- 1996-11-23-OA-FEA- Bank of Hawaii Annex Tower

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BANK OF HAWAII ANNEX TOWER

Final Environmental Assessment

October 1995

BANK OF HAWAII ANNEX TOWER

Final Environmental Assessment

Prepared by Belt Collins Hawaii

for

Stringer Tusher Architects Incorporated

Applicant:

Bank of Hawaii

Accepting Agency:

Department of Land Utilization,
City and County of Honolulu

Honolulu, Hawaii

October 1995

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CHAPTER I
INTRODUCTION AND SUMMARY

1. PURPOSE OF THIS DOCUMENT

This Final Environmental Assessment (EA) has been prepared by Belt Collins Hawaii, Ltd., on behalf of Stringer Tusher Architects, Incorporated, for Bank of Hawaii (BOH). The owner and developer of the subject property is BOH. The project site is identified as Tax Map Key 1-7-02:02 and is depicted in Figure 1. This EA is in support of BOH's application to the City and County of Honolulu's Department of Land Utilization for a major Chinatown Special District permit. The issuance of this permit will allow planning, development and construction to proceed expeditiously. The governmental agencies and interested parties consulted during the preparation of this EA are listed in Chapter VII.

This EA complies with the provisions of Hawaii Revised Statutes (HRS) Chapter 343 and Title 11, Department of Health, Chapter 200, Environmental Impact Rules. It is required pursuant to Section 11-200-6 (1)(D), which states that an EA is necessary when an action is proposed within any historic site as designated in the national or Hawaii register. Chinatown is the oldest section of downtown Honolulu and is listed on the National Register of Historic Places. Because of its historical and cultural significance, the City and County of Honolulu has designated Chinatown as a Special District.

2. DESCRIPTION OF THE PROPOSED PROJECT

2.1 Overview

The proposed project is located in the Makai Precinct of the Chinatown Special District of downtown Honolulu. The property is bounded by Smith Street, Nimitz Highway, Nuuanu Avenue and Marin Street (see Figure 2). The project site is a 38,177 square foot property presently occupied by a five-story building containing about 100,000 square feet of space and 27 at-grade parking spaces. The existing building will be demolished and a new office tower constructed on the property.

The proposed new structure consists of a 21-story office building with six levels of below-grade parking (see Figure 3). The height of the proposed office tower will be about 250 feet, per Chinatown Special District height limitations. The project is oriented to the Central Business District to the east and the Chinatown District to the west. The building will contain a total of approximately 280,000 square feet of gross floor area, of which approximately 230,000 square feet will be rentable within 20 office levels. The BOH intends to occupy some of the building. The remainder will be leased to qualified tenants at market terms.

In conformance with Chinatown Special District requirements, the project will create a transition between the high-rise Central Business District and the historic core of Chinatown; provide a visible pedestrian connection between Nimitz Highway and the interior of Chinatown; and provide a landscaping theme along Nimitz Highway to emphasize its role as a major accessway into the Central Business District and Waikiki.

2.2 Architectural Design

The project will be massed as a singular structure that consists of three principal components: the main tower, the podium, and the plaza. The podium will be present on three sides of the main tower. The fourth side of the main tower along Nuuanu Avenue will appear to rise from ground level rather than from the top of the podium.

Key to the concept of the project is the creation of a public plaza that is oriented to Nuuanu and Merchant Streets, and the Central Business District (see Figure 4). The plaza is envisioned as a well-landscaped, pedestrian-oriented space that is functional as well as transitional. Activities could include public gatherings, art displays, entertainment, and outdoor dining. The plaza will run the length of the property along Nuuanu Avenue, providing expanded view exposure toward the harbor and mauka locations.

Benches, lighting, planting, and textured paving will form a plaza that will accentuate the building's three-story exterior arcade that frames the main entrance. Once inside the two-story lobby, pedestrians will be directed to tower and podium elevator lobbies. The theme of the plaza will continue into the lobby to enhance the connection and transition between interior and exterior spaces. A natural transition and flow are important aspects of design which affect the pedestrian's urban environment. This natural transition is reminiscent of some of the noteworthy examples of Hawaiian architecture that include the Alexander and Baldwin building a few blocks away.

The ground floor spaces will be utilized for commercial/retail space and service-related functions. Awnings that are metal framed and clad will enhance the pedestrian scale and provide a sense of protection from the elements for ground level windows. Storefronts will be designed with patterned window mullions to provide scale and rhythm. Building standards for tenants will encourage creative signage and unique entrances. Loading and parking access will be provided to the project from Smith Street.

The podium portion of the building will contain three floors and forms a building mass and street edge that is consistent with neighboring projects' podium forms. The position of the podium relative to the main tower will have the effect of minimizing pedestrians' perception

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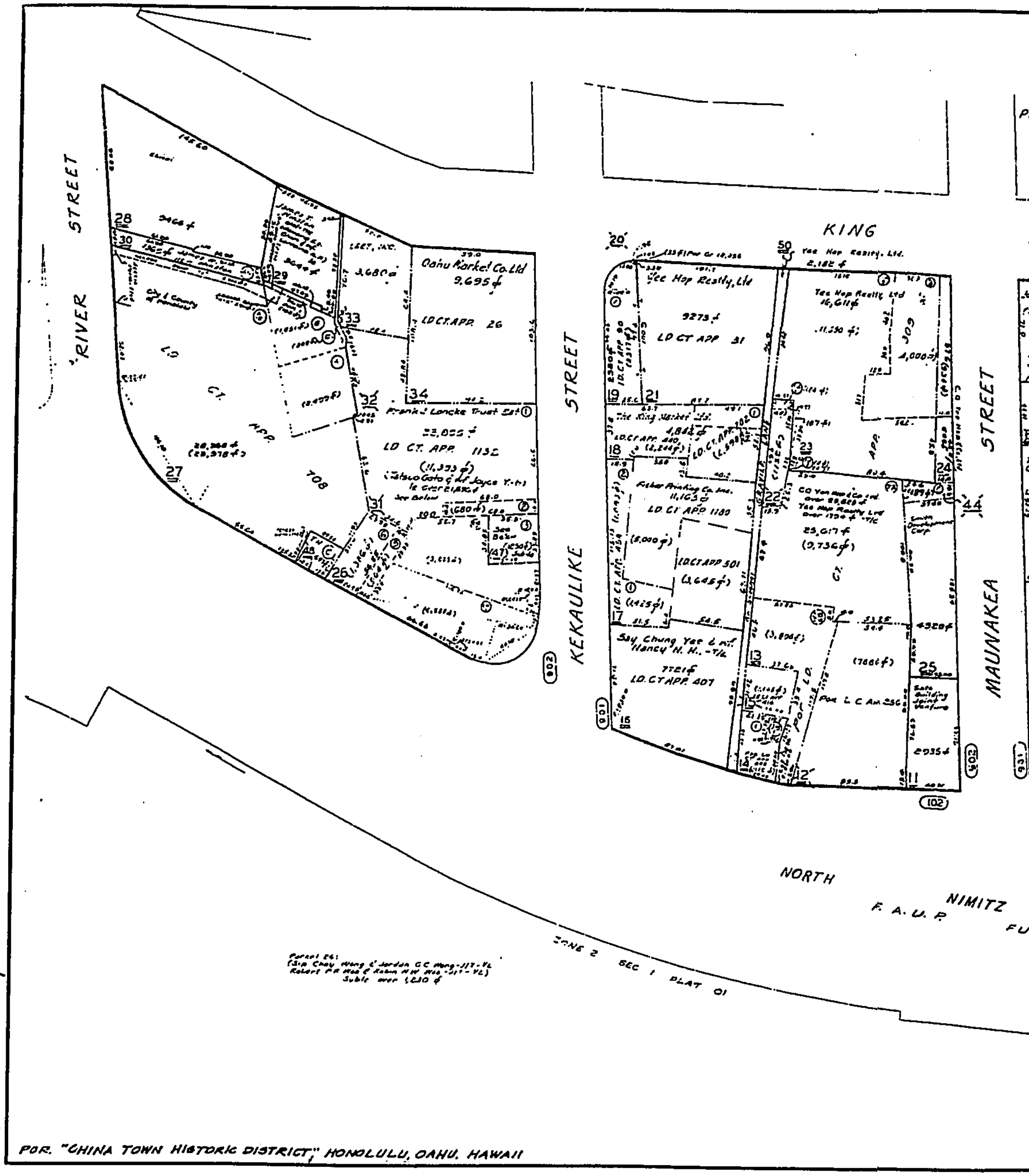

Source: Tax Maps Bureau
By: 14 Nov 1987

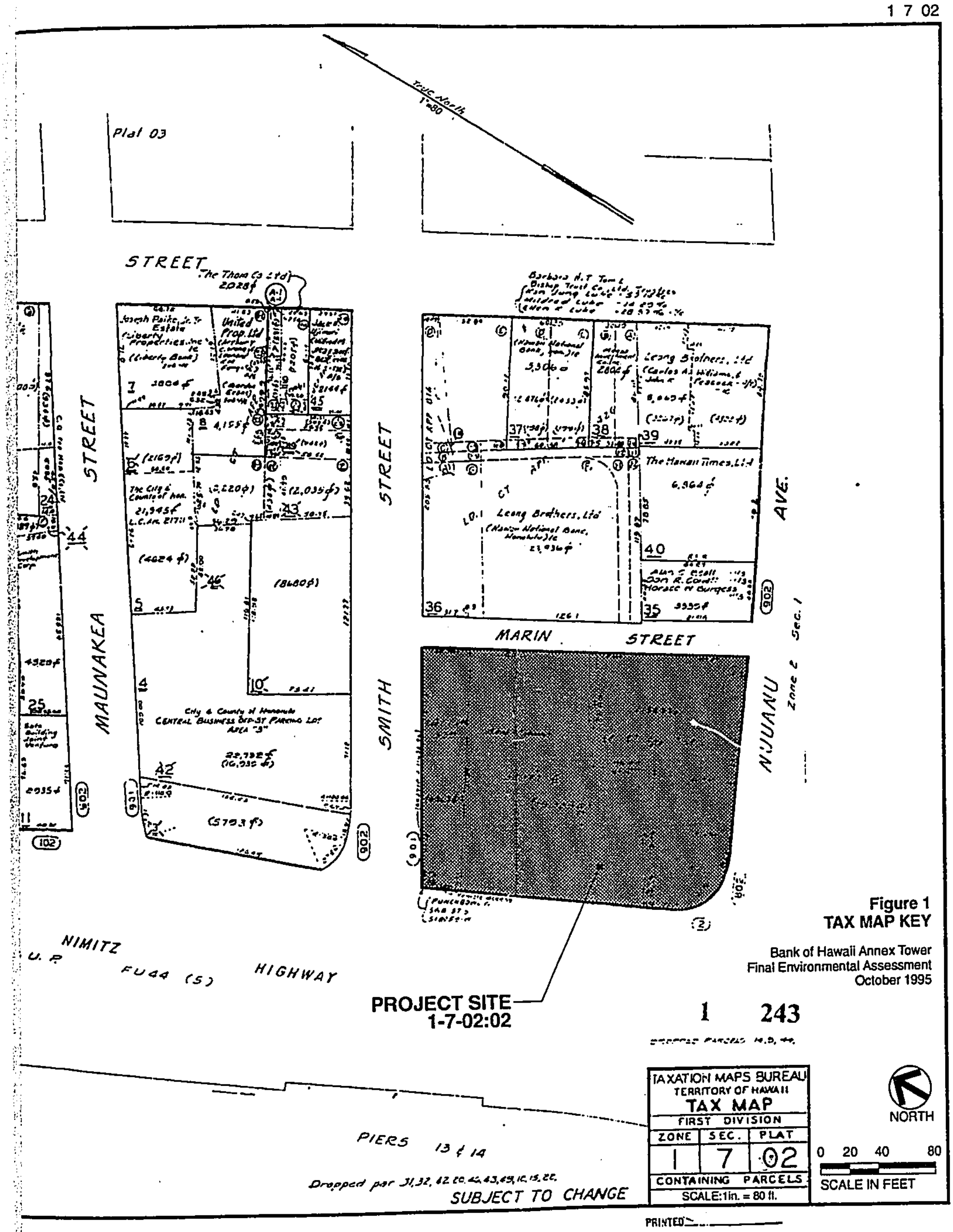

Figure 1
TAX MAP KEY

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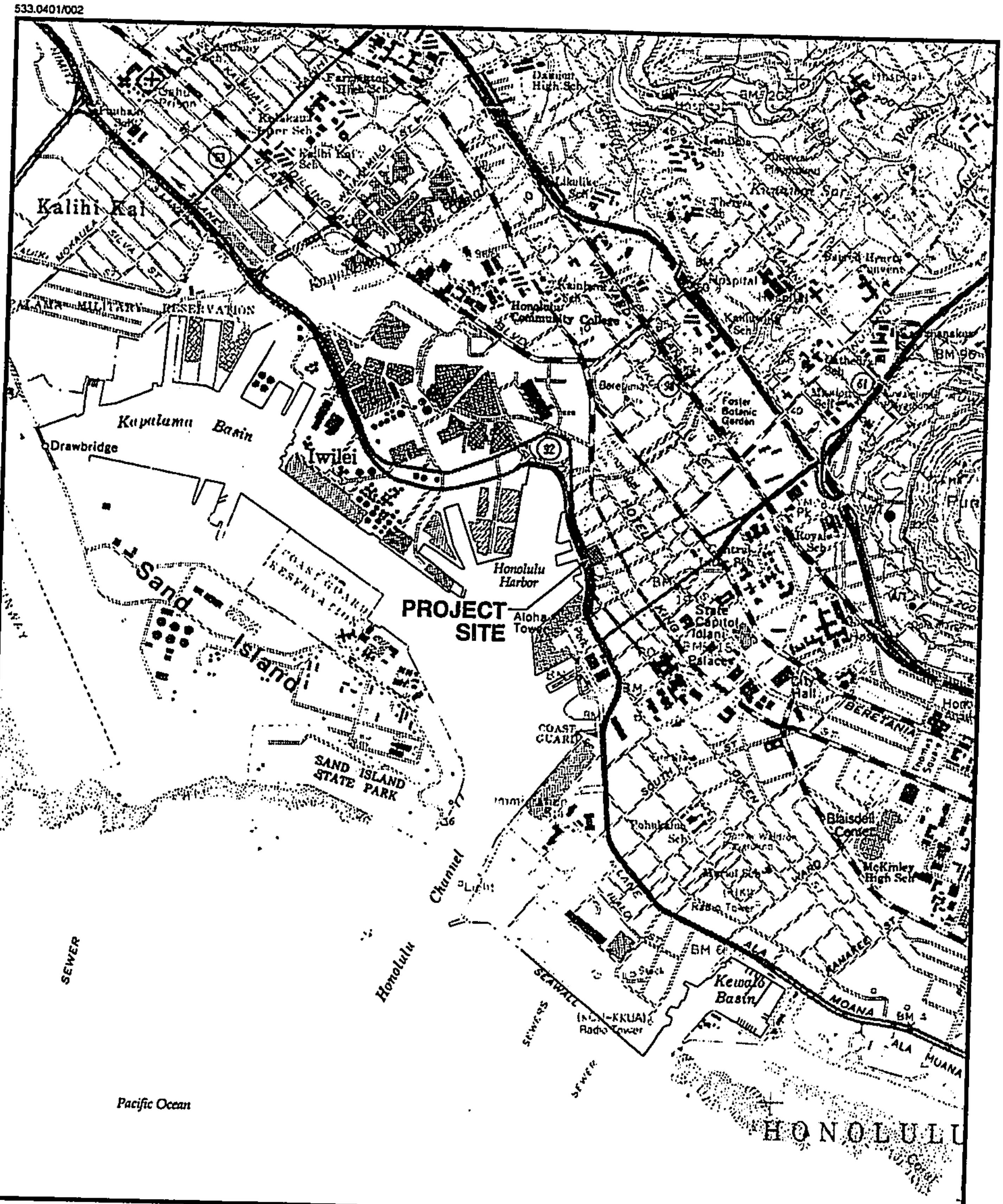
533.0401/002



Source: U.S. Grological Survey, 1983

NORTH

0 500 1000 2000
SCALE IN FEET

Figure 2
PROJECT LOCATION

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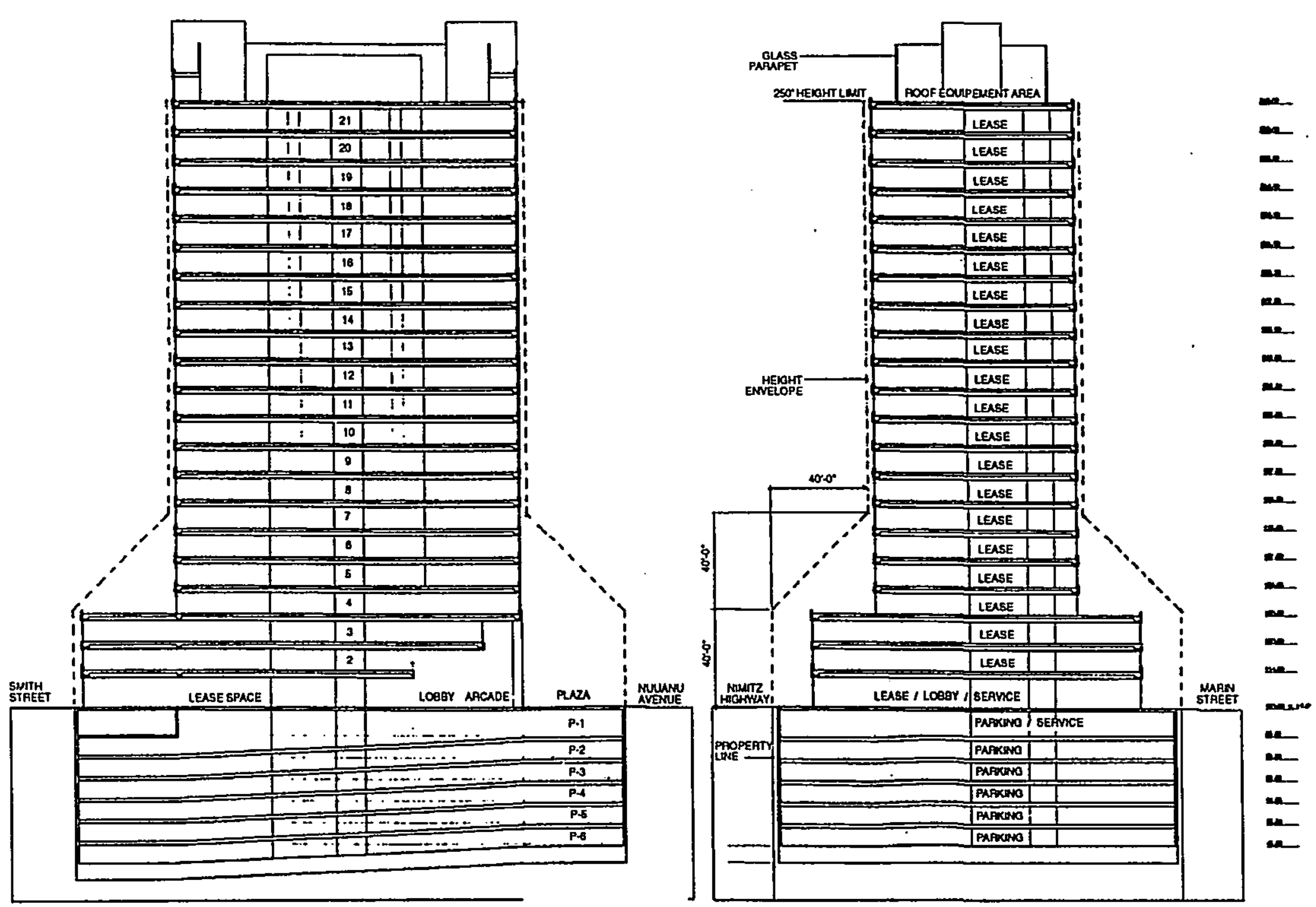

Source: Stringer Tusher Architects Incorporated

Figure 3
BUILDING SECTIONS

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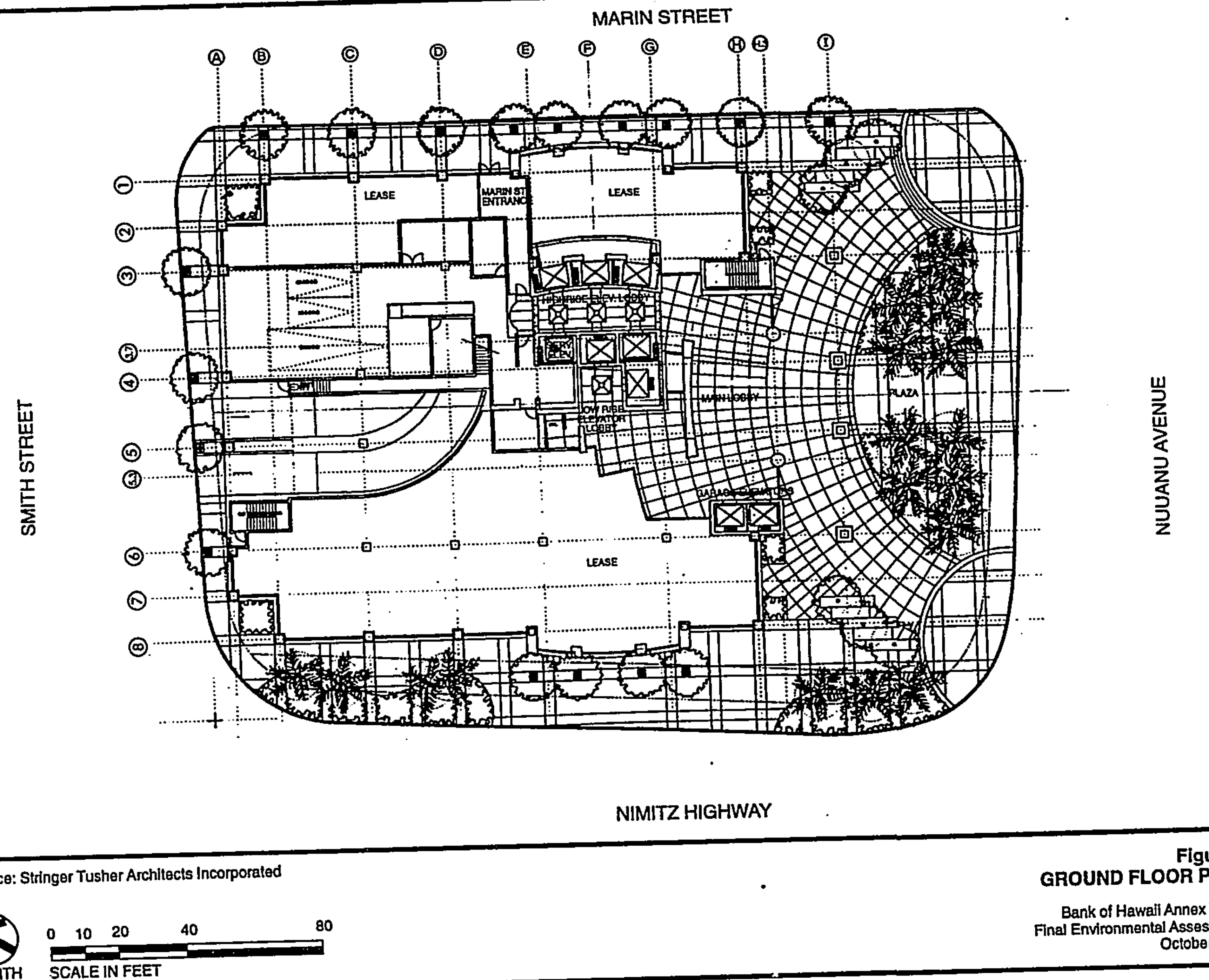

Source: Stringer Tusher Architects Incorporated

Figure 4
GROUND FLOOR PLAN

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of the tower. A floor plan for typical podium floor is presented in Figure 5. The upper levels of the proposed office tower are consistent with the building setback, open space and landscaping and design guidelines of the Chinatown Special Design District. The three-story height of the office tower's podium is consistent with that of the existing Marin Tower retail/residential component, Hawaii National Bank and Queen's Court projects and will serve to reinforce the pedestrian scale of the area.

