engineering recommendations for the design of the CCTV, VMS, and speed reader structure foundations. The scope of work for this exploration included the following tasks and work efforts:

1. Research and review of available in-house geologic and soils information at the CCTV, VMS, and speed reader sites under this project.

2. Application of necessary excavation permits from the State of Hawaii – Department of Transportation, Highways Division.

3. Coordination of the boring stakeout and utility toning and clearance with various utility companies.

4. Provisions of police officers and safety devices for traffic control and lane closures at the boring locations during our field exploration program.

5. Mobilization and demobilization of a truck-mounted and track-mounted drill rigs and two operators to the project sites and back.

6. Drilling and sampling of nine borings extending to depths of about 20.3 to 32.5 feet below the existing ground surface.

7. Coordination of the field exploration and logging of the borings by our geologists.

8. Laboratory testing of selected soil and rock samples obtained during the field exploration as an aid in classifying the materials and evaluating their engineering properties.

9. Engineering analyses of the field and laboratory data to formulate geotechnical engineering recommendations for the CCTV, VMS, and speed reader foundations.

10. Preparation of this report summarizing our work on the project and presenting our findings and geotechnical engineering recommendations.

11. Coordination of our overall work on the project by our senior engineer.

12. Quality assurance of our work and client/design team consultation by our principal engineer.

13. Miscellaneous work efforts such as drafting, word processing, and clerical support.

Detailed descriptions of our field exploration and the Logs of Borings are provided in Appendix A. Results of the laboratory tests performed on selected soil and rock samples are presented in Appendix B.

END OF GENERAL