The main tower form will be concentrated in the central zone of the property, and the podium is the prominent mass on the Nimitz Highway, Smith Street, and Marin Street edges (see Figure 6). The tower's "gridded" system of pre-cast concrete elements form structured corners which embrace a radius-shaped central glass form that unifies the overall tower form and presents a stately, balanced, symmetrical skyline profile (see Figure 7). A typical tower floor plan is presented in Figure 8, and the roof plan is presented in Figure 9.

2.3 Loading and Service Functions

All loading and related service functions will be located on the ground floor, on the Smith Street side of the project. As shown in Figure 4, one 12'x35' and two 8.5'x19' loading stalls will be provided, consistent with City and County requirements.

2.4 Parking

All parking for the project will be below-grade. Approximately 600 parking stalls are anticipated. Tenant and customer parking will be considered the highest priority, with extra public parking likely to be provided on a space-available basis.

2.5 Mechanical and Electrical Elements

The air conditioning system consists of a central chilled water plant serving air handler units and fan coils in the building. The chilled water plant includes two centrifugal water cooled chillers for normal business hours, one reciprocating water-cooled chiller for off-hour usage, two roof mounted cooling towers, six chilled water pumps (three primary/three secondary), and three condenser water pumps. Pumps will be contained in a primary/secondary packaged pumping system. The refrigerant monitoring system in the chiller room exhausts the room and sounds an alarm if there is a refrigerant leak. The refrigerant monitoring system will also be monitored by the building management system.

A 1,200 square foot elevator machine room will be required for the five high-rise elevators anticipated. Preliminary requirements indicate that approximately 20 feet will be

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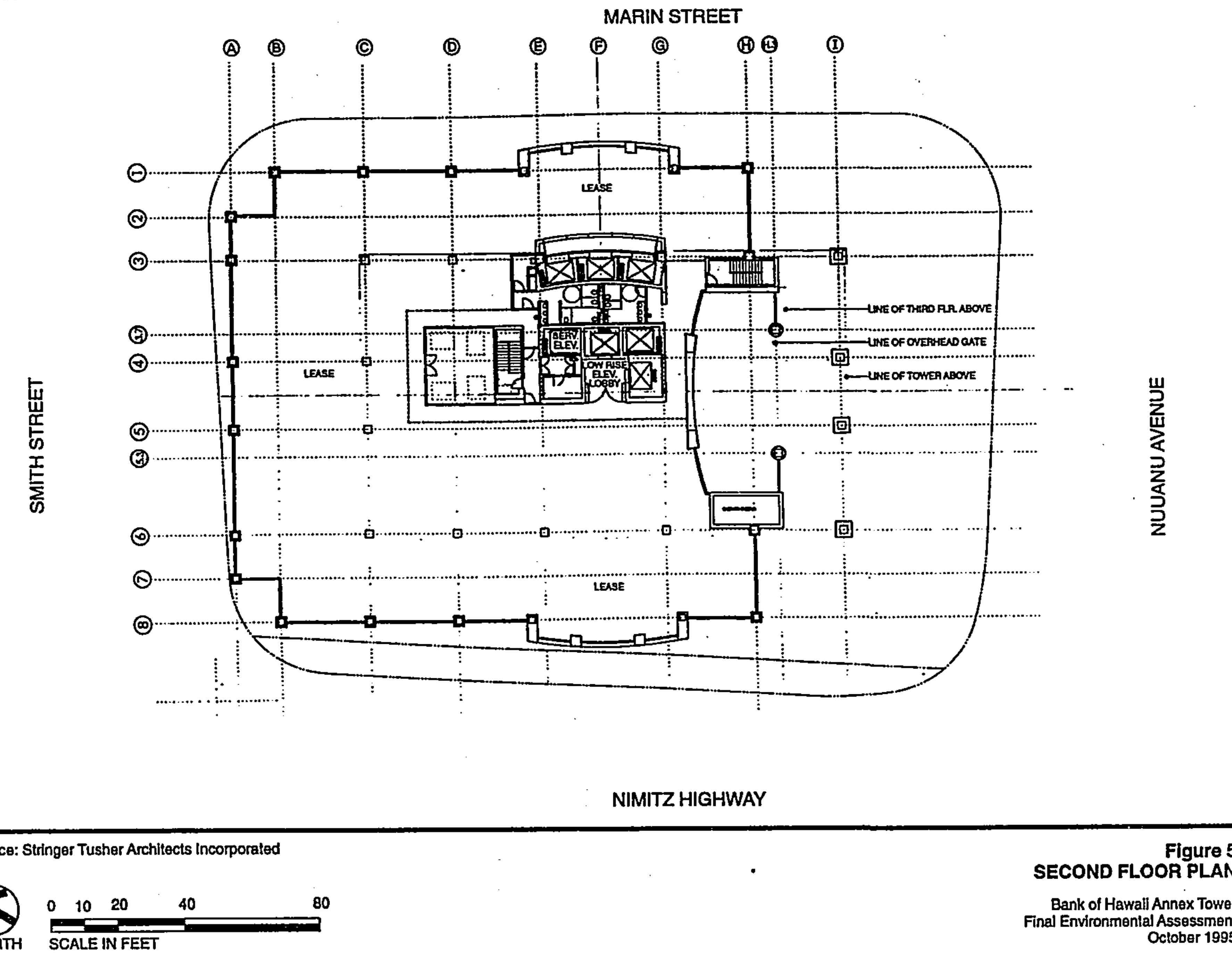

Source: Stringer Tusher Architects Incorporated

Figure 5
SECOND FLOOR PLAN

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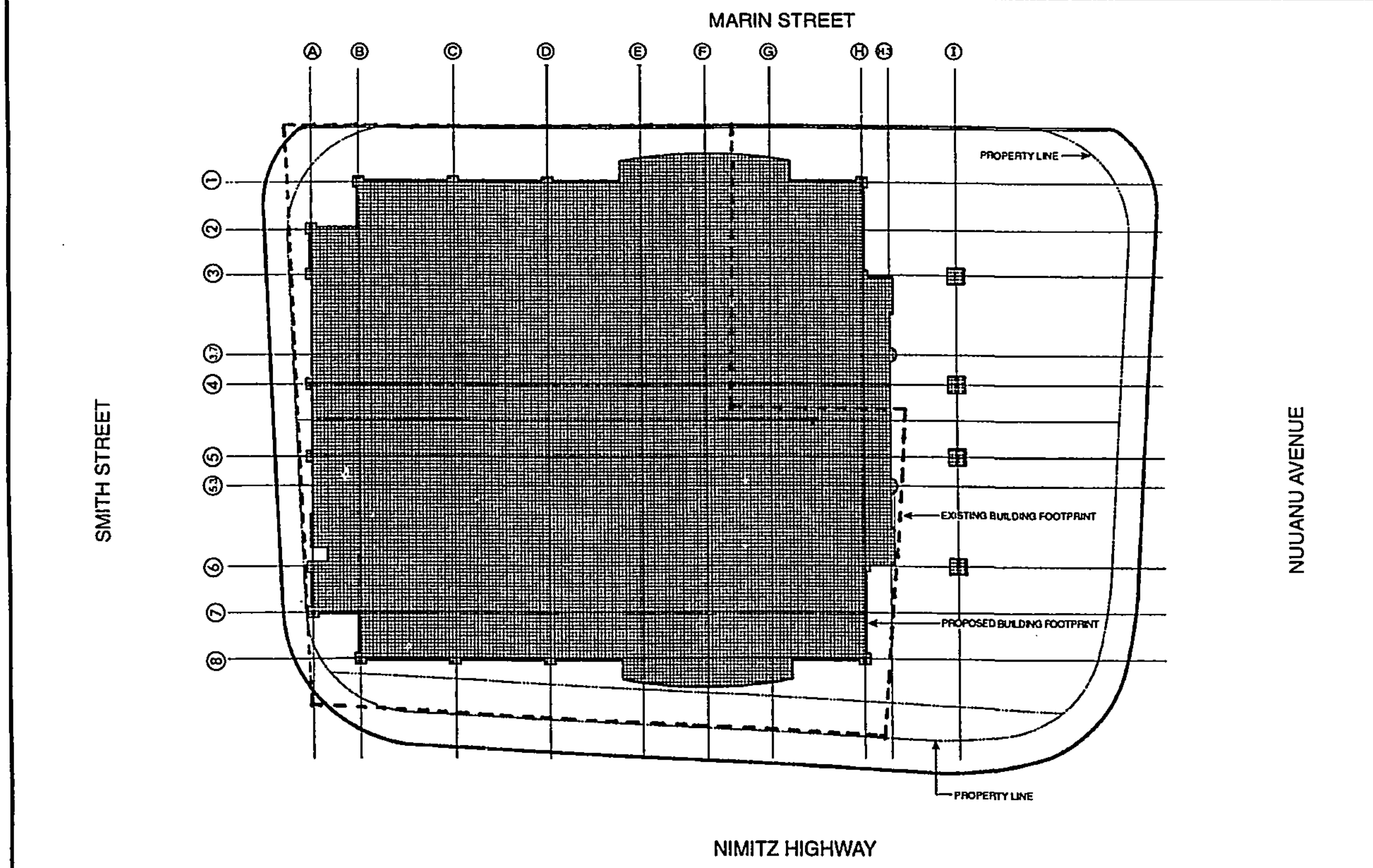

Source: Stringer Tusher Architects Incorporated

Figure 6
BUILDING FOOTPRINTS

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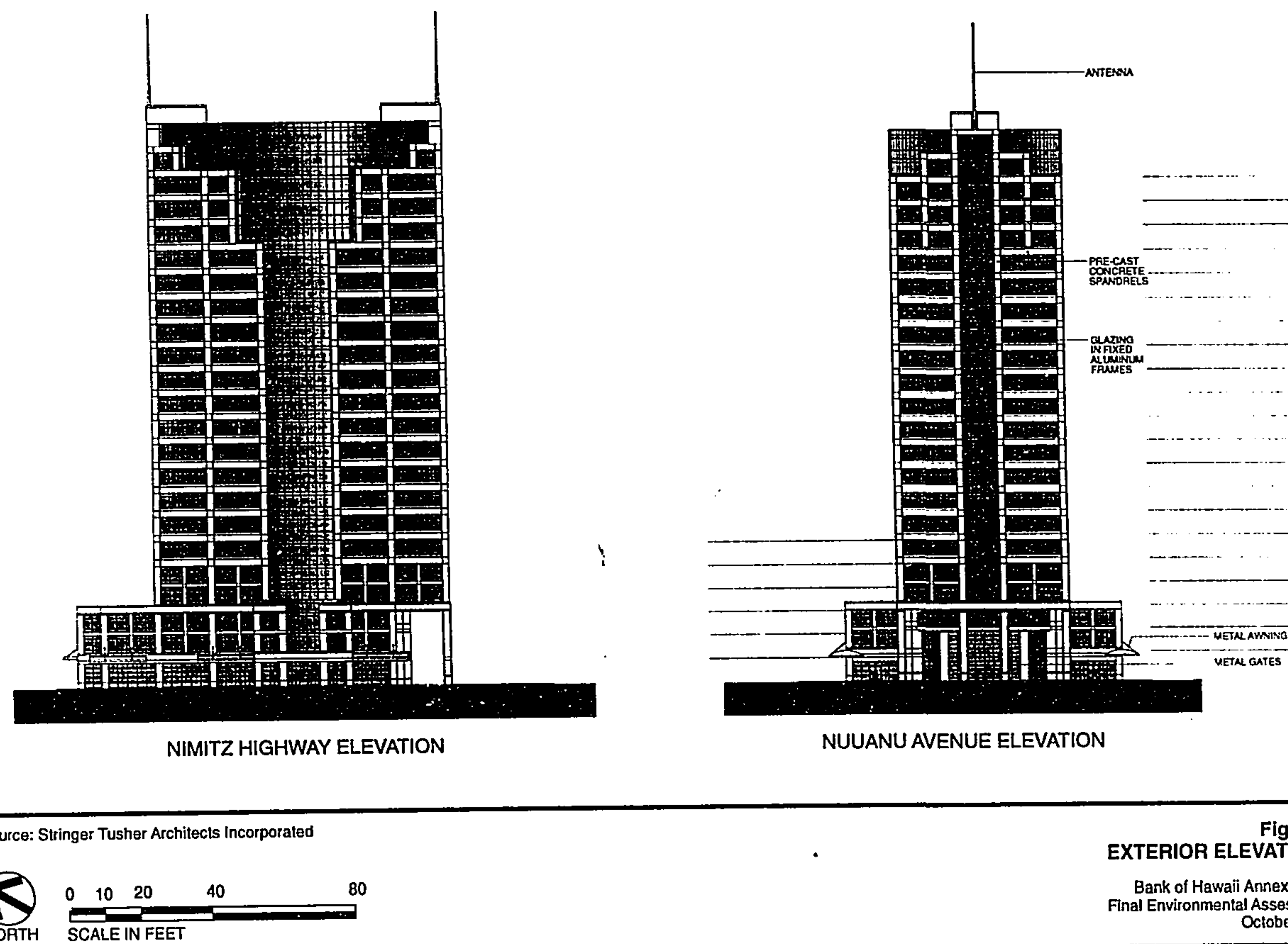

Source: Stringer Tusher Architects Incorporated

Figure 7
EXTERIOR ELEVATIONS

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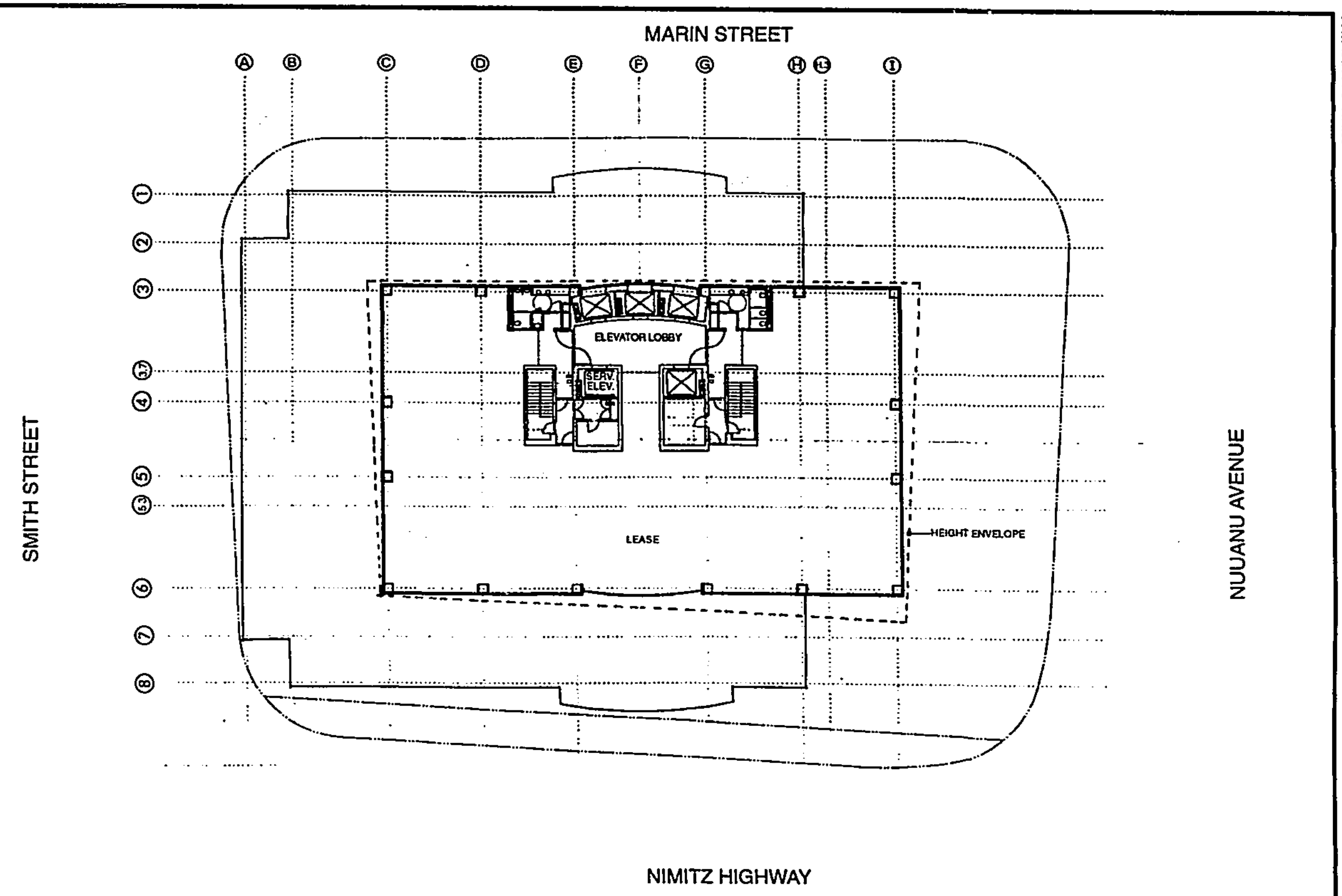

Source: Stringer Tusher Architects Incorporated

NORTH

0 10 20 40 80
SCALE IN FEET

Figure 8
TYPICAL TOWER PLAN

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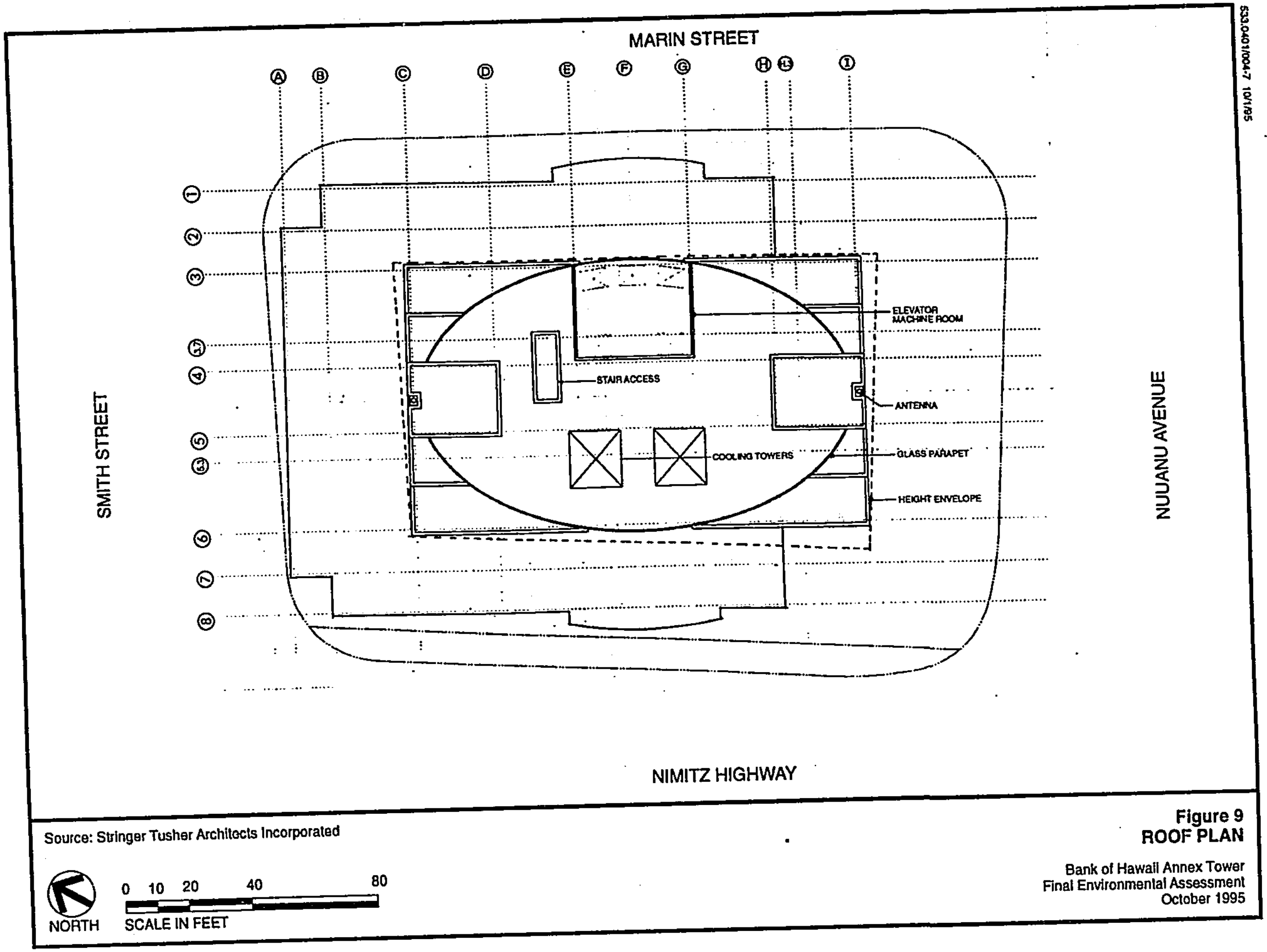

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Source: Stringer Tusher Architects Incorporated

Figure 9
ROOF PLAN

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required above the 250 foot height envelope for the elevator machine room. The machine room and related core below is designed to be located in the central/mauka area of the main tower's footplate.

The underground parking garage ventilation system will have a system of supply air fans and exhaust air fans to provide a minimum exhaust of 1.5 cubic feet per minute (CFM) per square foot of gross floor area. Two supply air shafts and two exhaust air shafts serve the provided air paths into and out of the parking levels. Six supply fans and six exhaust fans per parking level will be tied into these shafts. Fans will have back-draft dampers. The carbon-monoxide monitoring system will maintain the CO level below 25 parts per millions (PPM) by controlling the supply fans and exhaust fans. This system will be tied into the building management system. Intake air grills are intended to be located within large planting areas at each property corner in the plaza (Nuuanu Avenue). Grills will be located at approximately grade level and central to the planting areas. Exhaust air discharge will be located on the property at the corners of Smith/Marin and Smith/Nimitz. Exhaust grills will be wall mounted and located approximately 12 feet above grade. Grills will be designed to be an integral and intentional part of the podium elevation design.

Electrical and telecommunications service will be provided by the appropriate utility companies. The emergency generator will be a 300 KW, automatic start, 277/480 volt, 3-phase, 4-wire, 1800 RPM diesel, with a day and main fuel storage tank and battery charger. The emergency generator will serve a building elevator and a parking elevator. Life safety systems including fire pump, exit lights, exitway lighting, building management system, fire alarm system, telephone switch and security system will also run from the generator. A load bank will be included to permit regular load testing. It is anticipated that testing will occur on a standard, monthly basis.

Exterior lighting design will be confirmed as the project continues to its final development. Two types of code-compliant lighting have been discussed: ground floor lighting and building lighting. Safety and security are prime concerns for ground floor areas. A well-illuminated plaza and ground floor perimeter will be provided through the use of overhead/indirect lights at awnings and storefronts. Tenant-provided signs will be directly illuminated by lights within the awnings. The plaza will be illuminated by indirect landscape lights and/or pole mounted fixtures. With regard to building lighting, the aesthetic qualities of light washes on portions of the main tower will create an identity for the project during evening hours. Indirect illumination of the upper parapet of the building is also under consideration. Other projects that have provided exterior building lighting include Harbor Court, Amfac Center and Alii Place.

3. CONSTRUCTION SEQUENCE

Construction of the proposed project will follow standard building construction techniques and methods. Demolition of the existing building will likely consist of a crane-operated wrecking ball. No implosion is anticipated. Following demolition, excavation for the below-grade parking floors will be performed utilizing wall stabilization techniques recommended by the soils engineer (see Appendix A). The building's concrete mat foundation will then be poured and construction of the parking garage and tower begun.

The floors of the tower superstructure will be constructed with precast prestressed concrete planks. Vertical and lateral support will be provided by the reinforced concrete core, configured around elevator and stair shafts and a perimeter reinforced concrete frame. Generally, about a floor of the tower will be completed every fourth to fifth working day. Total estimated construction time of the entire project, including excavation, is about 30 months.

4. NEED FOR THE PROPOSED PROJECT

4.1 Project Objectives

The objectives of the proposed Bank of Hawaii Annex Tower are to (1) provide Class A office space in downtown Honolulu at the time Class A office space is forecast to be in demand, (1999 to 2000), and (2) to provide office development in a timely manner that is compatible with the overall revitalization of Chinatown. Additionally, the new building will provide expansion facilities for Bank of Hawaii operations that require state-of-the-art technology.

4.2 Market Demand

The timing of the proposed project is market-driven. Current indications are that the project would be completed in the third quarter of 2000. The Demand Analysis study conducted for the proposed project (see Appendix B) indicates that the present excess supply of Class A office space in downtown Honolulu will be substantially absorbed by the year 2000 and that the proposed office tower will be economically feasible and well received.

5. REGIONAL SETTING AND LAND USE CLASSIFICATIONS

The project is located in downtown Honolulu's Central Business District, the financial hub of the state, is strategically located near the harbor, courts of law, and public agency offices and is centrally positioned between the airport and Waikiki, the tourism center of Honolulu. The project site is designated Commercial Emphasis Mixed Use on the Primary

Urban Center Development Plan land use map, zoned BMX-4, and is located in the Makai Precinct of the Chinatown Special District. The Chinatown Special District imposes a height limit of 250 feet, which will be met by the proposed project. The property is not in the Special Management Area (SMA).

6. SUMMARY OF POTENTIAL ENVIRONMENTAL IMPACTS

Potential environmental impacts include short-term impacts related to construction and long-term impacts related to its presence and operation. On the short-term, the project will impact air quality and ambient noise conditions in the immediate vicinity of the project. Air quality impacts will be limited to fugitive dust and construction vehicle emissions. Noise impacts related to construction are not anticipated to be significant. Construction-related traffic impacts will be mitigated to ensure that normal traffic during peak A.M. and P.M. periods is not unduly disrupted. The implementation of a Best Management Practices Plan for construction activities, including dewatering of the excavation site, is intended to mitigate the potential impact of such activities. As a result, no significant adverse short-term impacts to the environment, including water quality in Honolulu Harbor, are anticipated.

In the long-term, the proposed structure will have a visual impact upon the surrounding environment. However, given the high-rise character of the surrounding area, the allowable height limit, and the current zoning of the property, the visual impact of the structure is not considered to be significant. The project will increase vehicular traffic in the immediate area, but no significant changes in Level of Service resulting from the project are anticipated for surrounding roadways. While the project will be in compliance with all federal air quality regulations, under a hypothetical worst-case scenario, the State's 1-hour maximum for carbon monoxide may be exceeded at the corner of Smith Street and Nimitz Highway during the peak P.M period. However, this condition will likely exist even if the proposed project is not constructed, due to projected annual growth in ambient traffic in the downtown area. No other significant long-term environmental impacts have been identified.

The project is expected to have short- and long-term positive socioeconomic impacts. Short-term positive impacts will result from increased construction-related employment during the construction of the project. Long-term positive socioeconomic impacts will result from an increase in Class A office space at the time it is forecast to be required; by providing additional retail shopping opportunities for residents; and by increasing resident's and visitor's knowledge of the cultural and historical significance of the project site and area through the display of archaeological and/or art exhibits of the property's history. Long-term positive economic impacts also will result from increased business opportunities for businesses providing goods and services to building tenants and through increased tax revenues to the State and City and County of Honolulu.

7. SUMMARY OF MITIGATION MEASURES

Measures to minimize and/or mitigate potential adverse environmental effects will be implemented for archaeological/cultural resources, air and noise quality and forecast traffic conditions. In addition, improvements to the sewer serving the project site will be made at the developer's expense.

8. SUMMARY OF UNRESOLVED ISSUES

Unresolved issues concern the issuance of appropriate development permits and the selection of a final design alternative for wastewater collection.

9. SUMMARY OF COMPATIBILITY WITH LAND USE POLICIES AND PLANS

Upon issuance of requested permits, the proposed project will be consistent with the Oahu General Plan, the Primary Urban Center Development Plan and the Chinatown Special District policies. The project site is outside the SMA.

10. REQUIRED PERMITS AND APPROVALS

The following major environmental and land use approvals and permits are required.

TABLE I-1
SUMMARY OF MAJOR PERMITS AND APPROVALS REQUIRED

PERMIT/APPROVAL	APPROVING AGENCY
STATE OF HAWAII	
Chapter 343, HRS, Environmental Review	Office of Environmental Quality Control
Chapter 6E, HRS, Historic Preservation	Department of Land and Natural Resources
NPDES Permit	Department of Health
CITY AND COUNTY OF HONOLULU	
Chinatown Special District Major Project Permit	Department of Land Utilization/City Council
Grading/Excavation/Building Permits	Building Department

CHAPTER II
ALTERNATIVES CONSIDERED

1. INTRODUCTION

The proposed project was selected as the most cost-effective alternative available to fulfill the applicant's objectives, taking into account potential environmental and social impacts. This chapter discusses the alternatives that were considered during the early design stages of the project but which were rejected as inferior to the proposed action.

2. NO ACTION

The no action alternative would retain the existing building and parking lot. The existing building is not considered to be consistent with the overall theme and objectives of the Chinatown Special District because it does not contribute to better pedestrian circulation in the area, provides no ground-level retail element, and provides a poor transition between the Central Business District and Chinatown. The no action alternative would not help promote the long-term economic viability of the Chinatown Special District as a unique community of retail, office and residential uses; enhance pedestrian-oriented commercial uses and building design; improve traffic circulation; or improve mauka/makai view corridors of the harbor and core Chinatown areas. Further, this alternative would not fulfill the owner's objectives and would result in a continued under-utilization of the property. For these reasons, this alternative was dropped from further consideration.

3. PROJECT USE AND LAYOUT ALTERNATIVES

Several different configurations of the proposed project were evaluated during the preliminary design phases of the project. These alternative configurations included various combinations of Class A office space in conjunction with residential units, above and below grade parking configurations and different combinations of office, retail, and residential spaces.

The market study conducted for the BOH (see Appendix B) concluded that the proposed office/retail space configuration is the most economically viable project, given presently known potential competition and forecast trends in the Chinatown/Downtown Honolulu area. Other combinations, including those with residential units do not appear to be economically viable due to the present and forecast oversupply of market-priced residential units. Similarly, increased retail space except for ancillary uses to an office building does not appear economically viable because of the location of the property.

4. FACILITY SIZE ALTERNATIVES

The objectives of the proposed Bank of Hawaii Annex Tower (see Chapter I, Section 4.1) are based, in part, upon the need to create a building that provides a fair economic return to its owners. This can be accomplished by having a balanced mix of leasable office, retail and public space. Given historical, present and forecast absorption of office and retail space in the Chinatown and Downtown areas, the proposed building square footage has been determined to be the most economically viable building configuration which, in turn, will contribute positively to the applicant's long-term investment.

5. ALTERNATIVE METHODS OF REDUCING VISUAL IMPACTS

In the course of designing the proposed structure, the architect has considered alternative design schemes. As the preferred alternative, the proposed building design represents the "best fit" between requirements for economic feasibility (which often manifest as "highest and best use") and mitigating visual impacts (which often manifest as "less is better"). The proposed structure is consistent with the Chinatown Special District building envelope and setback requirements and includes ample public spaces, especially on the ground floor, that will improve harbor and core Chinatown area views. Similarly, views into and out of the downtown Honolulu area are improved via building setbacks and landscaping around the perimeter of the building, especially along Nimitz Highway and Marin Street as demonstrated in Figure 6. These design measures have been proposed to improve the visual qualities of the project, which in turn improve the marketability of the building, and, therefore, contribute to the economic viability of the project.

CHAPTER III
EXISTING ENVIRONMENT, POTENTIAL IMPACTS AND MITIGATION MEASURES

1. INTRODUCTION

This chapter describes the socioeconomic and environmental setting of the project site and area and addresses the socioeconomic and environmental consequences of the proposed project. The physical design and layout of the project presents the applicant's best efforts to avoid significant environmental impacts to every extent practicable. Where significant impacts are unavoidable, specific measures are proposed to mitigate the effect of the project on its surrounding environment. Mitigation measures are intended to reduce or eliminate any negative consequences.

2. REGIONAL AND ECONOMIC CONDITIONS

This section discusses the project's identifiable socioeconomic impacts in the Chinatown Special District as well as the general downtown Honolulu area.

2.1 Existing Conditions

Chinatown is the oldest section of downtown Honolulu and reflects a dynamic ethnic population and business community. Like other business districts, Chinatown faces numerous physical, social and economic problems. In some cases, this has led to a deterioration of commercial and residential structures, a decline in business activity, and an erosion in housing stock. However, in the past few years, there has been a resurgence in community pride and in business activity. Several new art galleries and restaurants have been established, and new housing projects for all socioeconomic levels have been built. There has been increased public involvement in maintaining the rich history of the area. In addition, the recently opened Aloha Tower Market Place and various downtown nighttime functions have increased the general public's awareness of the cultural richness and variety afforded by the Chinatown area.

According to the market study conducted for the proposed project (see Appendix B), since 1980, there has been a 77 percent increase in available office space in downtown Honolulu. As of the end of 1993, there were approximately 7.5 million square feet of leasable floor area available in 53 commercial (office, retail, service) multi-tenant projects of varying design. Of the 53 commercial projects, 25 account for almost 70 percent of the total space available and include almost all of the Class A offices.

In 1990, the resident population of downtown Honolulu was approximately 11,929 persons (State Data Book, 1994). There are presently over 10,000 parking stalls in office buildings or parking structures plus on-street parking in the downtown area.

The building currently occupying the subject property has a day-time occupancy of approximately 450 persons and parking space for 27 cars. There are no residential units in the existing building.

2.2 Potential Impacts

For the reasons described below, the project is not expected to create any long-term adverse socioeconomic impacts that cannot be mitigated. There will be short-term social impacts during the construction period due to minor, localized changes in traffic patterns and pedestrian circulation caused by general construction activities.

The proposed project is expected to draw tenants from existing buildings as well as new businesses locating in downtown Honolulu. It is estimated that between 936 and 1,170 persons will be employed in the proposed building. This represents less than one percent of the existing 1990 downtown population. Because no residential units are proposed, the building, in and of itself, will not impact the existing or future residential population of the downtown area. The day-time occupancy of the building will be at least double the current building's occupancy.

The increase in employees at the proposed Annex Tower may contribute to an increase in the demand for residential space in the downtown area because employees may desire to relocate closer to their place of employment. This is considered to be a secondary impact but it cannot be easily quantified because it is not possible to determine at this junction who the project's future tenants will be. However, it is considered to be a beneficial impact in view of the City's policy to increase residential occupancy in the downtown area as a means of reducing commuting traffic and revitalizing downtown businesses.

The project will enhance the City and County of Honolulu and State's tax base and provide a long-term public benefit by providing a greater foundation for maintenance employment, increased tax revenues and general economic growth. The project will also provide short-term economic benefits through the construction process.

2.3 Recommended Mitigation Measures

Because of the lack of significant adverse socioeconomic impacts, mitigation measures are not warranted.

3. ENVIRONMENTAL CONSIDERATIONS

3.1 Geology and Topography

3.1.1 Existing Conditions

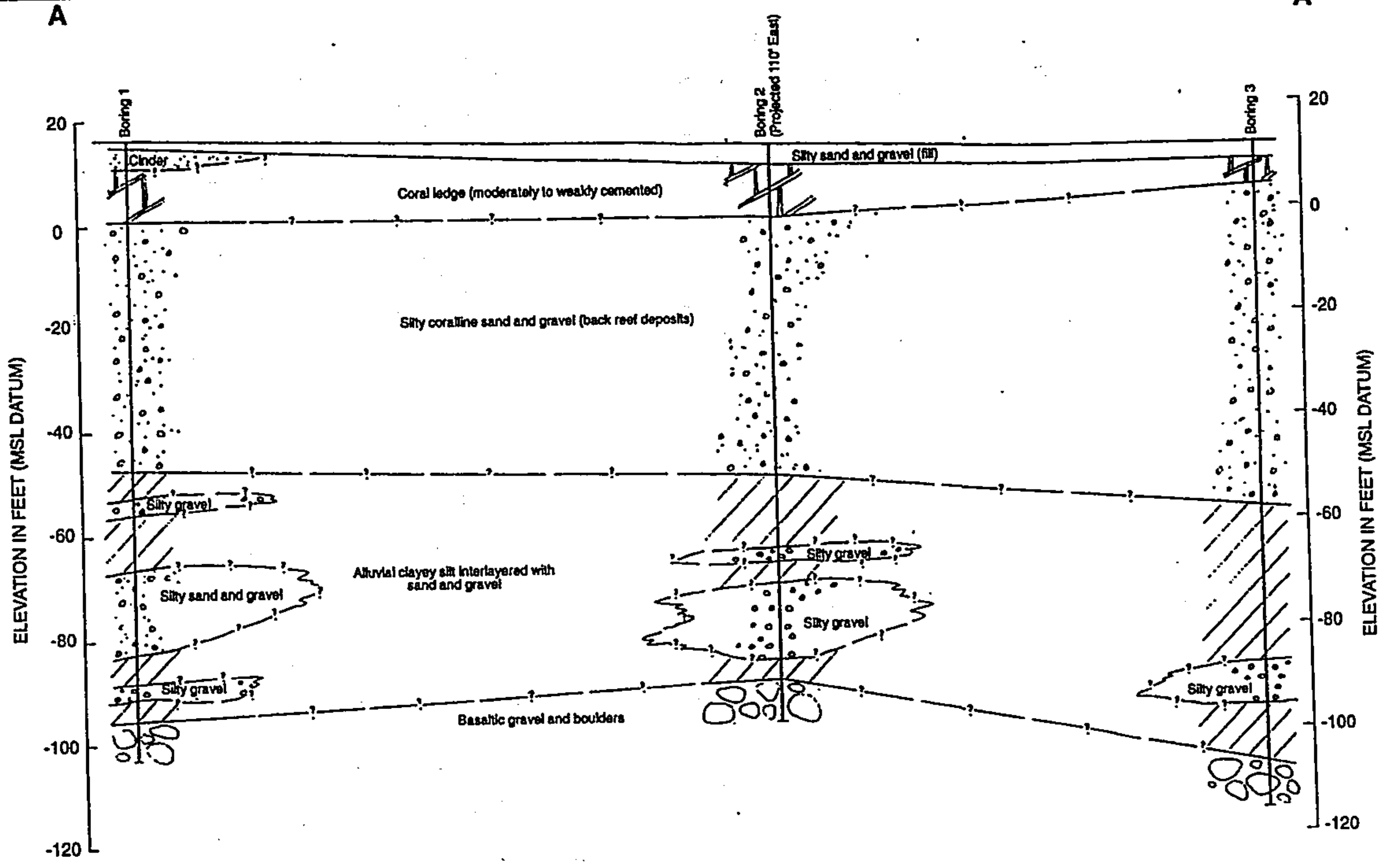
The land upon which the project will be constructed is relatively flat, sloping gently westward towards Nimitz Highway. The ground surface elevation of the project site is estimated to be between +7.5 to +11.5 feet, Mean Sea Level (MSL).

Geologically, the site is underlain by the Honolulu Series basalt flows. The basalt was probably weathered in place and later covered by a layer of brown clayey silt alluvium. Subsequent deposition of coralline sands and gravel over the alluvium provided the base for a subsequent recemented and algal coral reef. Volcanic cinder sand from the eruption of Tantalus and Punchbowl covered the coral reef. Figure 10 is a generalized soil profile showing approximate subsurface conditions at the site. As evidenced in Figure 10, the underlying basalt exceeds 80 feet in depth, which means that the proposed excavation will likely not reach the basalt layer.

3.1.2 Potential Impacts

The proposed project will have no significant impact upon the geology of the project site or area. Excavation of up to six subsurface parking levels is technically feasible and will require installation of dewatering cutoff walls and/or soldier piles with lagging and earth anchors to support the sides of the excavation (see Appendix A). The impacts of dewatering during construction are discussed below in Section 3.4.

The project will be constructed on an 8-foot thick concrete mat foundation with the floors of the tower structure framed with precast prestressed concrete planks. This type of construction is standard for the type of geological formation and is consistent with City and County building codes and standards. Impacts upon the area's topography will be limited to the grading of the project site. However, this impact is not significant due to previous alterations and the urban character of the surrounding area.



Note:
The conditions illustrated between borings are based on geological interpretations.
While these are believed to be generally correct, the conditions may vary locally from those indicated.

Source: Dames & Moore (Appendix A)

0 10 20 40 80
HORIZONTAL SCALE IN FEET

Figure 10
GENERALIZED SUBSURFACE CROSS-SECTION A-A'

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3.1.3 Recommended Mitigation Measures:

No mitigation measures are warranted.

3.2 Soils and Agricultural Potential

3.2.1 Existing Conditions

There are no important soils or agricultural activities on the property. Excavation for the below-grade parking levels will be down to approximately -60 feet MSL. Approximately 85,000 cubic yards of material will be removed. This is about 10 percent less than that removed for the First Hawaiian Center now under construction in downtown Honolulu. The soils will be disposed of at approved disposal sites or reused as fill material for other construction projects.

A 1,000 gallon underground diesel fuel storage tank is presently located on the subject property to provide fuel for the existing building's back-up generator. Based upon regular electronic monitoring of the tank, BOH believes that no leakage has occurred. Although the soil at the subject property is believed to be free of petrochemical or other possible contaminants, it will be tested for the existence of possible contaminants at some point during the site redevelopment process. Archaeological investigations and mitigations related to the proposed project are discussed in section 3.11 below.

3.2.2 Potential Impacts

It is expected that the excavated soils will be used as fill for other construction projects or disposed of at an approved disposal site.

3.2.3 Recommended Mitigation Measures

None.

3.3 Surface Water and Drainage

3.3.1 Existing Conditions

There is no surface water on or in the vicinity of the project. Rainfall averages about 23 inches per year. No naturally occurring drainageways exist in the area of the proposed project. Rainwater runoff is into the existing City and County of Honolulu storm drain system.

3.3.2 Potential Impacts

The proposed project will have no significant impact upon drainage in the area. The construction of the office tower may result in decreased runoff from the site due to the removal of the present asphalt paved parking lot. New roofed areas will replace the existing parking lot and new landscaping will absorb some of the runoff (see section 3.4 below for a more detailed discussion of storm-water runoff impacts). Drainage will be directed to the same storm drain system that presently serves the property. A drainage report, prepared by a State of Hawaii licensed engineer, will be submitted with construction documents at the time excavation, grading and building permits are requested.

3.3.3 Recommended Mitigation Measures

None.

3.4 Groundwater and Water Quality

3.4.1 Existing Conditions

Groundwater at the project site is between 12 and 13 feet below the ground surface. Because of the close proximity of the site to Honolulu Harbor, it is anticipated that the groundwater level will fluctuate with the tide. The shallow aquifer below the site is brackish, consisting of at least 60% seawater (Stearns, 1938). There are two existing brackish wells within a three-block radius of the subject property (a third brackish well was subsequently filled). All three were drilled into coral and sand to a depth of less than a hundred feet and used for industrial purposes.

3.4.2 Potential Impacts

Dewatering during construction of the below-grade parking levels will be required. However, the proposed project is not expected to significantly impact either the groundwater or hydrological characteristics of the project site or area over the long-term.

Careful consideration has been given to ensuring that construction of the proposed project will not result in significant adverse impacts upon groundwater quality or the receiving waters in Honolulu Harbor. Issues concerning suspended sediments in storm water runoff from the site, suspended sediments in dewatering effluent discharges to Honolulu Harbor, potential draw-down of groundwater resulting in subsidence of neighboring properties, offsite tracking of soil by construction equipment and contamination of soil, storm water and groundwater by construction equipment will all be addressed through the implementation of mitigation measures discussed in the following section.

3.4.3 Recommended Mitigation Measures

A Notice of Intent (NOI), prepared in compliance with National Pollutant Discharge Elimination System (NPDES) General Permit requirements will be filed with and approved by the State of Hawaii Department of Health Clean Water Branch before any dewatering activities begin. Special precautions will be taken during construction of the below grade parking levels. These precautions will include construction of dewatering cutoff walls and/or soldier piles with lagging and earth anchors to support the sides of the excavation in accordance with recommendations of the project's consulting soils engineer (see Appendix A). A Best Management Practices (BMP) Plan for construction, dewatering, storm water pollution control and site maintenance (good housekeeping) practices will also be implemented. The BMP Plan is included as Appendix C.

BMPs will prevent the introduction of sediment contamination into Honolulu Harbor resulting from construction. As outlined in the BMPs, no historic contamination is known to exist at the site. Construction and dewatering equipment will be maintained to prevent the introduction of contamination into dewatering effluent, some of which may be discharged into Honolulu Harbor. Any on-site leaks and spills will be contained and cleaned immediately and any contaminated materials will be taken off-site for appropriate disposal.

No suspended sediments are anticipated to be in the dewatering effluent. Draw-down wells for dewatering are proposed to be located outside of the limits of excavation so as to minimize suspended sediments in the water. The effectiveness of this technique as a mitigation measure was successfully demonstrated during the recent excavation for the new First Hawaiian Bank building at Bishop Street. The dewatering effluent will be discharged via the state highway storm drain system to Honolulu Harbor. The dewatering effluent will be visually checked several times each day and sampled weekly to ensure that it is of suitable quality for discharge into Honolulu Harbor. In the event that a change in the quality of the dewatering effluent is noted, the dewatering system will be taken out of operation and checked to determine the cause of contamination. The system will not be put back into operation until the problem is resolved.

Mitigation measures to prevent the subsidence of neighboring properties due to the draw-down of groundwater may include alternatives such as the recharge of the groundwater aquifer beneath the subject property via injection of dewatered effluent. To monitor potential subsidence, offsite controls such as fixed monuments on adjacent buildings and periodic surveying will be utilized to confirm that no settling is occurring.

Implementation of the BMPs will minimize and mitigate potential significant adverse impacts to the drainage, hydrology and water quality characteristics of the project site and area.

3.5 Natural Hazards

3.5.1 Existing Conditions

The project site, mauka of Honolulu Harbor and Sand Island, is located outside the tsunami inundation zone. The island of O'ahu is located in seismic zone 2, which means that the most severe earthquakes are expected to cause only minor damage (Zone 0 means no damage and Zone 4 means major damage).

The project is situated in Zone X as identified by the Federal Insurance Rate Map (FIRM). Zone X are areas determined to be outside the 500-year flood plain. Therefore, it will not be subjected to coastal floodwater inundation or storm waves.

3.5.2 Potential Impacts

The project site and building will not be impacted by tsunamis or flooding. Flooding due to surface runoff is unlikely to occur because there are no natural drainageways that impact the property. The proposed project may potentially be impacted by earthquakes of extreme intensity, but in light of historical experience, such impacts are not anticipated to be significant.

3.5.3 Recommended Mitigation Measure

All buildings will be designed and constructed to conform to current building codes (Building Code of the City and County of Honolulu) and to withstand the seismic forces that are reasonably expected in seismic zone 2.

3.6 Climate and Meteorology

3.6.1 Existing Conditions

The climate in Honolulu is relatively warm and dry with average daily maximum and minimum temperatures of 84.2 and 69.7 °F. Annual rainfall averages 23.47 inches. Mean wind speed is 11.3 miles per hour and is dominated by northeast tradewinds, which tend to flow parallel to Smith Street and Nuuanu Avenue.

3.6.2 Potential Impacts

Construction and operation of the project will not impact temperature or rainfall conditions of the project site or area. Wind patterns for portions of the property along Nimitz Highway and the area immediately makai of the building will be affected by the mass of the main tower. During strong tradewind conditions, an eddy would likely manifest along Nimitz Highway near the building. However, because there is limited pedestrian traffic on Nimitz and because Honolulu Harbor in the vicinity of the proposed project is not actively used for recreational sailing, an occasional eddy is not considered to constitute a significant adverse impact.

3.6.3 Recommended Mitigation Measures

Because of the lack of adverse impacts, mitigation measures are not warranted.

3.7 Air Quality

The federal Clean Air Act and amendments provide a system of ambient air quality standards (AAQS) and emission controls to protect human health and welfare. Similarly, state laws have been enacted to provide state AAQS which are at least as stringent as the federal standards. Federal and State of Hawaii standards have been developed for nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter less than 10 microns in aerodynamic diameter (PM-10), ozone, lead, total suspended particulates, and hydrogen sulfide. These are presented in Table III-1.

3.7.1 Existing Air Quality

Existing air quality in the State of Hawaii complies with all federal AAQS, and is generally in compliance with state AAQS. Occasional exceedances of the state AAQS for CO have been observed by the project's air quality consultant in downtown Honolulu approximately 1/2-mile northeast of the proposed project site and are suspected to result from CO emissions from traffic congestion coupled with infrequent stagnant meteorological conditions. Such findings are based on ambient air quality monitoring data collected by the State Department of Health (DOH).

TABLE III-1

SUMMARY OF FEDERAL AND STATE OF HAWAII AMBIENT AIR QUALITY STANDARDS

POLLUTANTS	SAMPLING PERIOD	FEDERAL PRIMARY STANDARDS µg/m³ (ppm)	FEDERAL SECONDARY STANDARDS µg/m³ (ppm)	STATE STANDARDS µg/m³ (ppm)
Total Suspended Particulate Matter (TSP)	Annual Geometric Mean			60
	Maximum Average in Any 24 Hours			150
Particulate Matter Less Than 10 Microns in Diameter (PM-10)	Annual	50	50	
	Maximum Average in Any 24 Hours	150	150	
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean	80 (0.03)		80 (0.03)
	Maximum Average in Any 24 Hours	365 (0.14)		365 (0.14)
	Maximum Average in Any 3 Hours		1,300 (0.5)	1,300 (0.5)
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean	100 (0.053)	100 (0.053)	70 (0.037)
Carbon Monoxide (CO)	Maximum Average in Any 8 Hours	10,000 (9)		5,000 (4.5)
	Maximum Average in Any 1 Hour	40,000 (35)		10,000 (9)
Photochemical Oxidants (O_3)	Maximum Average in Any 1 Hour	235 (0.12)	235 (0.12)	100 (0.05)
Hydrogen Sulfide (H_2S)	Maximum Average in Any 1 Hour			35 (0.025)
Lead (Pb)	Maximum Average in Any Calendar Quarter	1.5	1.5	1.5

Note: μ/m^3 = micrograms per cubic meter of air
ppm = parts per million

Source Hawaii Administrative Rules, Title 11, Chapter 11-59 (June 1992); U.S. Government. 40 CFR, Pt. 50, National Primary and Secondary Ambient Air Quality Standards (July 1991)

3.7.2 Potential Impacts

The proposed project will generate airborne emissions from demolition, construction, and operational activities. The impacts of these emissions will be a function of the quantity of emissions released, duration of emissions, meteorological conditions, and the distance between the source of emissions and receptor (the location of the person being impacted).

Demolition and Construction Phases

Construction activity will produce fugitive dust emissions and emissions from construction vehicles and equipment. The construction management techniques described below and in Appendix C (Best Management Practices Plan) will be used to limit emissions and insure that construction activities do not significantly degrade air quality.

Fugitive dust from structural demolition and earthmoving activities will be minimized in accordance with State DOH Hawaii Administrative Rules (HAR) Section 11-60.1-33 which requires that reasonable precautions be taken to control fugitive dust, such as the use of water for controlling fugitive dust during demolition or grading. Additionally, airborne emissions from demolition and construction activities will be short-term (less than 10 hours per day over a period of about two and a half months). Construction vehicle activity will increase automotive pollutant concentrations, but with proper traffic management to minimize vehicular delays, no significant adverse impacts to air quality are likely.

No significant emissions of asbestos are expected during the demolition of the existing structure. Asbestos inspection and handling procedures will be conducted in accordance with Subpart M of the National Emission Standards for Hazardous Air Pollutants (NESHAP), 40 CFR Part 61, and in conjunction with the State DOH. Should asbestos be found, an Asbestos Demolition/ Renovation notification will be filed with the State Department of Health, in compliance with the Asbestos Hazard Emergency Response Act (AHERA or TSCA Title II) and NESHAP. All asbestos removal will be performed by certified abatement workers under the direction of certified supervisory personnel. Further, all regulated quantities and types of asbestos-containing materials will be subject to emission control, proper collection, containerization, and disposal at a permitted landfill.

The combustion of fossil fuels by generators used to provide power for construction equipment and construction-related vehicles will produce other emissions. These emissions will be temporary and intermittent throughout the construction period and are expected to have negligible impacts on air quality.

Operational Phase

Airborne emissions from operational activities will be primarily from project-generated vehicle exhaust and to a lesser extent from the emissions of the proposed building's 300 kilowatt (kw), diesel-powered, stand-by generator.

The primary emission constituent from vehicles is CO, with relatively minor emissions of NO_2, PM-10, and volatile organic compounds (VOC). Because CO can cause health effects with acute (short-term) exposures and is the pollutant most likely to exceed ambient air quality standards, it has been used to assess the potential for adverse effects on air quality. Concentrations of CO are a function of the number of vehicles, extent of vehicle delays, meteorological conditions, and source-receptor distance. Elevated CO concentrations typically occur near roadways during peak-hour traffic periods under stagnant meteorological conditions which limit pollutant dispersion. Anticipated conditions that could affect air quality include the following.

- The projected poor level of service (LOS) in 1999 without the proposed project. LOS 'F' is anticipated at the intersection of Smith Street and Nimitz Highway due to non-project traffic (see Section 3.13 below for a full discussion of traffic impacts).

- The approximately 495 A.M. peak-hour and 471 P.M. peak-hour vehicle trips generated by the proposed project (based on the Traffic Impact Analysis presented in Appendix H and discussed in Section 3.13).

- The enclosed space created by the six-story, 600-stall, underground parking lot.

Computer models and modeling techniques recommended by the U.S. Environmental Protection Agency (EPA) were used to estimate potential "worst case" 1999 CO concentrations from vehicular emissions. The EPA recommends the use of hypothetical worst-case conditions, i.e., conditions that tend to err on overestimating actual impacts. Hypothetical worst-case assumptions include modeling peak-hour traffic periods under stable atmospheric conditions with a wind speed of 1 meter per second (2.2 miles per hour).

Modeled maximum 1-hour CO concentrations and estimated 8-hour concentrations resulting from hypothetical worst-case conditions were analyzed for the intersection of Smith Street and Nimitz Highway because projected traffic conditions at that intersection are expected to yield the highest CO concentrations in the affected area. The results of this analysis are presented in Appendix D and summarized here.

Under hypothetical worst-case conditions:

- Without the project, the maximum cumulative concentration of CO in 1999 is estimated to be 11.9 ppm, which would exceed the State's 1-hour AAQS by 2.9 ppm. No exceedances of the federal standards are anticipated. (Note: Federal standards are health-protective and are based on concentrations, above which, toxicological effects have been observed. The State standard is approximately one-fourth that of the federal standard and has no demonstrated toxicological basis.)

- Worst-case project-related CO concentrations are about 1.9 parts per million (ppm), or about 14 percent of total maximum cumulative CO concentration of 13.8 ppm. Total maximum cumulative concentrations include contributions from natural growth in existing traffic, traffic resulting from full development of other projects such as the Aloha Tower Marketplace and Harbor Court, project-related traffic, and background concentrations.

As discussed in Section 3.13 below, Smith Street is proposed by the City and County of Honolulu for conversion to two-way traffic. The traffic impact analysis (see Appendix H) assumes that the conversion will be implemented and concludes that it will result in LOS 'F' without the project. For air quality purposes, retaining the one-way traffic on Smith Street would be preferable. To address the deterioration in air quality resulting from the two-way conversion, a traffic mitigation measure recommended in this report involves the elimination of the separate left-turn traffic signal phase from Smith Street to Nimitz Highway, an action that would improve the LOS to 'D'.

Potential air quality impacts of CO were also evaluated for the recommended traffic mitigation measure. For this analysis, hypothetical worst-case conditions at the intersection were assumed. Results from this analysis indicate:

- The improved traffic flow that would result from the elimination of the left-turn phase from Smith Street to Nimitz Highway would lower CO concentrations by 2.4 ppm, yielding a total modified "worst case" cumulative 1-hour concentration of 11.4 ppm with the proposed project. This is just slightly above the state 1-hour CO standard.

- With the exception of the state 1-hour AAQS, all cumulative concentrations will comply with state and national AAQS.

Concentrations of CO in the proposed underground parking garage will be limited by the operation of the ventilation system described in Section 2.5 of Chapter I. Forced-air ventilation will be activated whenever concentrations of CO in the parking garage exceed 25 ppm. The 25 ppm criterium was determined based upon 8-hour exposure levels for workers recommended by the American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE). Because exposures within the parking lot are typically a fraction of an 8-hour period, limiting CO concentrations up to25 ppm is expected to provide an adequate margin of safety to human health.

Emissions of CO from the parking ventilation system exhaust create another source of emissions that could impact pedestrians walking along Smith Street, and possibly to building occupants using the fourth floor deck. To better understand the potential impact of ventilation system exhaust, CO emissions from the two proposed exhaust air shafts have been modeled to estimate maximum 1-hour CO concentrations. Results of this analysis indicate that the maximum 1-hour concentration resulting from the parking ventilation system exhaust is 8.5 ppm. To minimize cumulative concentration of CO, that is to say, concentration due to both the parking ventilation system exhaust and vehicular emissions from adjacent roadways, it is recommended that the ventilation system be operated when the concentration of CO within the parking lot reaches 20 ppm rather than the guideline of 25 ppm discussed above. This modification will reduce emissions of CO from the ventilation exhaust and reduce the concentrations of CO from 8.5 ppm down to 6.8 ppm (see Appendix D for more detailed discussion).

The stand-by generator will be located one floor below grade (floor P-1 in Figure 3). Emissions from the stand-by generator will not significantly impact air quality because it will only be used to power life safety and security systems, as well as two emergency elevators, during power outages.

3.7.3 Recommended Mitigation Measures

CO concentrations resulting from vehicular traffic are not likely to cause exceedances in the federal AAQS. The state 1-hour CO concentration could occasionally be exceeded with or without the project based on a hypothetical worst-case scenario. Two possible mitigation measures have the potential of improving air quality.

Elimination of the separate left-turn signal phase from Smith Street to Nimitz Highway would reduce CO concentrations and help to minimize the number of exceedances of the state 1-hour AAQS. This would require the City and County of Honolulu to change its present plans for this intersection. Because exceedances of the state 1-hour standard are anticipated without the project, regional mitigation measures are needed to eliminate all exceedances of the 1-hour standard but are beyond the scope of this project.

CO concentrations in the underground parking garage will be mitigated with the use of forced-air ventilation that will be activitated when concentrations of CO exceed 20 ppm within the underground parking garage. Ventilation design will conform to 1991 City and County of Honolulu Uniform Building Code standards and will consist of a ventilation design capable of exhausting a minimum of 1.5 cubic feet per minute (cfm) per square foot of gross floor area or an alternative system designed to exhaust a minimum of 14,000 cfm for each operating vehicle, the latter being contingent upon approval of the City's Building Department.

3.8 Visual Attributes

3.8.1 Existing Conditions

At present a five-story building and asphalt parking lot with 27 parking stalls are on the project site. There is minimal landscaping and the building, although more than 50 years old, has been modified to the extent that the architectural style and intent of the original structure has been lost. The State Historic Preservation Division has determined that it has no intrinsic historic value or significance (see Appendix F) .

Present mauka/makai views along Smith Street are restricted due to the minimal setback of the existing building. Mauka/makai views along Nuuanu Avenue are less than aesthetic due to the parking lot fronting the existing building and views along Nimitz Highway and Marin Street are typical of older downtown areas.

3.8.2 Potential Impacts

One of the Chinatown Special District design guidelines requires new structures to retain the low-rise form and character of the historic core of Chinatown while allowing for moderate redevelopment at the mauka and makai edges of the District. The proposed project's podium will serve to continue and reinforce the low-rise urban form and streetscape through the incorporation of storefronts, signage, awnings and modulated architectural detailing. Approximately 70 percent of the building perimeter will be commercial or pedestrian access frontage and another 20 percent is comprised of the main pedestrian entrance arcade.

Views along Smith Street and Nuuanu Avenue, looking makai, will be expanded due to the increased building setbacks (up to 25 feet at the mauka end of the structure). Pedestrian views along Merchant Street toward the project will be improved by the landscaped plaza and views of terraced podium levels. Views along Nimitz Highway are also expected to be enhanced by the curvilinear form of the main tower which will reflect a sweeping, stable profile that is thematically consistent with the harbor's maritime and expansive qualities.

The addition of the main tower will, however, impact existing views from Marin Tower, Hawaii National Bank, Queen's Court and Chinatown Gateway due to the increased building height over that of the existing structure.

Shadows from the three-story podium will affect all streets surrounding the project, but to a lesser degree than shadows from the existing 5-story building. Morning shadows will be cast on the Marin Tower podium. Afternoon shadows will be cast on the low-rise buildings at the corner of Marin Street and Nuuanu Avenue and Hawaii National Bank. During the winter, the main tower winter shadows will be accentuated on these properties. During the summer, shadows will primarily affect the project site itself and Nimitz Highway, with the exception of late afternoon shadows which will affect Marin Street, Nuuanu Avenue and Hawaii National Bank.

While final material selection has not been made, window glazing will be colored and will not have a high reflective (mirrored) quality. Consequently, reflections from the building are not expected to impact nearby buildings or the project area. The glazing color will likely be of a blue-green tone that will relate to the color of the adjacent harbor. Window mullions will be color-coated in a similar tone to minimize contrast between the glazing and the mullions.

3.8.3 Recommended Mitigation Measures

The design and orientation of the building, especially the public access and plaza areas, have been specifically selected to improve and enhance views of and from the proposed project. Material selection will ensure the building is compatible with the intent of the Chinatown Special District design guidelines by emphasizing stone and plastered materials that are consistent with the historic character of the area.

3.9 Flora

3.9.1 Existing conditions

The flora of the existing site consists of about 25 fiddlewood trees (*Citharexylum spinosum*) planted around the parking lot, common hibiscus (*Hibiscus rosa-sinensis*) hedge and one clump of Areca palms (*Chrysalidocarpus lutescens*) on the Nimitz Highway side of the parking lot. A small strip of common bermuda grass (*Cynodon dactylion*) is also planted between the building and parking lot. These are all introduced species commonly found throughout the State.

3.9.2 Potential Impacts

Development of the proposed project will result in a net gain of landscaping material over that which is presently located at the property. The loss of existing vegetation is not considered to be significant because it is commonly found throughout the region and in similar environmental conditions around the state.

3.9.3 Recommended Mitigation Measures

In keeping with Chinatown Special District and City and County of Honolulu design guidelines, the Nimitz Highway side of the building will be landscaped, replacing the present hard, non-landscaped edge. Although plant materials for the new structure have not been selected, careful consideration will be given to the use of native species and those species that provide aesthetically pleasing views. If practicable, the existing trees will be saved and replanted at the subject property or elsewhere.

3.10 Fauna

3.10.1 Existing Conditions

The existing fauna of the project site consists of common house sparrows (*Passer domesticus*), doves (*Geopelia striata* and *Streptopelia chinensis*) and, most likely, rats (*Rattus rattus*), mice (*Mus musculus*) and feral cats. No significant bird or mammal habitats have been identified in the project area.

3.10.2 Potential Impacts

Development of the proposed project will result in an increase of habitat for most bird species due to the increased landscaping. Existing fauna that frequent the subject property will be displaced by construction activity but will eventually reestablish themselves. The State Department of Health requires demolition companies to implement a rat extermination program for at least one week prior to the demolition of a building as a means of eliminating the potential for rats to migrate to neighboring properties.

3.10.3 Recommended Mitigation Measures

State Department of Health vector-control procedures will be implemented to control rats. Further mitigation measures to minimize potential adverse impacts are not warranted due to the lack of significant adverse impacts.

3.11 Historic and Archaeological Resources

3.11.1 Existing Conditions

A complete history of the project site and existing building is provided in *Steel Heart-The Industrial Center of Old Honolulu*, (Kleiger, 1994) (see Appendix G). In brief, by the 1850s a steam powered flour mill at the site was converted into a machine shop and foundry and Honolulu Iron Works was developed at the site. This business occupied a large portion of the project area for well over one hundred years. Other areas on the project site were occupied by small retail stores and offices well into the twentieth century. The existing building on the project site was constructed around 1914.

Because the existing building on the project site is more than 50 years old, it would generally be considered historically significant. However, due to the extent and nature of modifications to the building over the years, the architectural style and intent of the original structure have been lost and it has no intrinsic historic value or significance. This has been confirmed by the Department of Land and Natural Resource's (DLNR) Historic Preservation Officer (see Appendix F).

The DLNR's Historic Preservation Division (HPD) has also indicated that sub-surface archaeological deposits may be extant under the present infrastructure and might be significant for the information they are likely to yield on the history of early Honolulu.

3.11.2 Potential Impacts

Because the proposed building includes excavation to accommodate below-grade parking, there is the possibility that existing sub-surface archaeological deposits would be adversely affected. The kinds of remains that are anticipated are valuable because of the information which they will contain about life in area in the early 19th century. However, the remains do not need to be preserved *in situ* to preserve their value. Once their location has been recorded according to accepted archaeological procedures, they can be removed for possible public display, which is considered to be a positive cultural impact of the proposed project.

3.11.3 Recommended Mitigation Measures

The Bishop Museum report (see Appendix G) is mindful of adjacent construction projects and indicates that there is a likelihood of on-site archaeological deposits. As a result of this report, the developer has allotted a budget and time schedule to adequately address the requirements for an archaeological inventory survey and follow-up data recovery process as needed.

The HPD has confirmed that inventory survey excavations will be required and that they may take place prior to demolition of the existing building. The pre-demolition inventory survey is anticipated to take approximately 8 weeks. Assuming there is no discovery of significant artifacts, an executive summary report will be prepared and demolition and construction will be allowed to commence. This will be followed by a comprehensive final report to HPD. If significant artifacts are discovered during the inventory survey phase, an additional 8 weeks has been allotted after demolition of the existing building for additional data recovery excavations and HPD's authorization to proceed with construction. The above noted schedules will be extended or contracted as required to perform the inventory survey and data recovery work to the satisfaction of HPD.

Accomplishment and implementation of the above mitigation measures are expected to result in the proposed project having no significant adverse effect on the archaeological and cultural resources of the project site.

In addition to the above, the developer will include a historical/cultural resources display area within the building plaza. If significant and appropriate for public display, artifacts and other items recovered during the archaeological inventory survey or data recovery activities may be displayed along with historical notes on the project site and area. In this event, the displays will be designed to inform visitors of the rich cultural and historical significance of the Chinatown/downtown/harbor areas.

3.12 Pedestrian Access

3.12.1 Existing Conditions

At present, ingress/egress into the project site and existing building parking lot is from Nuuanu Avenue. Public sidewalks around the property provide public pedestrian access to all sides of the property.

3.12.2 Potential Impacts

Pedestrian access to the project site will be limited during construction. However, in the long-term, no significant adverse impact is anticipated. Due to the increase in employees resulting from the increased size of the building over the present structure, pedestrian traffic in the immediate vicinity of the building is expected to increase, especially during the lunch hour and peak A.M. and P.M. periods.

The building design will also increase public access to and around the project site as well as provide increased public pedestrian circulation and access to the Central Business District, Aloha Tower area and the Chinatown core area. Increased pedestrian circulation and access to the building will be achieved by increasing building setbacks along all streets. Mauka/makai pedestrians will have increased harbor view exposure and more shade will be provided by the increased landscaping. Setbacks along Nimitz Highway and Marin Street will be increased from present conditions by 10 feet. The increased width will provide greater circulation and a stronger landscape concept that unifies the property.

The property corners at the plaza will be designed to include larger corner sidewalks that will facilitate greater circulation capacity and freedom of movement and will be oriented toward the Central Business District and Aloha Tower. The remaining property corners will also be designed to increase accessibility to the property. Modifications to specific corners will be made with respect to satisfying City requirements (Ordinance 2412). These modifications will include work to modify property and sidewalk radii, curb cut access, and related utility locations to current design standards as well as the requirements of the Americans with Disabilities Act.

Loading and parking access will be provided to the project from Smith Street. The loading parking entrances will be designed to incorporate the thematic pattern and colors of the commercial storefronts. Vehicular access is discussed in greater detail in Section 3.13 below.

3.12.3 Recommended Mitigation Measures

Because no significant adverse impacts to pedestrian circulation have been identified, no specific mitigation measures are warranted. As discussed above, the project will have a positive impact on pedestrian circulation.

3.13 Traffic

3.13.1 Existing Conditions

A traffic study prepared specifically for the proposed project is included as Appendix H. The following is a synopsis of that study. Existing intersections and lane configurations providing access to and from the project site are shown in Figure 11. Smith Street is presently one-way north (mauka), Marin Street is one-way east (Diamond Head), Nuuanu Avenue is one-way south (makai), and Nimitz Highway is a four-lane divided highway east/west (Diamond Head/Ewa).

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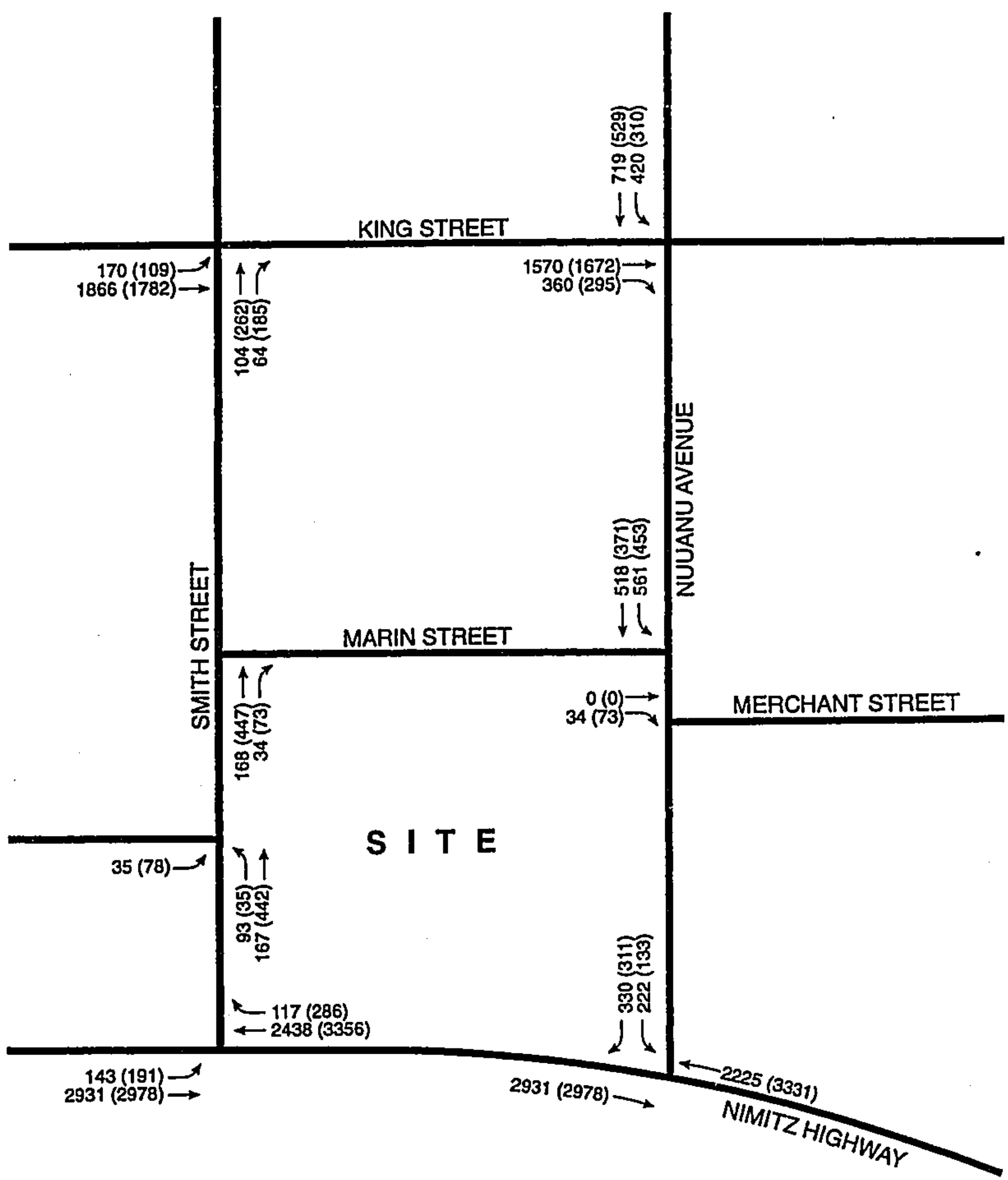

Source: Barton Aschman Associates, Inc.

NORTH

LEGEND
117 (286)
PM PEAK HOUR
AM PEAK HOUR

Figure 11
EXISTING TRAFFIC CONDITIONS

Bank of Hawaii Annex Tower
Final Environmental Assessment
October 1995

It should be noted that at the time of this writing, the City and County's Department of Transportation Services (DTS) is in the processing converting Smith Street to two-way traffic. This work is scheduled for completion by the end of October. This study assumed that Smith Street will be a two-way street at the time the proposed project is constructed. The study also assumed that the City and County will implement its plans to modify the Marin Tower parking garage to allow traffic to enter the Marin Tower parking garage from Maunakea Street and exit onto Smith Street before the proposed project is constructed. [1]

Intersection controls in the vicinity of the project site are as follows. On Nimitz Highway traffic signals are provided. These are typically two-phase with pedestrian crossing signals. On King Street, traffic signals, that are also typically two-phase with pedestrian crossing signals, control traffic. At the Smith/Marin Street intersection there are no traffic controls because right turns only from Smith Street into Marin Street are allowed. Traffic at the Marin Street/Nuuanu Avenue intersection is controlled by a STOP sign. Traffic along Marin Street yields to traffic along Nuuanu Avenue. Traffic may turn right onto Nuuanu Avenue or proceed toward Diamond Head along Merchant Street.

Existing weekday morning and afternoon traffic volumes have been taken from traffic studies conducted in 1990 and 1993 for other projects as well as traffic counts made specifically for the proposed project in June 1994. Traffic counts completed along Nimitz Highway indicate that 1993 hourly traffic volumes were less than in 1990. Traffic associated with Harbor Court has been estimated, because it was unoccupied at the time the 1994 traffic counts were made, and included with traffic generated by related projects. The planning method used to analyze operating efficiency of the signalized intersections adjacent to the project site are described in the *1985 Highway Capacity Manual* (HCM). This method involves the calculation of a volume-to-capacity (V/C) ratio which is related to a level-of-service.

Level-of-Service (LOS) is a term that denotes any of an infinite number of combinations of traffic operating conditions that may occur on a given lane or roadway when it is subjected to various traffic volumes. LOS is a qualitative measure of the effect of a number of factors that include: space, speed, travel time, traffic interruptions, freedom to maneuver, safety, driving comfort, and convenience. There are six LOS, A through F, that relate to the driving conditions from best to worst, respectively.

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1 It should be noted that while the main body of the traffic report presented in Appendix H identified Smith Street as a one-way street (which was accurate at the time the report was initially drafted), the report includes an addendum which reflects the conversion of Smith Street and the Marin Tower parking garage and their impact upon traffic conditions that are forecast for 1999.

The characteristics of traffic operations for each LOS are summarized in Table III-2. In general, LOS A represents free-flow conditions with no congestion. LOS F represents severe congestion with stop-and-go conditions. LOS D is generally considered acceptable for peak-hour conditions in urban areas.

TABLE III-2
LEVEL OF SERVICE DEFINITIONS FOR SIGNALIZED INTERSECTIONS[1]

LEVEL OF SERVICE	INTERPRETATION	VOLUME-TO-CAPACITY RATIO[2]	STOPPED DELAY (SECONDS)
A, B	Uncongested operations; all vehicles clear in a single cycle.	0.000 - 0.700	<15.0
C	Light congestion; occasional backups on critical approaches	0.701 - 0.800	15.1 - 25.0
D	Congestion on critical approaches but intersection functional. Vehicles must wait through more than one cycle during short periods. No long standing lines formed.	0.801 - 0.900	25.1 - 40.0
E	Severe congestion with some standing lines on critical approaches. Blockage of intersection may occur if signal does not provide protected turning movements.	0.901 - 1.000	40.1 - 60.0
F	Total breakdown with stop-and-go operation.	>1.001	>60.0

(1) Source: Highway Capacity Manual, 1985.

(2) This is the ratio of the calculated critical volume to Level of Service E capacity.

The LOS for unsignalized intersections is described in the same manner as signalized intersections. However, the LOS for unsignalized intersections is based on the ability of vehicles to cross or turn between gaps in the traffic stream. A complete description of both signalized and unsignalized LOS and V/C calculation methods is provided in Appendix H.

The existing LOS for the signalized intersections in the vicinity of the project site is shown in Table III-3. The calculated LOS were confirmed by field observations. All of the subject intersections operate at LOS C or better, indicating acceptable operating conditions.

The poor LOS along Nimitz Highway may be misleading because traffic is backing up from the adjacent intersections at Bishop Street and Alakea Street. Under free-flow conditions, these intersections would carry more traffic and the LOS would be lower. The LOS calculation for the Smith/Marin Street intersection is not applicable because there is no merging of traffic. The LOS analysis for Nuuanu Avenue is inconclusive because Nuuanu Avenue is a one-way street (makai direction).

TABLE III-3
EXISTING LEVEL OF SERVICE ANALYSIS

	AM PEAK HOUR		PM PEAK HOUR	
INTERSECTION	V/C[1]	LOS[2]	V/C[1]	LOS[2]
Nimitz Highway @ Smith Street	0.480	A	0.558	A
Nimitz Highway @ Nuuanu Avenue	0.672	B	0.657	B
Marin Street @ Smith Street	N/A[3]	N/A	N/A	N/A
Marin Street @ Nuuanu Avenue	N/A	N/A	N/A	N/A
King Street @ Smith Street	0.387	A	0.416	A
King Street @ Nuuanu Avenue	0.722	C	0.517	A

(1) V/C = Volume-to-Capacity Ratio
(2) LOS = Level-of-Service. Calculated using method described in HCM.
(3) N/A = Not Applicable
Source: Appendix H

Traffic generated by the existing building has been estimated to determine the net increase in traffic expected from the proposed project. Parking at the existing building is for visitors only. Therefore, employees in the building who drive to work must park elsewhere. Because of this, only a small portion of the vehicle trips generated by the existing building actually have origins or destinations on the project site.

The traffic that would use an off-site location and the traffic that would use the existing parking lot exit was estimated using traffic approach and departure information developed as part of the traffic studies for other projects (see discussion in Appendix H). It was assumed that 10% of the employee related vehicle trips during peak hour are oriented to the project site and 90% are oriented elsewhere. Of the 90% oriented elsewhere, 50% are assumed to be directed to Marin Tower. In other words, 50% of the existing employees are assumed to be parking at Marin Tower. Table III-4 indicates the result of the trip generation analysis for the existing site. As shown in the table, it is estimated that the existing building generates 255 vehicle trips during the morning peak hour and 242 trips during the afternoon peak hour.

TABLE III-4
TRIP GENERATION ANALYSIS FOR EXISTING SITE

NUMBER OF EMPLOYEES	500	
PERIOD	EQUATION	VEHICLE TRIPS
Weekday Total	Ln(T) = 0.87 Ln(E) +2.06	1749
AM Peak Hour Total	Ln(T) = 0.98 Ln(E)-0.55	255
AM In (87%)		222
AM Out (13%)		33
PM Peak Hour Total	Ln(T)=0.98 Ln(E)-0.60	242
PM In (16%)		39
PM Out (84%)		203

Source: Appendix H
Notes: Ln is a natural logarithm; T = Trips; E = Employees

3.13.2 Potential Impacts

Future traffic growth in the project area without the project will consist of two components: (1) "background" traffic that is a result of regional growth and cannot be attributed to a specific development; and (2) estimated traffic that will be generated by other development projects in the vicinity of the proposed project.

The growth rate of background traffic was determined through historical traffic counts by the State Department of Transportation (DOT) from 1985 through 1992 for Nimitz Highway between Bishop Street and Fort Street, three blocks east of the project site. Table

III-5 presents the DOT traffic counts. The average annual growth rate was calculated to be 3.68 percent per year over the past eight years.

TABLE III-5
HISTORICAL TRAFFIC VOLUMES ALONG NIMITZ HIGHWAY(1)(2)

YEAR	24-HOUR TRAFFIC VOLUME	PERCENT GROWTH
1985	61,203	N/A
1987	59,642	-1.28
1989	67,294	6.41
1990	68,073	1.16
1991	72,103	6.74
1992	76,965	6.74
Average (1985-1992)	N/A	3.68

(1) Source: Appendix H; DOT Traffic Counts
(2) Location of the counts is along Nimitz Highway between Bishop and Fort Streets.

The estimated related-project trip-generation rates were determined using the Waterfront at Aloha Tower and Harbor Court projects because they are the two newest developments in the vicinity of the proposed project.

The number of Waterfront at Aloha Tower-generated trips that would affect the project site study intersections were determined from a previous traffic study for the Waterfront project (Barton-Aschman Assoc., August 1993). Peak hour trips generated by Harbor Court were estimated using trip-generation rates and/or equations from *Trip Generation*, Fifth Edition (Institute of Transportation Engineers, February 1995), the standard reference for trip-generation analyses. A summary of the trips generated by each project is presented in Table III-6.

The estimated 1999 cumulative traffic volumes, without the proposed project, are calculated by applying the background growth rate to existing traffic volumes and adding trips generated by related projects. The resulting 1999 cumulative peak hour traffic projections are shown in Figure 12.

TABLE III-6

SUMMARY OF TRIP GENERATION BY NEIGHBORING PROJECTS

PROJECT	WEEKDAY TOTAL	AM PEAK HOUR			PM PEAK HOUR		
		TOTAL	IN	OUT	TOTAL	IN	OUT
Harbor Court	3390	585	509	76	549	88	461
Aloha Tower (Phase 1)	7015	219	153	66	1,169	598	598
TOTAL	10,405	804	662	142	1,745	686	1,059

Source: Appendix H

Future traffic volumes to be generated by the proposed project were determined using trip generation equations from *Trip Generation*, Fifth Edition. The trip generation analysis and the resulting daily and peak hour volumes are summarized in Table III-7.

TABLE III-7

TRIPS GENERATED BY BANK OF HAWAII ANNEX TOWER

Gross Floor Area (Sq Ft)	286,000	
PERIOD	EQUATION	VEHICLE TRIPS
Weekday Total	Ln(T)=0.75 Ln(A)+3.77	3,017
AM Peak Hour Total	Ln(T)=0.86 Ln(A)+1.34	495
AM In (87%)		431
AM Out (13%)		64
PM Peak Hour Total	Ln(T)=0.83 Ln(A)+1.46	471
PM In (16%)		75
PM Out (84%)		396

Source: Appendix H

Ln is a natural logarithm; T = Trips; A = Square Feet Gross Floor Area

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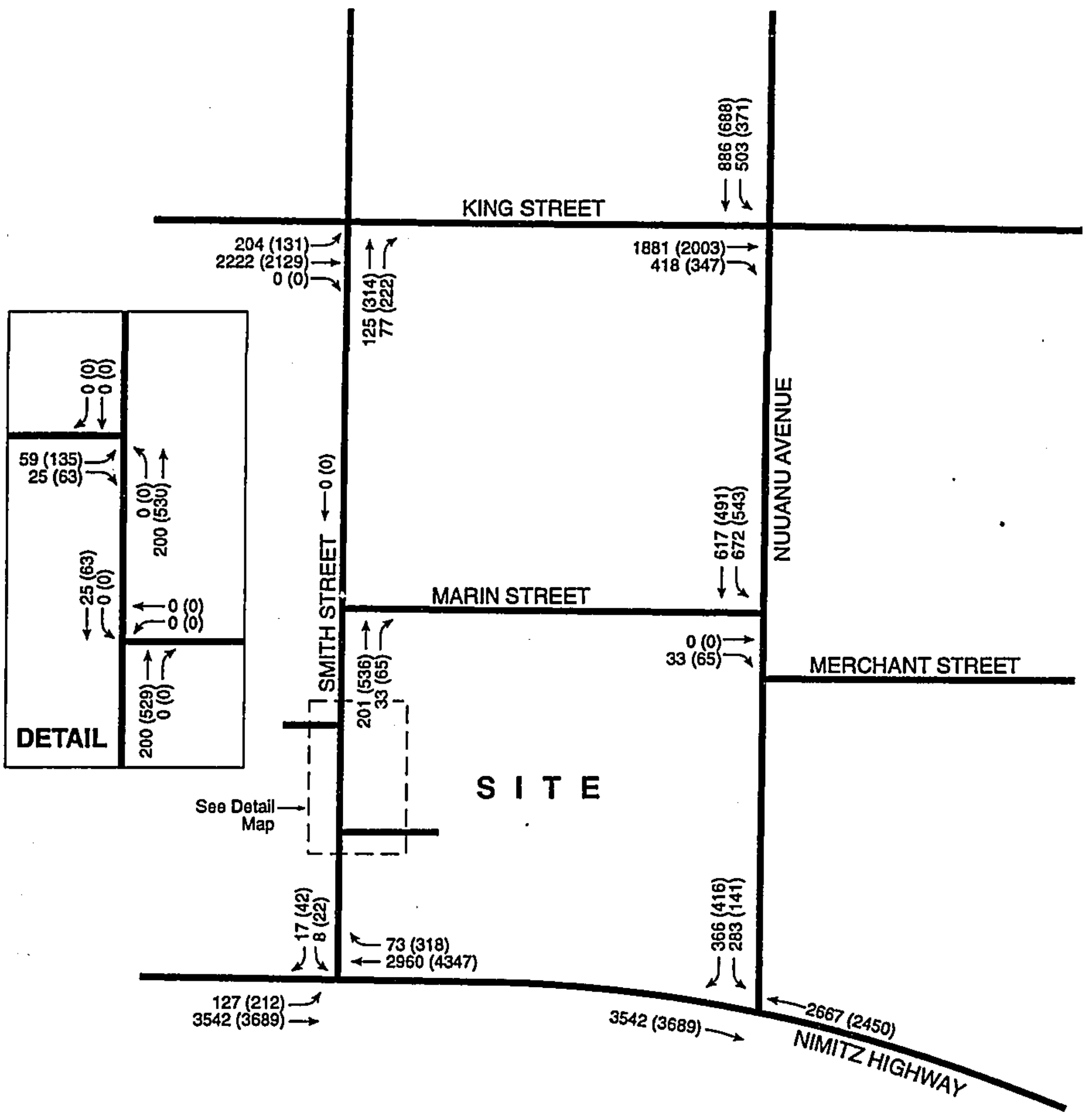

Source: Barton Aschman Associates, Inc.

NORTH

LEGEND

PM PEAK HOUR
AM PEAK HOUR

Figure 12
1999 CUMULATIVE TRAFFIC VOLUMES WITHOUT PROJECT
Bank of Hawaii Annex Tower
Final Environmental Assessment
October 1995

Future traffic volumes with the project were determined by superimposing the project-generated traffic on the 1999 cumulative traffic volumes. It should be noted that given the physical location of the proposed project, only some of the trips identified in Table III-6 above actually show up at the project's intersections. Figure 13 indicates the resulting traffic volumes.

Criteria for determining if the proposed project will have a significant traffic impact, thereby requiring measures to minimize or mitigate potential adverse effects, include the following: (1) If LOS without the project is E or F and the V/C ratio change is greater than 0.030; and (2) If the LOS with the project is D or better. If the first criterion is not met, measures are required to reduce the project-related change in the V/C ratio to less than 0.030 and if the second criterion is met, no mitigation is required. These criteria have been used by the City and County of Honolulu Department of Transportation Services (DTS) in the past and are believed to be applicable to this project.

Construction activities will have impacts on the surrounding roadway system. Heavy trucks, earth movers, and various construction vehicles will need access to and from the site. Because these vehicles can be difficult to maneuver, it may be necessary to close part of the curb lane of the adjacent streets under certain conditions. This is expected to be a short-term occurrence, likely to be limited to the excavation phase of construction. The General Contractor will be required by BOH to mitigate the impact of construction workers on parking conditions in the vicinity of the project during the period that below-grade construction activities occur by implementing a program to transport them to the construction site from a centralized parking area.

As indicated previously, there is relatively little traffic in and out of the present site due to the low number of parking spaces and all parking being for visitors to the building with employees who drive to work parking elsewhere. Therefore, the proposed project will have greater impacts on the surrounding roadways than the existing building. However, the analyses performed indicate that at no time will the LOS be below D, which is the generally accepted minimum LOS for peak hours in urban areas. The anticipated LOS for 1999 and anticipated traffic impacts are summarized in Table III-8.

The conclusions of the analyses performed are:

1. All intersections will operate at LOS C or better during the morning peak hour;

2. All intersections except the ones along Nimitz Highway operate at LOS C or better during the afternoon peak hour;

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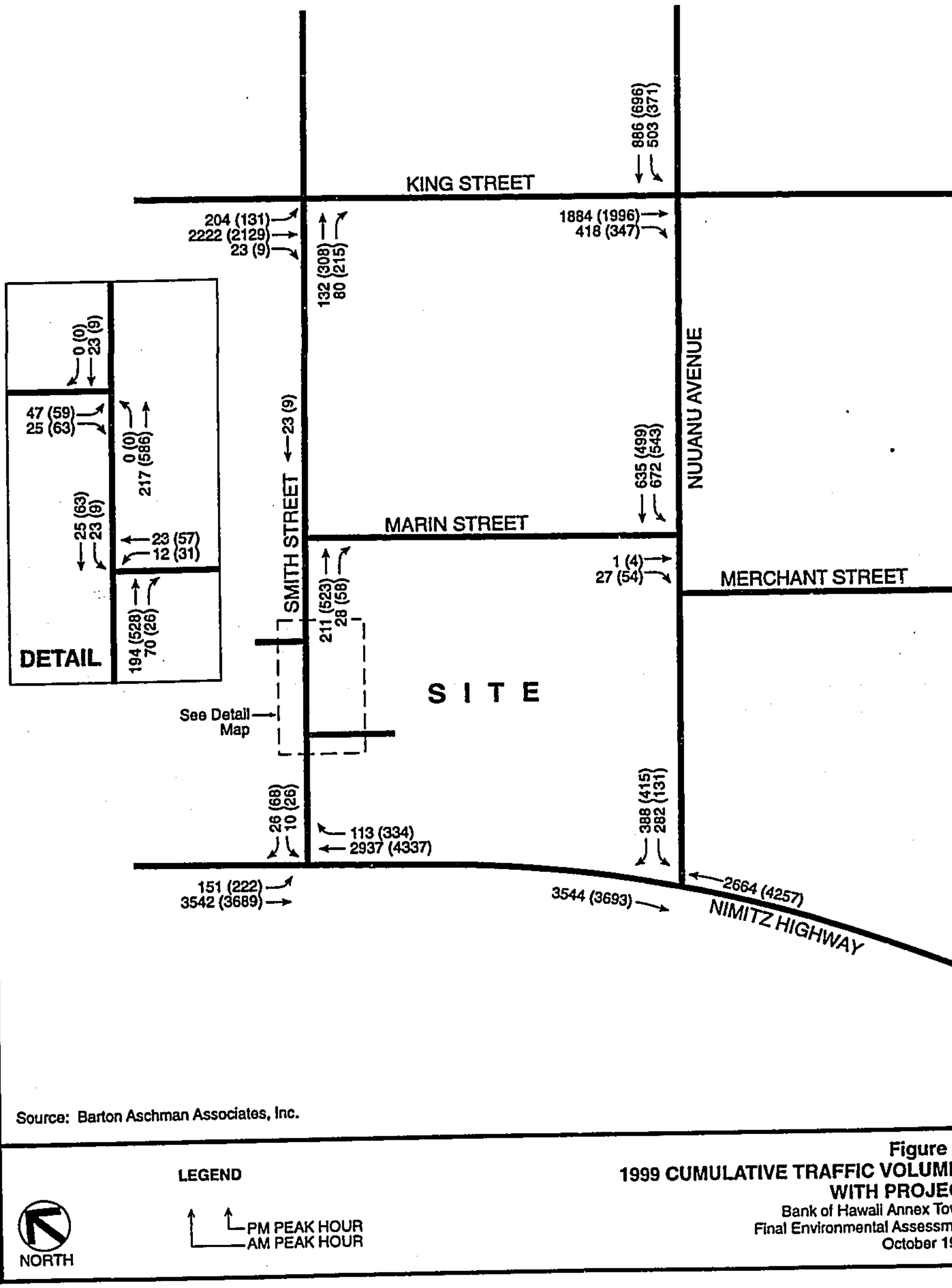


Source: Barton Aschman Associates, Inc.

Figure 13
1999 CUMULATIVE TRAFFIC VOLUMES WITH PROJECT
Bank of Hawaii Annex Tower
Final Environmental Assessment
October 1995

TABLE III-8
LEVEL OF SERVICE ANALYSIS FOR 1999

	AM PEAK HOUR					PM PEAK HOUR				
	WITHOUT PROJECT		WITH PROJECT			WITHOUT PROJECT		WITH PROJECT		
INTERSECTION	V/C[1]	LOS[2]	V/C	LOS	CHANGE	V/C	LOS	V/C	LOS	CHANGE
Nimitz Hwy. @ Smith St.	0.563	A	0.586	A	0.023	1.075	F	1.093	F	0.018
Nimitz Hwy @ Nuuanu Ave.	0.702	C	0.712	C	0.010	0.833	D	0.833	D	0.000
Marin St. @ Smith St.	0.073	A	0.075	A	0.002	0.188	A	0.182	A	-0.006
Marin St. @ Nuuanu Ave.	0.269	A	0.006	A	-0.263	0.215	A	0.012	A	-0.203
King St. @ Smith St.	0.422	A	0.428	A	0.006	0.478	A	0.475	A	-0.003
King St. @ Nuuanu Ave.	0.721	C	0.729	C	0.008	0.654	B	0.656	B	0.002
Smith St. @ Bank of Hawaii Drive	0.063	A	0.015	A	-0.048	0.165	A	0.081	A	-0.084
Smith St. @ Marin Tower Drive	0.178	A	0.180	A	0.002	0.455	A	0.442	A	-0.013

(1) V/C = Volume to Capacity Ratio
(2) LOS = Level of Service
Source: Appendix H

3. The intersection of Nimitz Highway and Smith Street will operate at LOS F during the afternoon peak hour as a result of the conversion of Smith Street from one-way to two-way. Traffic from the proposed project will increase the volume-to-capacity ratio 0.018. This is less than the 0.020 used to define a change as significant.

   The LOS at Nimitz and Smith results from the additional left-turn signal phase that would be required. However, elimination of the separate left turn phase would improve the LOS to D both without and with the proposed project. If the separate left turn phase were eliminated, vehicles turning right from Smith to Nimitz would move concurrently with the left turns from Nimitz Highway to Smith Street, and the LOS would improve significantly; and

4. The LOS at the intersection of Nimitz Highway at Nuuanu Avenue does not change with the addition of the project-related traffic. The volume-to-capacity ratio is 0.833 both with and without the project. This is because the redistribution of employee traffic balances the addition of the project traffic. Traffic volume increases are in the non-critical movements.

3.13.3 Recommended Mitigation Measures

The impact of the conversion of Smith Street from one-way to two-way has a positive effect on the intersection of Nimitz Highway at Nuuanu Avenue. With Smith Street as one-way, traffic from the ewa and mauka directions has to circulate down Nuuanu Avenue, along Nimitz Highway and then mauka along Smith Street. This route is now eliminated in favor of a more direct route down Smith Street. However, the conversion adversely affects the Smith Street/Nimitz Highway intersection as indicated previously.

Left turns from Smith Street into the proposed project parking garage (by vehicles moving makai on Smith) will have to yield to mauka bound traffic along Smith Street. However, because the number of turns is relatively small, delays are expected to be minimal and no queues should form that would block the exit from Marin Tower for a noticeable length of time.

Traffic exiting the proposed project parking garage will have to yield to Smith Street traffic. Left turns into the makai lane of Smith Street will have a slightly longer delay with Smith Street as two-way versus one-way. Prohibiting left turns from the parking garage would force traffic to circulate around the block, impacting Marin Street and the Nuuanu Avenue/Nimitz Highway intersection.

As indicated in Table III-8, the conversion of Smith Street to two-way traffic has an adverse impact upon traffic conditions at the intersection of Nimitz Highway, without the addition of project-related traffic. While this impact is not considered to be significant according to the criteria of the City, it can be mitigated. Therefore, it is recommended that the State not implement a separate left-turn phase at the Nimitz/Smith Street traffic signal (makai direct on Smith). Eliminating the separate left-turn signal would improve the LOS from 'F' to 'D'.

Based on the traffic analyses performed, the proposed project has no significant adverse impact upon traffic conditions. Therefore, no specific mitigation measures are warranted because the LOS will not be decreased below LOS D on any of the streets or roadways in the vicinity of the project site as a result of the proposed project.

However, in response to recommendations raised by the DOT and the DTS, the following measures will be taken:

1. All vehicular access points will be constructed as standard City and County dropped driveways. New sidewalks, curbs and gutters per standard City and County standards will replace existing driveways that will not be used by the proposed project;

2. Driveway grades will be 5 percent or less for a minimum distance of 35 feet from the curb line and adequate sight distance to pedestrians and other vehicles will be provided and maintained;

3. Parking entry controls will be recessed into the project and the type and method of parking fee collection will be designed to minimize vehicular queuing on Smith Street;

4. All street modifications, sidewalks, signals and other traffic modifications will be designed in compliance with DOT and DTS requirements and standards;

5. The developer will continue to work closely with DOT and DTS during the early stages of the project to determine the extent of street improvements that will be necessary to support the project;

6. The General Contractor will be required to implement a program to reduce the parking impacts of construction worker vehicles in the area. This program could

involve the bussing of workers from a centralized parking area or pick-up area to the job-site; and

7. The owner will appoint a Transportation Coordinator to implement a transportation management system (TSM) that could include ridesharing, commuter information networks, transit and carpool/vanpool management, City and County bus service coordination, parking fee incentives that encourage carpooling vanpooling and the provision of secure bike racks for bike riders. The goal of the TSM will be to reduce peak-hour trips, especially by employees in the building.

3.14 Noise

3.14.1 Existing Conditions

A noise study has been conducted specifically for this EA and is included as Appendix E. Following is a brief synopsis of that study. Because the proposed project site is located in downtown Honolulu, it is not considered to be within a noise sensitive areas and is exposed to relatively high traffic noise levels along Nimitz Highway. Generally, the noise levels decrease as the distance from Nimitz Highway is increased.

Noise measurements at and in the vicinity of the project site (see Appendix E for exact locations and methods used) are shown in Table III-9. As indicated, existing noise levels, primarily from traffic, range from 61.8 Leq, DBA to 74.0 Leq, dBA.

Existing Nimitz Highway traffic noise is shown in Table III-10. As indicated, the traffic noise measurements range from 71.7 Leq, dBA to 72.6 Leq, dBA.

With regard to the location of the project site relative to the Honolulu International Airport Ldn (day/night loudness) noise contours, the project site is exposed to an Ldn of less than 60 dBA, which is predicted to decrease to about 55 dBA in the year 2007 due to newer and quieter and more fuel-efficient aircraft. State Department of Transportation guidelines indicate office buildings are an acceptable use within noise levels up to 65 dBA without incorporating additional Noise Level Reduction (NLR) measures.

3.14.2 Potential Impacts

Traffic along Nimitz Highway is expected to continue to be the dominant noise source in the vicinity of the project site. Future noise levels with and without the proposed project are shown in Table III-11. As indicated, the increase in 1999 peak hour traffic noise levels over existing levels will range from 0.7 dBA to 1.2 dBA. As also shown, there are no differences between 1999 traffic noise levels from Nimitz Highway with or without the proposed project. That is, the proposed project will not significantly add to projected Nimitz Highway traffic noise levels.

TABLE III-9
EXISTING NOISE LEVEL MEASUREMENTS FOR PROJECT SITE

LOCATION	Leq[1], dBA[2]	COMMENTS
Nimitz Highway	74.0	Traffic noise dominant with occasional departing aircraft audible
Smith Street	67.1	Traffic on Nimitz Highway dominant noise source with construction equipment on King Street Audible
Marin Street	61.8	Traffic noise on Nimitz Highway dominant noise source
Nuuanu Avenue	66.5	Traffic on Nimitz Highway dominant noise source

1 Leq = Equivalent Sound Level
2 dBA = A-weighted sound level in decibels
Source: Appendix E

TABLE III-10
EXISTING PEAK HOUR TRAFFIC NOISE LEVELS ALONG NIMITZ HIGHWAY AT PROJECT SITE

CONDITION	Leq, dBA	COMMENTS
AM Peak Hour	71.7	30 feet mauka of highway
PM Peak Hour	72.6	30 feet mauka of highway

Source: Appendix E

TABLE III-11
FUTURE PEAK HOUR TRAFFIC NOISE LEVELS ALONG NIMITZ HIGHWAY

CONDITION	Leq, dBA	COMMENTS
1999 WITHOUT PROJECT		
AM Peak Hour	72.4	30 feet mauka of highway
PM Peak Hour	73.8	30 feet mauka of highway
1999 WITH PROJECT		
AM Peak Hour	72.4	30 feet mauka of highway
PM Peak Hour	73.8	30 feet mauka of highway

Source: Appendix E

TABLE III-12
RELATIVE DIFFERENCE IN FUTURE PEAK HOUR TRAFFIC NOISE LEVELS WITH AND WITHOUT THE PROJECT

LOCATION	DIFFERENCE IN Leq, dBA	COMMENTS
SMITH STREET		
AM Peak Hour	0.3	Slight increase with project
PM Peak Hour	0.0	No difference
MARIN STREET		
AM Peak Hour	-0.7	Slight decrease with project
PM Peak Hour	0.0	No difference
NUUANU AVENUE		
AM Peak Hour	0.1	Slight increase with project
PM Peak Hour	0.0	No difference

Source: Appendix E

Projected peak hour traffic noise levels for the other streets bordering the project site are shown in Table III-12. As indicated, the proposed project is expected to slightly influence the 1999 morning peak hour traffic noise. There will be slight increases in traffic noise along Smith Street and Nuuanu Avenue of 0.3 dB and 0.1 dB respectively. A decrease of 0.7 dB will occur along Marin Street. As with the present conditions, the much higher traffic volumes and proximity of Nimitz Highway result in the noise levels in the vicinity of the project site being dominated by traffic along Nimitz Highway.

In addition to project site generated traffic noise, construction equipment is expected to generate noise during the construction period. Project construction will not require the use of pile drivers. All construction equipment will be required to meet applicable noise guidelines and requirements and construction generally will be limited to normal day time construction hours (7:00 am to 6:00 pm). Other construction activities will be within allowable noise limits or permits to exceed noise limits will be obtained from the State Department of Health. There may be an occasion where nighttime or weekend construction efforts will be required. This is expected to occur when large quantities of concrete are poured. In these instances, the developer or contractor will acquire the proper clearances prior to construction activities.

During operation of the building, noise could be generated by mechanical and electrical equipment, such as air conditioning equipment as well as trash pickup and delivery trucks. These noise generation sources are expected to be minimal and will be mitigated through the implementation of the measures described below.

3.14.3 Recommended Mitigation Measures

Mitigation measures to minimize or eliminate traffic generated noise are not required because the proposed project is not expected to cause the generation of significant traffic noise. Similarly, the building design will accommodate potential aircraft noise intrusion caused by aircraft taking off or landing at Honolulu International Airport.

To minimize potential noise from mechanical and electrical equipment, and to allow the building to meet applicable State Department of Health and City and County of Honolulu Land Use Ordinance noise regulations, the following measures will be taken:

1. Intake and discharge silencers will be placed on cooling towers if required.

2. Acoustical louvers or silencers will be placed on mechanical and electrical equipment room intake and exhaust openings if required.

3. The emergency electrical generator will be equipped with effective exhaust silencers and air inlet and outlet silencers if required.

4. Noisy equipment rooms will be equipped with wall and ceiling sound absorbing materials.

5. Acoustically treat service areas utilized for deliveries and trash pickup and/or restrict use of such areas during nighttime and early morning hours.

3.15 Water, Wastewater and Solid Waste Disposal

3.15.1 Existing conditions

The existing building and project site are served by a 12-inch water line in Nuuanu Avenue, a 28-inch sanitary sewer line in Nimitz Highway, and the 32- to 36-inch sanitary sewer line in Ala Moana Boulevard. Solid waste collection and disposal for the existing building are provide by private services.

3.15.2 Potential Impacts to Potable Water, Wastewater, and Solid Waste Disposal Systems

The Board of Water Supply has indicated that the existing 12-inch water line will be adequate to serve the needs of the proposed project. While the City and County of Honolulu Department of Department of Wastewater Management has indicated the present sewer lines serving the project site are inadequate for the proposed project, the applicant and the City have identified a potential solution to the problem which involves rerouting wastewater flow to an alternate line with sufficient capacity (see discussion below). When implemented, the proposed project will have no significant adverse impact upon the wastewater collection and treatment system.

The proposed project is expected to generate more solid waste than the present building. Existing solid waste disposal facilities are capable of handling the increased quantities of solid waste that will be generated.

3.15.3 Recommended Mitigation Measures

The applicant will continue to work with the City and County of Honolulu Department of Wastewater Management (DWM) to appropriately size and improve public sewer lines serving the project. Completion of a wastewater relief line on Nimitz Highway (presently in its design phase) may provide new capacity for the downtown area. In addition, the rerouting of wastewater flow in the King Street/Punchbowl Street area to provide more capacity for the downtown area has been discussed with the DWM. The preliminary conceptual design of such a rerouting has been approved by DWM, with the capacity gained reserved for the proposed project.

Costs for wastewater improvements needed for the project will be borne by the owner. Additionally, appropriate measures, such as the use of low-flush toilets and automatic shutoff lavatory fixtures, will be taken to reduce wastewater flows and water consumption.

Efforts to reduce the solid waste stream could include the establishment of a building-wide recycling program for newspapers, office paper, corrugated cardboard, aluminum cans and plastics. Recycling programs will be determined as planning and design for the project move forward.

3.16 Electrical Power and Communications

3.16.1 Existing Conditions

The project site is served by Hawaiian Electric Company (HECO) power lines. Communications service to the existing building is provided by Hawaiian Telephone Company.

3.16.2 Potential Impacts

Electricity for the proposed building will be provided via extension of the existing underground system. Electrical service is anticipated to be 3,000 kilovolt amperes (KVA) with demand at 1,700 KVA. Existing HECO generation, transmission and distribution lines are capable of serving the proposed project.

Telecommunications service will include eight four-inch conduits from the main telephone backboard to a Hawaiian Telephone Company manhole for voice/data communications. Raceways and support for 2,000 pairs of communications lines will be provided. Existing Hawaiian Telephone Company service is capable of serving the proposed project. Telecommunications services may include provisions for digital and fiber optic systems.

3.16.3 Recommended Mitigation Measures

Construction of a new building affords an opportunity to implement new energy-saving technologies. To the extent practical and in keeping with sound energy conservation practices, energy-efficient lighting and controls, air conditioning equipment, pumps, appliances and equipment will be designed into the building as part of an overall energy management system. In addition, users of the building will be encouraged through public announcements to conserve energy to the greatest extent practical.

3.17 Public Facilities (Police, Fire, Schools, Health Care)

3.17.1 Existing Conditions

Public facilities serving the proposed project include police and fire protection services provided via the downtown police substation located approximately four blocks from the property and fire protection services provided by the Beretania fire station located approximately eight blocks from the property. Response times to the property for both services are less than five minutes.

Public schools in the downtown/Chinatown area include Royal Elementary School, Central Intermediate School and McKinley High School. The nearest private school is St. Andrews Priory.

The primary health care facilities in the vicinity of the property are Queen's Hospital and Straub Clinic, each about 10 to 15 minutes from the subject property. There are a number of medical doctors of different specialties in buildings close to the project property.

3.17.2 Potential Impacts

The proposed project is not expected to have a significant affect on the existing or future operation of schools, health care facilities, police or emergency facilities. The addition of approximately 650 employees over the existing building's 450-500 employees is considered to represent a marginal increase in demand for public services and facilities, but is anticipated to have a beneficial impact on neighboring businesses.

3.17.3 Recommended Mitigation Measures

Mitigation measures to minimize potential adverse impacts are not warranted due to the lack of adverse impacts.

CHAPTER IV
RELATIONSHIP OF PROPOSED ACTION TO LAND USE CONTROLS

1. INTRODUCTION

The applicable governmental land use plans, policies and controls affecting the proposed project include the Oahu General Plan, the Primary Urban Center Development Plan and the Chinatown Special District Land Use Ordinance. As discussed below, the project will be consistent with these plans, policies and controls upon issuance of all applicable permits.

2. OAHU GENERAL PLAN

The Oahu General Plan is the policy document for the long range comprehensive development of the island of Oahu. The General Plan provides direction for balanced growth of the County. The Plan contains goals, policies and standards for the island in general, as well as specific areas, including the downtown area. The proposed project is consistent with the Oahu General Plan goals, policies and standards, which include:

Population Objective C, Policy 1: Facilitate the full development of the primary urban center;

Natural Environment Objective A, Policy 7: Protect the natural environment from damaging levels of air, water, and noise pollution;

Natural Environment Objective B, Policy 2: Protect Oahu's scenic views, especially those seen from highly developed and heavily travelled areas;

Transportation and Utilities Objective A, Policy 9: Promote programs to reduce dependence on the use of automobiles;

Physical Development and Urban Design Objective A, Policy 2: Coordinate the location and timing of new development with the availability of adequate water supply, sewage treatment, drainage, transportation, and public safety facilities;

Physical Development and Urban Design Objective B, Policy 6: Maintain and improve downtown as the financial and office center of the island, and a major retail center; and

Physical Development and Urban Design Objective F, Policy 1: Encourage new construction to complement the ethnic qualities of the older communities of Oahu;

3. PRIMARY URBAN CENTER DEVELOPMENT PLAN

The proposed project has been planned and designed to be consistent with the Primary Urban Center (PUC) Development Plan. The project is located along Nimitz Highway, the primary access into the downtown/Chinatown areas; improves public views of the downtown/Chinatown areas as well as mauka/makai views; enhances the architectural character of the makai Chinatown area and downtown skyline; and is a compatible use and design integration of the makai boundary of the Chinatown District.

The principle planning elements of the PUC Development Plan that are applicable to the proposed project include the continued location of commercial uses along major roadways; maintenance of public views of historically and architecturally significant urban areas, places and buildings, such as Chinatown; the emphasis of historic preservation, architectural character and adaptive reuse in the development and redevelopment of the Chinatown district; the encouragement of compatibility of uses and design integration at the boundaries of the sub-areas, such as the Chinatown/Aloha Tower-Honolulu Harbor boundary; the maintenance, preservation or enhancement of views from public streets and thoroughfares to Aloha Tower, Honolulu Harbor, the mountains and the Hawaii capital district; and building height controls.

4. ZONING

The project site is zoned Central Business Mixed Use (BMX - 4) pursuant to the Land Use Ordinance. The proposed project is a permitted use in this district. As such, it is consistent with this zoning and no waivers or variances are required. The floor area ratio for the property is 7.5 with a maximum allowable square footage of 286,327.5 square feet. As presently designed, the proposed building will contain about 280,000 square feet.

5. CHINATOWN SPECIAL DISTRICT

The preservation and development of the Chinatown area is controlled by the Chinatown Special District section of Land Use Ordinance 86-96, October 1986, as amended. The overall objectives of the Chinatown Special District are to:

(A) help promote the long-term economic viability of the Chinatown district as a unique community of retail, office and residential uses;

Discussion: Redevelopment of the property to a higher use, while increasing setbacks and improving pedestrian and vehicular circulation will contribute to the long-term economic viability of the Chinatown district.

(B) retain the low-rise urban form and character of the historic interior core of Chinatown while allowing for moderate redevelopment at the mauka and makai edges of the district;

Discussion: The project's podium will serve to continue and reinforce the low-rise urban form and streetscape through the incorporation of storefronts, signage, awnings, and modulated architectural detailing. The proposed project is located with the district's Makai Precinct which is identified as the transition area between the Central Business District and Chinatown. The proposed tower is consistent with the guidelines for the Makai Precinct.

(C) retain and enhance pedestrian-oriented commercial uses and building design, particularly on the ground level;

Discussion: A comparatively high percentage of the ground level is dedicated to pedestrian-oriented commercial space. Approximately 70% of the building perimeter will be commercial or pedestrian building access frontage. Another 20% is comprised of the main pedestrian entrance arcade. The remaining 10% is dedicated to vehicular access to the garage and service loading area. Commercial spaces will be designed to be at the same level as the adjacent sidewalk, providing ease of access and a "friendly" street presence.

(D) preserve and restore, to the extent possible, buildings and sites of historic, cultural and/or architectural significance, and encourage new development which is compatible with and compliments these buildings and sites, primarily through building materials and finishes, architectural detailing and provisions for pedestrian amenities, such as storefront windows and historic signage details;

Discussion: The State Historic Preservation Division of the DLNR has determined that the existing structure has no historical value. Therefore, it need not be preserved or restored. As described above, storefront and signage will be stressed as important thematic design elements that have a character consistent with the project context. Finishes and architectural detailing is indicated as being a combination of stone and textured plaster. These materials are considered to be consistent with the buildings that characterize the Chinatown area.

(E) improve traffic circulation with emphasis on pedestrian linkages within and connecting outside Chinatown; and

Discussion: The public plaza on the Nuuanu side of the property will form an important pedestrian amenity. Mauka-makai views will be enhanced by the increased building setback along Smith Street. The generously proportioned sidewalks that are thematically consistent throughout the property will facilitate pedestrian linkages with Marin Tower, Harbor Court, the Central Business District, and the Aloha Tower complex.

(F) retain makai view corridors as a visual means of maintaining the historic link between Chinatown and the harbor.

Discussion: Makai view corridors along Smith Street and Nuuanu Avenue will be enhanced by greater sidewalk width and a comprehensive landscape plan that will unify the site. Mid-block views from King Street are currently affected by existing structures that include Hawaii National Bank and other two- and three-story buildings. Consequently, the proposed project, in and of itself, cannot improve mid-block views.

The Chinatown Makai Precinct Special District objectives include:

(1) *provide for expansion of housing and office development from the central business district, compatible with the overall revitalization of Chinatown, including an active retail-oriented ground level and distinctive facade treatments;*

(2) *create a transition between the high-rise central business district and the historic core of Chinatown;*

(3) *provide a visible connection between Nimitz Highway and the interior of Chinatown; and*

(4) *develop a continuous street landscaping theme along Nimitz Highway to emphasize its role as a major accessway into the Central Business District and Waikiki.*

While the applicant believes that the proposed project is consistent with the Chinatown Special District objectives and Makai Precinct development standards, the project will soon undergo a formal consistency review by the Department of Land Utilization in conjunction with the processing of the Special District Permit. The project must be found by the City to be consistent with the Special District objectives and Makai Precinct development standards before the Major Permit will be issued. To that end, the applicant will work with the DLU to ensure conformance with the relevant objectives and development standards.

The project will: help promote the long-term economic viability of the Chinatown district by providing Class A office space and retail outlets at the time additional office/retail space is forecast to be needed; retain and enhance pedestrian-oriented commercial uses and building design; improve pedestrian circulation and emphasize pedestrian linkages within and outside Chinatown; improve mauka/makai visual links between Chinatown and the harbor; and provide continuous street landscaping along Nimitz Highway where none exists at present.

6. CHAPTER 205A, HAWAII REVISED STATUTES

The proposed project is outside the SMA.

CHAPTER V
TOPICAL ISSUES

1. RELATIONSHIP BETWEEN SHORT-TERM USES AND MAINTENANCE OF LONG-TERM PRODUCTIVITY

Analyses of various on- and off-site environmental and socioeconomic features have found the subject property possesses physical attributes that are desirable both as amenities for the proposed project as well as for their own sake. These attributes include location adjacent to the Central Business District and within the Makai Precinct of Chinatown; location relative to Honolulu International Airport and Waikiki, the tourism center of Honolulu; and the physical size of the property relative to the proposed building size. The analyses have also indicated the project will enhance the existing conditions of the site and area and have minimal natural environmental effects while having positive socioeconomic effects. The specific measures that will be employed to mitigate and minimize potential adverse effects, as described in Chapter III, will be followed in the design, construction and operation phases of the project.

No short-term exploitation of resources that will have negative long-term consequences have been identified. The proposed Bank of Hawaii Annex Tower is envisioned by the development manager and owner as having the same high quality attributes as other new downtown and Chinatown projects and the project is being designed to last for decades. The principal long-term benefits of the proposed project include the productive use of the property at a greater economic return to the owners specifically and indirectly to the citizens of the City and County of Honolulu, Chinatown and the State. Increased business opportunities for firms supplying goods and services to the businesses located within the building, as well as increased shopping opportunities for residents and visitors will provide long-term economic benefits to everyone. The proposed project is a logical extension of past development in Chinatown and the Central Business District.

2. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The development of the proposed project and resultant construction will result in the irreversible and irretrievable commitment of certain natural and fiscal resources. Major resource commitments include the land on which the project will be built, as well as money, construction materials, manpower and energy. The effects of using these resources should be weighed against the expected positive socioeconomic benefits to be derived from the project versus the consequences of taking no action or adopting another less beneficial use of the property.

The proposed project does not call for a substantial commitment of government supplied services or facilities that would not be required without the project. The project will add to the cultural resources available to the residents of and visitors to Chinatown. Similarly, the project will add to the tax revenues of the State and City and County of Honolulu.

3. OFFSETTING CONSIDERATIONS OF GOVERNMENTAL POLICIES

By the very existence of a complex system of land use policies, plans, goals, objectives and controls at both the state and county levels of government, development proposals requiring major and minor permits are often faced with inherent contradictions and conflicts within the land use regulatory system. As indicated in Chapter IV, with issuance of the applicable permits, the proposed project will be consistent with state, county and Chinatown land use plans, policies, objectives and controls. Further, the analysis of public revenues versus public expenditures indicates an extremely favorable ratio. The project will be privately funded and not require the expenditure of significant sums of public monies.

4. UNRESOLVED ISSUES

The owner and development manager of the proposed project have met with local concerned public groups and agencies over the past 2 to 3 years. At present, unresolved issues related specifically to the project include the issuance of appropriate permits, for which this EA has been prepared to address, and final design solutions for wastewater disposal, which have been approved in concept by the City but require further engineering analysis.

Occasional exceedances of the state 1-hour AAQS for maximum CO concentration in 1999 at the intersection of Nimitz Highway and Smith Street are also an unresolved issue. However, because this condition is anticipated without the proposed project, it is beyond the scope of the project.

5. ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

There are no adverse environmental effects that cannot be avoided or mitigated.

6. CUMULATIVE IMPACTS

The proposed project is not expected to create any adverse cumulative impacts on the natural or socioeconomic environments of the project area or island in general. Implementation of the proposed project is expected to have positive socioeconomic effects that will benefit the community in general.

7. INDIRECT EFFECTS AND THEIR SIGNIFICANCE

By increasing the available supply of Class A office space and associated retail space at the time when it will be needed, the project will have the effect of stabilizing overall lease rents and office expenses for the community will be stabilized to the extent possible. This will be significant when compared to the no action alternative or an alternative that does not have the same forecast economic returns as the proposed project.

CHAPTER VI
DETERMINATION

During the project developer's discussions of the proposed project's consistency with the Oahu General Plan and the Primary Urban Center Development Plan, as well as with the Chinatown Special District objectives, the applicant has considered the sum effects of the project on the quality of the environmental and socioeconomic conditions in the area to be impacted, including its cumulative effects. The applicant has considered every phase of the proposed project, the expected consequences, both primary and secondary, and short-and long-term effects of the proposed action. As a result of these considerations, it has been determined that:

a. The proposed project does not involve an irrevocable commitment to loss or destruction of any significant natural, historical, archaeological, or cultural resource.

b. The proposed project represents a permitted and approved land use.

c. Approval of the requested action would be consistent with the goals, policies, and courses of action of the Oahu General Plan and Primary Urban Center Development Plan and uses permitted in a BMX - 4 zoned district.

d. The proposed project will have a positive effect on the economic and social welfare of the community, county, and state.

e. The proposed project does not involve substantial secondary impacts, such as population changes that are not already contemplated and accommodated by the Oahu General Plan.

f. The proposed project does not increase the demand for public services or facilities that are not already contemplated.

g. The proposed project does not substantially affect public health.

h. The proposed project does not involve substantial degradation of the natural environment.

i. The proposed project does not substantially affect rare, threatened, or endangered species or habitats.

j. The proposed project does not substantially affect air or water quality or ambient noise levels.

k. The proposed project does not substantially affect an environmentally sensitive area such as a flood plain, tsunami zone, special management area, erosion-prone area, geologically hazardous land, estuary, coastal waters, or inland waters.

l. The proposed project does not involve a larger commitment for further actions.

The proposed project has been designed to be compatible with the locality and surrounding area and is appropriate for the physical conditions characterizing the area. The mitigation measures proposed will ensure that the existing environmental character of the area will be preserved. The applicant will be responsible for, and comply with, all applicable statutes, ordinances, and rules of federal, state, and county governments.

Based on the significance criteria contained in Title 11, Chapter 200-12 of the Hawaii Administrative Rules, the proposed project will have no significant adverse environmental impact.

CHAPTER VII
REFERENCES

Barton-Aschman Associates, Inc. (1995). Traffic Impact Analysis Report for Bank of Hawaii Annex Tower. Honolulu, Hawai'i.

Barton-Aschman Associates, Inc. (1993). Traffic Study for The Waterfront at Aloha Tower, Phase One in Honolulu Hawaii.

City & County of Honolulu (1995). Land Use Ordinance. Honolulu, Hawai'i.

City & County of Honolulu (1992). General Plan Objectives and Policies. Honolulu, Hawai'i.

City & County of Honolulu (1994). Primary Urban Center Development Plan. Honolulu, Hawai'i.

Dames & Moore (1991). Preliminary Foundation Investigation and Dewatering Consultation - Proposed Bank of Hawaii Annex Tower. Honolulu, Hawai'i.

Department of Geography, University of Hawaii (1983). Atlas of Hawaii. Honolulu: University of Hawaii Press.

Department of Housing and Community Development (1987). Environmental Assessment - River Nimitz Housing Project. Honolulu, Hawai'i.

Hawai'i State Department of Business and Economic Development (1994). The State of Hawai'i Data Book, 1994. Honolulu, Hawai'i.

Institute of Transportation Engineers (1995). Trip Generation (1995 Update).

Klieger, Paul C., Ph.D. (1994). Steel Heart -- The Industrial Center of Old Honolulu. Honolulu, Hawai'i.

Stearns, Harold T., (1938). Records of the Drilled Wells on the Island of Oahu, Hawaii. Honolulu, Hawai'i.

The Hallstrom Group (1995). Demand Analysis for the Proposed Bank of Hawaii Annex Tower. Honolulu, Hawai'i.

CHAPTER VIII
CONSULTED PARTY COMMENTS AND APPLICANT RESPONSES

The following governmental agencies, private groups and interested individuals have been consulted during the preparation of this EA and/or given or made aware of presentations regarding the project by the developer. Comments on the proposed project and responses to the comments provided by the various agencies are provided in this chapter.

STATE OF HAWAII:

Department of Land and Natural Resources, Historic Preservation Division
Department of Transportation, Harbors Division and Highways Division
University of Hawaii at Manoa Environmental Center

CITY AND COUNTY OF HONOLULU:

Department of Land Utilization
Department of Transportation Services
Department of Wastewater Management
Department of Public Works
Director of Finance, Real Estate Division
Board of Water Supply
Department of Housing and Community Development
Downtown Neighborhood Board No. 13

PRIVATE GROUPS AND INDIVIDUALS:

H. William Burgess Trust
Yoko G. Nakagawa, Linda N. Wu Trust
Downtown Improvement Association
Historic Hawai'i Foundation
Chinatown Merchants Association
McCormack Properties
Murphy's Bar and Grill, c/o Mr. Don Murphy
O'Tooles Restaurant, c/o Mr. Gary Naftel
Davis and Levin, c/o Mr. Mark Davis, Esq.

DEPARTMENT OF LAND UTILIZATION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813 • (808) 523-4432

JEREMY HARRIS
MAYOR

PATRICK T. ONISHI
DIRECTOR

LORETTA K.C. CHEE
DEPUTY DIRECTOR

RECEIVED
AUG 4 1995
STRINGER TUSHER & ASSOC.

95/ED-001(ASK)

Route to:	
cc	DGS
✓	TT
IC	Chron
	cc Lee Sichter
	Phil Russel
File: BOH	
File #: 1.6 EA	
Return to:	

August 3, 1995

Mr. Terry Tusher
Stringer Tusher Architects, Inc.
1100 Alakea Street, Suite 200
Honolulu, Hawaii 96813

Dear Mr. Tusher:

Draft Environmental Assessment (DEA)
Bank of Hawaii - Annex Tower
Tax Map Key: 1-7-02: 02

We are forwarding copies of all comments we have received relating to the DEA for the above-referenced project.

In accordance with the provisions of Chapter 343, Hawaii Revised Statutes (HRS), you must respond in writing to these and any other comments which were received during the 30-day comment period which began with the publication of a notice of availability of the DEA in the OEQC Bulletin on February 8, 1995. The final Environmental Assessment (FEA) must include these comments and responses, as well as revised text, if appropriate.

The issues raised in those comments generally relate to infrastructure, historic and archaeological resources, design, orientation, air quality, traffic and construction impacts. The FEA should address these concerns.

The following are our specific comments on the DEA which also must be addressed in the FEA:

1. Detailed information should be provided to substantiate claims made in the DEA. For example, the information in the following excerpt is too general (page 6):

> "All research to date indicates that the project will not impact (or be subject to adverse): flooding, tsunamis, erosion, estuaries, flora and fauna, fresh water, coastal waters, or other natural resources".

The research that was done, and the findings and reasons for the conclusions, should be described. The DEA contains other generalizations that should be explained.

2. The project will increase parking from 27 to 570 spaces. We are concerned that the increase in vehicular traffic will adversely impact air quality. The FEA should describe these impacts.

3. Site, elevation and landscape plans should be provided to illustrate the "terraced forms", setbacks, plaza and other architectural features of the project.

4. The DEA states that construction of the six-level below-grade parking garage will require dewatering (page 6). Possible impacts of dewatering during project construction and mitigation measures should be disclosed in the FEA.

5. The main text of the FEA should include a brief summary of the findings of the historical study prepared by the Bishop Museum (DEA Exhibit 3).

6. The FEA should summarize the traffic impacts and proposed mitigation measures of the construction activities in the main body of the text. Also, the Traffic Study (DEA Exhibit 4) proposes traffic systems management programs that should be incorporated into the main text of the FEA.

7. <u>Design</u>

Page 4 of the DEA states that "the main tower form is ... consistent with the Land Use Ordinance/Chinatown Special Design District guidelines". We request that this statement be eliminated or reworded as it seems premature. Review for consistency with Land Use Ordinance/Chinatown Special District requirements will occur in conjunction with processing of the special district permit. Further, the applicant has indicated that the building design has changed from that shown in previously submitted plans.

Page 6 of the DEA states that demolition of the historic structure has been approved by the Department of Land and Natural Resources. However, a major permit will be required for its demolition and to date, we are not aware of any formal approvals. We ask that this language be revised accordingly.

Page 7 of the DEA states that the project will have no impact to cultural resources. We recognize the Chinatown Special District as a historical and cultural resource. As such, the FEA should include a discussion of project and construction impacts to this resource and proposed mitigation measures. Specific aspects which must be addressed are the visual presence of the project and tower to the district, changes in pedestrian traffic, relationships to surrounding structures, changes in the skyline, shadow patterns, wind patterns and potential reflective sunlight.

8. As indicated in the attached comment letters, the FEA should address impacts to infrastructure, including existing water supply, project generated sewage and solid waste.

9. We recommend that the FEA include an index to assist the reader in locating information.

Should you have any questions, please contact Ardis Shaw-Kim of our staff at 527-5349.

Very truly yours,

PATRICK T. ONISHI
Director of Land Utilization

PTO:am
Enclosures

g:deaboh.ask

MEMO TO FILE **File No.** bohannex.pbe

Department of Land Utilization Urban Design Branch

To: Ardis, ERB

From: Patrick, UDB Date: 3/9/95

Re: Bank of Hawaii Annex Tower / EA

On page 4, the applicant states that "the main tower form is ...consistent with the Land Use Ordinance/Chinatown Special District." We request the applicant to eliminate this or reword it as this statement seems premature. A special district permit for the project has not been accepted, therefore a complete SD permit review has not been completed, especially if the previously submitted design has been changed.

On page 6, the applicant states that demolition of the historic structure has been approved by DLNR, however, a major permit will be required for its demolition and to date we are not aware of any formal approvals. We ask that this language be a revised accordingly.

On page 7, the applicant states that there is no impact to a cultural resource. Apparently they do not consider Chinatown a cultural or historic resource, but we do. Further discussion should be provided toward the impact the project and its construction will have to this resource and the measures being provided to mitigate them. This should include the visual presence of the project and tower to the district, pedestrian traffic, adjoining structures, the skyline, shadow patterns, wind patterns and potential reflective sunlight.

It appears more specific discussion is warranted for potential projected demands to to existing water supply, project generated sewage and solid waste, the potential for archaeological findings and what mitigative measures will be provided.

Stringer Tusher Architects Incorporated AIA

October 23, 1995

Mr. Patrick T. Onishi
Director of Land Utilization
City and County of Honolulu
650 South King Street, 7th Floor
Honolulu, Hawaii 96813

Dear Mr. Onishi:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
Tax Map Key 1-7-02:02

Thank you for your letter of August 3, 1995 concerning the above-referenced project. Following are responses to your comments in the order they were presented in your letter. Please note that these responses also address concerns raised by your staff in its Memo to File, dated March 9, 1995.

1) The Final Environmental Assessment (EA) has been expanded substantially to address your concern that claims presented in the Draft EA need to be substantiated. Please note that the document has been reformatted by subject matter so that the discussion of impacts and potential mitigation measures is more accessible to the reader. In addition, eight appendices are included which provide the requested substantiation of claims. These include a soils analysis, a market report, a Best Management Practices Plan, an air quality impact analysis, a noise analysis, an historical study, a summary of correspondence with the State Historic Preservation Division of the Department of Land and Natural Resources, and a traffic impact study. Moreover, we have attempted to eliminate all generalizations from the document.

2) Section 3.7 of Chapter III of the Final EA includes a detailed discussion of air quality impacts resulting from vehicular traffic increases as well as construction activities.

3) Architectural plans for the proposed project are now included in the Final EA as Figures 3 through 9.

4) The impacts of dewatering and recommended mitigation measures are presented in Section 3.4 of Chapter III. In addition, a Best Management Practices Plan is included as Appendix C.

5) A summary of the findings of the historical study prepared by the Bishop Museum is presented in Section 3.11 of Chapter III. The entire study is included as Appendix G.

Stringer Tusher Architects Incorporated AIA

6) Traffic impacts and recommended mitigation measures are presented in Section 3.13 of Chapter III. The complete traffic impact analysis is included as Appendix H. Please note that this appendix also includes an addendum to the study that addresses the imminent conversion of Smith Street from one-way to two-way traffic. Traffic system management (TSM) programs discussed in the traffic study have been included in the main text of the Final EA under Section 3.13.3 of Chapter III.

7) Chapter IV of the Final EA includes a summary of the proposed action's relationship to land use controls. The statement concerning the project's consistency with the LUO and Chinatown Special Design District guidelines has been modified to reflect your concern. The discussion is presented in Chapter IV, Section 5.

The language concerning approval of the demolition of the existing structure has been removed from the document.

The Final EA has been expanded to fully address the potential impacts of project construction. The analysis is presented by subject matter and dispersed throughout the document. Please refer to the following sections of Chapter III for these discussions: Wind Impacts (Section 3.6.2); Air Quality Impacts (Section 3.7); Visual, Shadow and Reflective Impacts (Section 3.8); Pedestrian Impacts (Section 3.12); Traffic Impacts (Section 3.13); and Noise Impacts (Section 3.14).

8) The impact of the project upon infrastructure and public facilities is discussed in Chapter III, Section 3.15, 3.16 and 3.17.

9) A table of contents has been added to the Final EA to serve as an index of subject matter for readers.

Should you have any questions about the information provided above, please contact me.

Sincerely,

Terry Tusher

95-00912

BUILDING DEPARTMENT

CITY AND COUNTY OF HONOLULU

HONOLULU MUNICIPAL BUILDING
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

JEREMY HARRIS
MAYOR

RANDALL K. FUJIKI
DIRECTOR AND BUILDING SUPERINTENDENT

ISIDRO M. BAQUILAR
DEPUTY DIRECTOR AND BUILDING SUPERINTENDENT

PB 95-107

February 15, 1995

'95 FEB 17 PM 4 00

MEMO TO: DEPARTMENT OF LAND UTILIZATION

FROM: RANDALL K. FUJIKI
DIRECTOR AND BUILDING SUPERINTENDENT

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT
BANK OF HAWAII ANNEX TOWER
TMK: 1-7-02:02

In response to your February 7, 1995 request, we have reviewed the subject document and have no comments to offer.

RANDALL K. FUJIKI
Director and Building Superintendent

cc: G. Tamashiro

Stringer Tusher Architects Incorporated AIA

October 23, 1995

Mr. Randall K. Fujiki
Director and Building Superintendent
Building Department
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Fujiki:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
Tax Map Key 1-7-02:02

Thank you for your letter of February 15, 1995 concerning the above-referenced project. We appreciate your taking time to review the document. Should you have any questions about the information provided above, please contact me.

Sincerely,

Terry Tusher

95-01464

BENJAMIN CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

KAZU HAYASHIDA
DIRECTOR

DEPUTY DIRECTORS
SAM CALLEJO
GLENN M. OKIMOTO

IN REPLY REFER TO:
HWY-PS
2.4821

March 15, 1995

'95 MAR 15 AM 7 49
DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

Mr. Patrick T. Onishi, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Onishi:

Subject: Environmental Assessment, 95/ED-001, Proposed Bank of Hawaii Annex Tower, Honolulu, Oahu, Hawaii; TMK: 1-7-02: 02

Thank you for the opportunity to comment on the proposed project within the shoreline setback.

We have the following comments:

1. The proposed project will replace a five-story office building and 27 parking stalls with a 21-story office building and 570 parking stalls. We disagree with the conclusion in the Traffic Impact Analysis Report that no traffic mitigation measures are required for the project.

2. The applicant should plan, design and construct a right-turn deceleration lane on Nimitz Highway into Smith Street to accommodate vehicles entering the parking structure.

3. The applicant should also plan, design and construct an additional right-turn lane on Nuuanu Avenue for vehicles turning right onto Nimitz Highway.

4. The intersection of Nimitz Highway and Smith Street should accommodate bicycles in the Nimitz Highway bike lane which are turning left onto Smith Street.

5. Secured parking area for bicycles should be provided on-site at a rate of 5 percent of automobile parking stalls.

6. On-site shower facilities should be provided to encourage bicycle commuting.

7. The best "located" parking stalls should be designated exclusively for carpools and vanpools.

   The internal traffic circulation pattern for the project structure should be designed to prevent possible vehicle backups onto Nimitz Highway.

8. The parking garage parking fees should provide price incentives for carpools and vanpools, such as charging only half as much as the fee for people who drive alone to work.

9. The parking garage height clearance must be a minimum of 6-feet 11-inches to accommodate vans used for commuting.

10. The applicant should assign an on-site transportation coordinator to provide and distribute information on commuting alternatives and to operate the building's parking facilities.

11. The transportation coordinator should work with the State Highways Division's Transportation Demand Management Office to develop an ongoing program which would include but not be limited to the following:

    a. Matching tenant employees into carpools and vanpools;

    b. Providing and funding an emergency ride program;

    c. Identifying child care opportunities within the area;

    d. Organizing transit and carpool/vanpool subsidies;

    e. Distributing at least two rideshare promotional mailings per year;

    f. Conducting a transportation fair on-site at least once a year;

    g. Conducting annual commute surveys; and

    h. Providing a permanent area or bulletin board within the building which provides bus maps, bike routes and car/van pooling information.

12. All plans for construction must be submitted to State Highways Division for review and approval.

13. All roadway improvements required by State Highways Division must be provided by the applicant at no cost to the State.

Very truly yours,

KAZU HAYASHIDA
Director of Transportation

Stringer Tusher Architects Incorporated AIA

October 23, 1995

Mr. Kazu Hayashida, Director
Department of Transportation
State of Hawaii
689 Punchbowl Street
Honolulu, Hawaii 96813-5097

Dear Mr. Hayashida:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
Tax Map Key 1-7-02:02

Thank you for your letter of March 15, 1995 concerning the above-referenced project. We are enclosing for your files a copy of the Final Environmental Assessment for the project. Following are responses to your comments in the order they were presented in your letter.

1) The level-of-service (LOS) analysis prepared for the proposed project concludes that for 1999 conditions the expected LOS would be D or better. This is considered to be an acceptable LOS for urban peak-hour traffic conditions. However, in view of your concerns we have included a number of mitigation measures intended to ensure that the project's traffic-related impacts are minimized. The discussion of these measures is presented in Chapter III, Section 3.13.3.

2) According to our traffic consultant, Parsons Engineering Science, the tangent length of the block between Smith Street and Nuuanu Avenue is approximately 150 feet. This is insufficient length to provide a deceleration lane on Nimitz Highway for vehicles executing a right-hand turn into Smith Street.

3) Our traffic impact analysis concludes that provision of a right-turn-only lane on Nuuanu Avenue for vehicles turning right on Nimitz Highway results in a morning and afternoon LOS of 'B' and 'D' respectively. This same LOS can be obtained by modifying the middle lane to allow optional left or right turns. We believe that this is a more cost-efficient solution.

4) Your request to accommodate bicycles implies that a mechanism for the detection of bicycles in the left-turn lane from Nimitz Highway to Smith Street should be provided. This can be accomplished with the installation of a pedestrian push button mounted in a location appropriate for bicyclists or an adjustment to the sensitivity of the existing detectors to accommodate bicycles. Provision of the detection for bicycles would be subject to coordination with the City and County Department of Transportation.

Stringer Tusher Architects Incorporated AIA

5) A secured parking area for up to 30 bicycles will be provided on-site. The number of bicycles to be served is based on your suggested rate of 5% of the total number of parking stalls, which at this time are estimated to be approximately 600.

6) While we are concerned about the security implications of on-site shower stalls for bicyclists, we share your commitment to encourage increased bicycle commuting and will evaluate the merits of including such a facility in the project.

7) Designation of carpool and vanpool parking spaces will be addressed in the development of the functional plan for the parking garage. An analysis will also be performed to provide adequate off-street queue lengths for the parking garage entrance.

8) Your recommendation for the structuring of parking fees to encourage carpooling and vanpooling will be considered when the parking lot fee rates are determined.

9) The parking lot garage height clearance will be designed to accommodate non-commercial passenger vans by providing a minimum height clearance of 7 feet.

10 & 11) An on-site transportation coordinator will be appointed by the owner to address the transportation management system alternatives recommended in your letter.

12 & 13) It is understood that all plans for improvements on Nimitz Highway are subject to review and approval by the State Highways Division and that those required improvements will be privately-funded.

Should you have any questions about the information provided above, please contact me.

Sincerely,

Terry Tusher

BENJAMIN J. CAYETANO
~~JOHN WAIHEE~~
GOVERNOR OF HAWAII

'95 MAR 15 PM 2 21

DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

LAWRENCE MIIKE
~~JOHN C. LEWIN, M.D.~~
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HAWAII 96801

In reply, please refer to:
EMD-CAB

March 8, 1995

95-158 CAB

Mr. Patrick T. Onishi
Director of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Onishi:

SUBJECT: Comments on the "Proposed Bank of Hawaii-Annex Tower Project", 800 Nuuanu Avenue, Chinatown, Oahu
TMK: 1-7-02:02 (POR)

A Draft Environmental Assessment was submitted to the Department of Health for the proposed Bank of Hawaii-Annex Tower Project. This assessment was conducted since the property itself is considered a "historic site" as part of the Chinatown Special Design District. The project consists of demolishing an existing five-story building and an on-grade parking lot and replacing it with a twenty one-story office building and six levels of below-grade parking. In addition, the Bishop Museum/State Museum of Natural and Cultural History had conducted research on the history of the property and concluded that it may contain culturally significant resources. Therefore, a recommendation to conduct an archaeological investigation was incorporated into the project's schedule.

Demolition Involving Asbestos:

As a project that will entail demolition activity, the Federal Register, 40 CFR Part 61, National Emission Standard for Hazardous Air Pollutants, Asbestos NESHAP Revision; Final Rule, November 20, 1990, requires inspection of all affected areas to determine whether asbestos is present.

In 1986, Congress enacted the Asbestos Hazard Emergency Response Act (AHERA, or TSCA Title II) which mandated a regulatory program to address asbestos hazards in schools. A part of AHERA (Section 2-6; 15 U.S.C. 2646) dealt with the mandatory training and accreditation of persons who perform certain types of asbestos-related work in schools.

Subsequently, in 1990, Congress enacted ASHARA (Pub. L. 101-637), which amended AHERA and extended the training and accreditation requirements to persons performing such work in public and commercial buildings.

To comply with the ASHARA requirements, the inspector, management planner, project designer, abatement supervisor, and abatement worker must have an active AHERA certificate of training from an accredited training provider.

Under the NESHAP regulation, the project would be required to file an Asbestos Demolition/Renovation notification 10 working days prior to demolition of each building or the disturbance of regulated asbestos-containing material. All regulated quantities and types of asbestos-containing materials would be subject to emission control, proper collection, containerizing, and disposal at a permitted landfill.

If you have any questions regarding asbestos removal, please contact Mr. Robert Lopes at 586-4200.

Control of Fugitive Dust:

Due to the nature of the project, there is a significant potential for fugitive dust to be generated during the demolition and removal of debris, grading, excavation, and construction activities for this project. In addition, if the archaeological investigation requires that the property be left barren for prolong periods of time, this in itself may create fugitive dust problems. The close proximity to neighboring business establishments, the large concentration of vehicles travelling along Nimitz Highway and the narrow streets of Smith, Marin, Merchant and Nuuanu Avenue, where vehicles and people may be travelling along may compound dust problems. Implementation of adequate dust control measures during all phases of construction is warranted. Construction activities must comply with provisions of Chapter 11-60.1, Hawaii Administrative Rules, section 11-60.1-33 on Fugitive Dust.

Contractor should provide adequate means to control dust from road areas and during the various phases of construction activities, including but not limited to:

a. planning the different phases of construction, focusing on minimizing the amount of dust-generating materials and activities, centralizing material transfer points and onsite vehicular traffic routes, and locating potentially dusty equipment in areas of the least impact;

b. providing an adequate water source at site prior to startup of construction activities;

c. landscaping and rapid covering of bare areas, including slopes, starting from the initial grading phase;

d. control of dust from shoulders, project entrances, and access roads; and

e. providing adequate dust control measures during weekends, after hours, and prior to daily startup of construction activities.

If you have any questions regarding fugitive dust, please contact Mr. Timothy Carvalho at 586-4200.

Sincerely,

Wilfred K. Nagamine

WILFRED K. NAGAMINE, P.E.
Manager, Clean Air Branch

RL/TC:jm

Stringer Tusher Architects Incorporated AIA

October 23, 1995

Mr. Wilfred K. Nagamine
Manager, Clean Air Branch
Department of Health
State of Hawaii
P.O. Box 3378
Honolulu, Hawaii 96801

Dear Mr. Nagamine:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
Tax Map Key 1-7-02:02

Thank you for your letter of March 8, 1995 concerning the above-referenced project. Following are responses to your comments in the order they were presented in your letter.

Demolition Involving Asbestos: As discussed in Chapter III, Section 3.7.2 of the Final EA, "The presence of any asbestos will be identified through pre-demolition inspections and if present, will be removed prior to demolition. Asbestos inspection and handling procedures will be conducted in accordance with Subpart M of the National Emission Standards for Hazardous Air Pollutants, 40 CFR Part 61, and in conjunction with the State of Hawaii, Department of Health."

Control of Fugitive Dust: Your recommendations concerning the control of fugitive dust will be implemented during construction of the proposed project.

We appreciate your taking time to review the document. Should you have any questions about the information provided above, please contact me.

Sincerely,

Terry Tusher

95-01363

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
PACIFIC PARK PLAZA
711 KAPIOLANI BOULEVARD, SUITE 1200
HONOLULU, HAWAII 96813

JEREMY HARRIS
~~FRANK F. FASI~~
MAYOR

CHARLES O. SWANSON
~~JOSEPH M. MAGALDI, JR.~~
DIRECTOR

~~AMAR SAPPAL~~
~~DEPUTY DIRECTOR~~

TE-585
PL95.1.047

March 9, 1995

MEMORANDUM

TO: PATRICK T. ONISHI, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: CHARLES O. SWANSON, DIRECTOR

SUBJECT: BANK OF HAWAII - ANNEX TOWER
DRAFT ENVIRONMENTAL ASSESSMENT (EA)
TMK: 1-7-02: 02

This is in response to your memorandum 95/ED-001(ASK) dated February 7, 1995 requesting our comments on the subject draft EA.

Based on our review, we have the following concerns:

1. The following information should be included with future submittals:

   a. The number of existing on-site parking stalls.

   b. The projected number of employees upon completion of the project.

   c. The number of parking stalls available to employees of the 600 stalls to be provided.

   d. A site plan showing the proposed driveway location and loading/trash pick-up areas.

2. Justification of existing traffic volumes (Figures 3, 5) and future traffic volumes (Figures 6, 8 and 9) should be provided.

3. Additional information regarding the number of trips generated by the parking lot on the Ewa side of Smith Street should be provided and accounted for in the traffic volumes.

4. Trip Distribution percentages (Figure 7) at the Nuuanu Avenue approach to Nimitz Highway should be corrected.

5. Provide the level-of-service for each approach along King Street using the operational method. Our records indicate that the appropriate cycle length is 90 seconds.

6. All vehicular access points should be constructed as standard City dropped driveways. Existing driveways along the project's frontage which will not be used by this development should be adjusted to match the standard curb grade.

7. Driveway grades should not exceed 5 percent (5%) for a minimum distance of 35 feet from the curb line, and adequate sight distance to pedestrians and other vehicles should be provided and maintained.

8. Parking entry controls, if provided, should be recessed as far into the project as practical. The type and method of collection used should be designed to minimize the potential of vehicular queuing onto Smith Street.

9. All loading areas should be designed such that all maneuvering of vehicles occurs on-site.

10. The developer should work closely with our department during the early stages of the project to determine the extent of the street improvements that will be necessary to support this project. It appears that corner rounding improvements may be needed along the project's frontage.

11. Preliminary construction plans for off-site improvement work and driveway locations which may affect traffic circulation should be submitted for our review prior to the processing of building permit applications.

Should you have any questions, please contact Lance Watanabe of my staff at local 4199.

Peter H. P. Ho

for CHARLES O. SWANSON

Stringer Tusher Architects Incorporated AIA

October 23, 1995

Mr. Charles O. Swanson, Director
Department of Transportation Services
City and County of Honolulu
650 South King Street, Suite 1200
Honolulu, Hawaii 96813

Dear Mr. Swanson:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
Tax Map Key 1-7-02:02

Thank you for your letter of March 9, 1995 concerning the above-referenced project. We are enclosing for your files a copy of the Final Environmental Assessment (EA). Following are responses to your comments in the order they were presented in your letter.

1a) There are 27 existing parking stalls on-site. Access to these parking stalls is from Nuuanu Avenue.

1b) The total number of projected employees at the proposed building will be between 936 and 1,170.

1c) The number of employee-related parking stalls cannot be determined until the specific type of office and retail tenants have been allocated in the building. However, the number of employee stalls provided will comply with the requirements of the Land Use Ordinance.

1d) The site plan for the ground floor of the proposed project is presented as Figure 4 in the enclosed document. The driveway is located off Smith Street and the trash pick-up/loading zone areas will be located just mauka of the driveway.

2) The existing traffic volumes shown in Figures 2 and 3 of the Traffic Impact Analysis (Appendix H of the Final EA) are based on the following:

- Traffic volumes along Nimitz Highway are based on traffic counts conducted by Barton-Aschman Associates in 1992. These counts were expanded using a growth factor calculated by comparing 1992 counts with 1994 counts conducted by the State Department of Transportation between Bishop Street and Fort Street.
- The volumes for the intersections along King Street are based on field counts conducted by Barton-Aschman Associates in June and October 2394.

Stringer Tusher Architects Incorporated AIA

3) An afternoon traffic count was conducted at the Smith Street entrance and exit of the parking garage on Wednesday, April 5, 1995. The results of this count are summarized in the attached figure.

4) The corrected Figure 7 is attached.

5) Per discussion with DTS staff, the Level-of-Service (LOS) analysis for the intersections of King Street at Smith Street and King Street at Nuuanu Avenue were calculated using the operational method. These calculations are enclosed.

6) The project will conform to City and County standards, with the exception that the owner may provide stone paving at the sidewalks.

7) The project will conform to City and County standards. The present layout facilitates these requirements.

8) The project will conform to City and County standards. The present layout facilitates these requirements.

9) Discussions with DOT staff have indicated that the present layout may be satisfactory if a restricted time period of 9 am - 4 pm is enforced for the loading area.

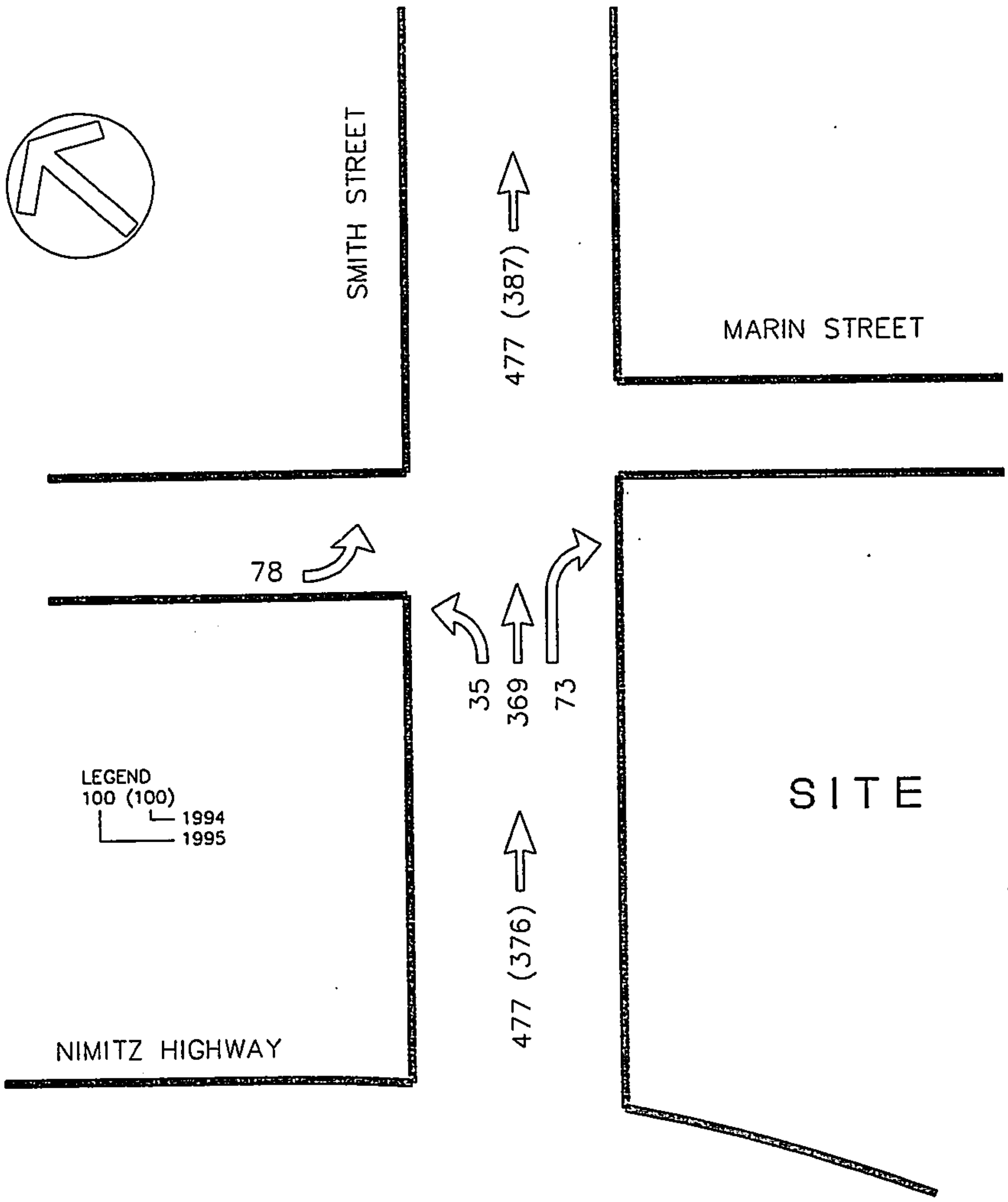
10) The Bank of Hawaii will work with the department to ensure its concerns are adequately addressed. Section 3.12.2 of Chapter III in the Final EA discusses the proposed design of the building's corners.

11) Preliminary construction plans for off-site improvement work and driveway locations will be submitted for review by the DTS prior to the submittal of building permit applications.

We appreciate your taking time to review the document. Should you have any questions about the information provided above, please contact me.

Sincerely,

Terry Tusher



Afternoon Traffic Volumes at Smith Street Entrance Exit to Marin Tower

Barton-Aschman Associates, Inc.

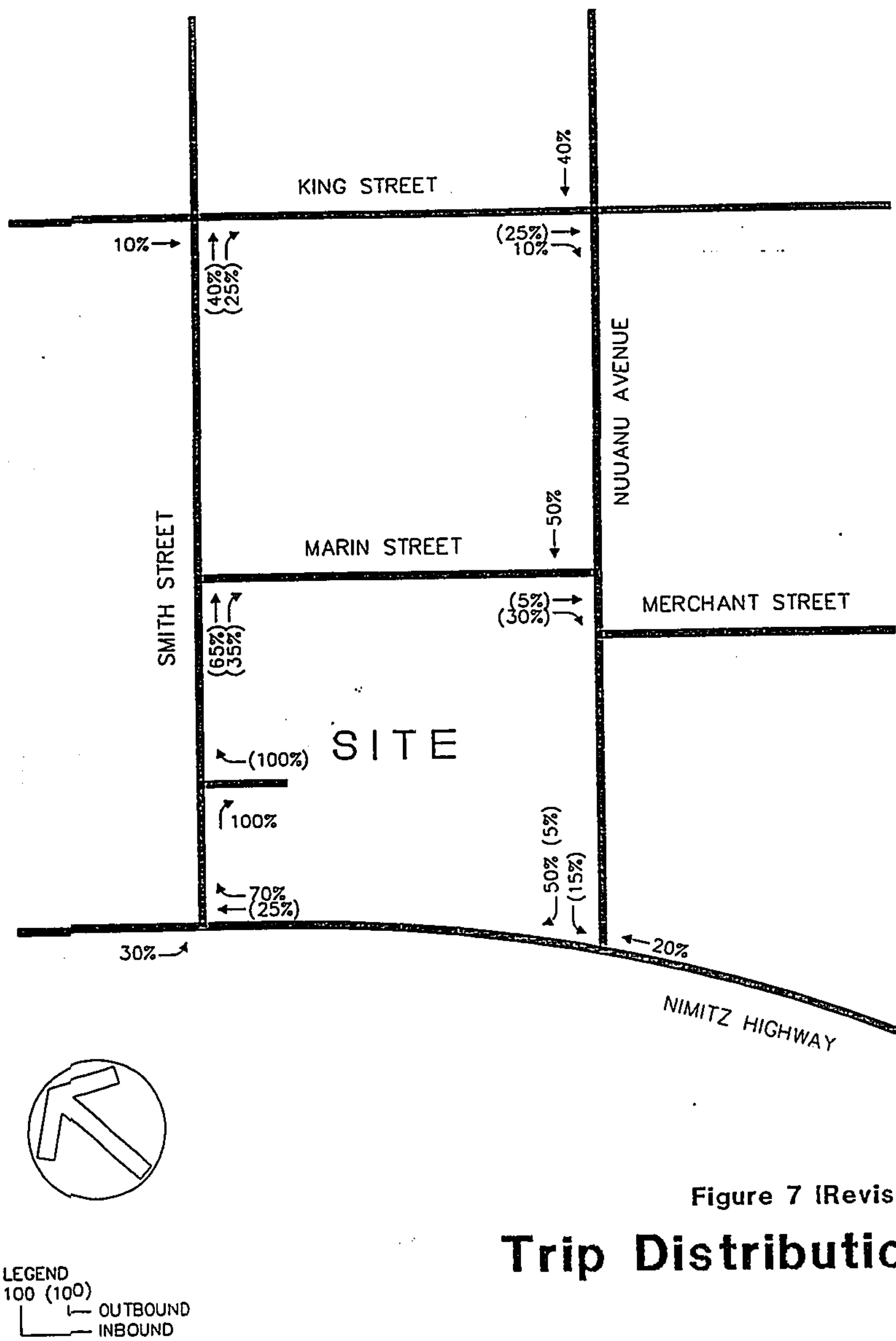


Figure 7 (Revised)

Trip Distribution

Level-of-Service Calculations for King Street at Smith Street and King Street at Nuuanu Avenue Using Operational Method

HCM: SIGNALIZED INTERSECTION SUMMARY 04-06-1995

Center For Microcomputers In Transportation

Streets: (E-W) King Street (N-S) Smtih Street

Analyst: PJR File Name: 1AMEX.HC9

Area Type: CBD 4-6-95 AM Peak

Comment: Existing Conditions

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes		> 4						2	1			
Volumes	170	1866						137	84			
PHF or PK15	0.95	0.95						0.95	0.95			
Lane Width		12.0						12.0	12.0			
Grade		0						3				
% Heavy Veh	0	0						0	0			
Parking	(Y/N) N						(Y/N) N					
Bus Stops			40						10			
Con. Peds			0			50			50			0
Ped Button	(Y/N) Y	14.5 s					(Y/N) Y	19.0 s				
Arr Type	3	3						3	3			
RTOR Vols			0						0			
Prop. Share	0		0				0		0			
Prop. Prot.									62			
Assign Perm	0						0					

Signal Operations

Phase Combination	1	2	3	4
EB Left	*			
Thru	*			
Right				
Peds	*			
WB Left				
Thru				
Right				
Peds	*			
NB Right	*			
SB Right				
Green	52.0P			
Yellow/A-R	4.0			
Lost Time	3.0			

	5	6	7	8
NB Left				
Thru	*			
Right	*			
Peds	*			
SB Left				
Thru				
Right				
Peds	*			
EB Right				
WB Right				
Green	30.0P			
Yellow/A-	4.0			
Lost Time	3.0			

Cycle Length: 90.0 secsPhase combination order: #1 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	Approach: LOS
EB	LT	3748	6365	0.63	0.59	9.4	B	9.4	B
NB	T	1160	3369	0.13	0.34	15.4	C	9.7	B
	R	1360	1360	0.06	1.00	0.0	A		

Intersection Delay = 9.5 sec/veh Intersection LOS = B

Lost Time/Cycle, L = 6.0 sec Critical v/c(x) = 0.445

HCM: SIGNALIZED INTERSECTION SUMMARY 04-06-1995

Center For Microcomputers In Transportation

Streets: (E-W) King Street (N-S) Smith Street

Analyst: PJR File Name: 1PMEX.HC9

Area Type: CBD 4-6-95 PM Peak

Comment: Existing Conditions

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes		> 4						2	1			
Volumes	109	1782						227	160			
PHF or PK15	0.95	0.95						0.95	0.95			
Lane Width		12.0						12.0	12.0			
Grade		0						3				
% Heavy Veh	0	0						0	0			
Parking	(Y/N) N						(Y/N) N					
Bus Stops			40						10			
Con. Peds			0			50			50			0
Ped Button	(Y/N) Y 14.5 s						(Y/N) Y 19.0 s					
Arr Type	3	3						3	3			
RTOR Vols			0						0			
Prop. Share	0		0				0		0			
Prop. Prot.									62			
Assign Perm	0						0					

Signal Operations

Phase Combination		1	2	3	4
EB	Left	*			
	Thru	*			
	Right				
	Peds	*			
WB	Left				
	Thru				
	Right				
	Peds	*			
NB	Right	*			
SB	Right				
Green		52.0P			
Yellow/A-R		4.0			
Lost Time		3.0			

		5	6	7	8
NB	Left				
	Thru	*			
	Right	*			
	Peds	*			
SB	Left				
	Thru				
	Right				
	Peds	*			
EB	Right				
WB	Right				
Green		30.0P			
Yellow/A-		4.0			
Lost Time		3.0			

Cycle Length: 90.0 secsPhase combination order: #1 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	LT	3748	6365	0.58	0.59	9.0	B	9.0	B
NB	T	1160	3369	0.22	0.34	15.9	C	9.5	B
	R	1360	1360	0.12	1.00	0.0	A		

Intersection Delay = 9.1 sec/veh Intersection LOS = B

Lost Time/Cycle, L = 6.0 sec Critical v/c(x) = 0.448

HCM: SIGNALIZED INTERSECTION SUMMARY 04-06-1995

Center For Microcomputers In Transportation

Streets: (E-W) King Street (N-S) Smtih Street
Analyst: PJR File Name: 1AMCUM.HC9
Area Type: CBD 4-6-95 AM Peak
Comment: Cumulative Conditions

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes		> 4						2	1			
Volumes	204	2235						164	101			
PHF or PK15	0.95	0.95						0.95	0.95			
Lane Width		12.0						12.0	12.0			
Grade		0						3				
% Heavy Veh	0	0						0	0			
Parking	(Y/N) N						(Y/N) N					
Bus Stops			40						10			
Con. Peds			0			50			50			0
Ped Button	(Y/N) Y	14.5 s					(Y/N) Y	19.0 s				
Arr Type	3	3						3	3			
RTOR Vols			0						0			
Prop. Share	0		0				0		0			
Prop. Prot.									62			
Assign Perm	0						0					

Signal Operations

Phase Combination	1	2	3	4	Phase Combination	5	6	7	8
EB Left	*				NB Left				
Thru	*				Thru	*			
Right					Right	*			
Peds	*				Peds	*			
WB Left					SB Left				
Thru					Thru				
Right					Right				
Peds	*				Peds	*			
NB Right	*				EB Right				
SB Right					WB Right				
Green	52.0P				Green	30.0P			
Yellow/A-R	4.0				Yellow/A-	4.0			
Lost Time	3.0				Lost Time	3.0			

Cycle Length: 90.0 secsPhase combination order: #1 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	LT	3748	6365	0.75	0.59	11.0	B	11.0	B
NB	T	1160	3369	0.16	0.34	15.5	C	9.8	B
	R	1360	1360	0.08	1.00	0.0	A		

Intersection Delay = 10.9 sec/veh Intersection LOS = B

Lost Time/Cycle, L = 6.0 sec Critical v/c(x) = 0.533

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HCM: SIGNALIZED INTERSECTION SUMMARY                         04-06-1995
                         Center For Microcomputers In Transportation
==========================================================================
Streets: (E-W) King Street                   (N-S) Smtih Street
Analyst: PJR                                 File Name: 1PMCUM.HC9
Area Type: CBD                               4-6-95 PM Peak
Comment: Cumulative Conditions
==========================================================================
             |  Eastbound    |  Westbound    |  Northbound   |  Southbound   |
             | L    T    R   | L    T    R   | L    T    R   | L    T    R   |
             |---- ---- ---- |---- ---- ---- |---- ---- ---- |---- ---- ---- |
No. Lanes    |   > 4         |               |      2    1   |               |
Volumes      | 131 2135      |               |    272  192   |               |
PHF or PK15  |0.95 0.95      |               |   0.95 0.95   |               |
Lane Width   |     12.0      |               |   12.0 12.0   |               |
Grade        |        0      |               |      3        |               |
% Heavy Veh  |  0     0      |               |      0  . 0   |               |
Parking      |(Y/N) N        |               |(Y/N) N        |               |
Bus Stops    |           40  |               |          10   |               |
Con. Peds    |            0  |            50 |          50   |            0  |
Ped Button   |(Y/N) Y 14.5 s |               |(Y/N) Y 19.0 s |               |
Arr Type     |  3     3      |               |      3    3   |               |
RTOR Vols    |            0  |               |           0   |               |
Prop. Share  |  0         0  |               |  0        0   |               |
Prop. Prot.  |               |               |          62   |               |
Assign Perm  |  0            |               |  0            |               |
--------------------------------------------------------------------------
                          Signal Operations
Phase Combination 1     2     3     4 |              5     6     7     8
EB   Left         *                   |NB   Left
     Thru         *                   |     Thru     *
     Right                            |     Right    *
     Peds         *                   |     Peds     *
WB   Left                             |SB   Left
     Thru                             |     Thru
     Right                            |     Right
     Peds         *                   |     Peds     *
NB   Right        *                   |EB   Right
SB   Right                            |WB   Right
Green           52.0P                 |Green     30.0P
Yellow/A-R       4.0                  |Yellow/A- 4.0
Lost Time        3.0                  |Lost Time 3.0
Cycle Length:   90.0 secsPhase combination order: #1 #5
--------------------------------------------------------------------------
                   Intersection Performance Summary
     Lane   Group:   Adj Sat    v/c     g/C                   Approach:
     Mvmts   Cap      Flow     Ratio   Ratio   Delay  LOS   Delay   LOS
     -----  -----    -------   -----   -----   -----  ---   -----   ---
EB   LT     3748      6365     0.70    0.59    10.3    B     10.3    B
NB   T      1160      3369     0.26    0.34    16.2    C      9.7    B
     R      1360      1360     0.15    1.00     0.0    A
            Intersection Delay =  10.2 sec/veh Intersection LOS = B
Lost Time/Cycle, L =    6.0 sec   Critical v/c(x)    = 0.537
--------------------------------------------------------------------------
```

HCM: SIGNALIZED INTERSECTION SUMMARY 04-06-1995

Center For Microcomputers In Transportation

Streets: (E-W) King Street (N-S) Smtih Street

Analyst: PJR File Name: 1AMPROJ.HC9

Area Type: CBD 4-6-95 AM Peak

Comment: Cumulative Plus Project Conditions

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes		> 4						2	1			
Volumes	204	2278						177	108			
PHF or PK15	0.95	0.95						0.95	0.95			
Lane Width		12.0						12.0	12.0			
Grade		0						3				
% Heavy Veh	0	0						0	0			
Parking	(Y/N) N						(Y/N) N					
Bus Stops			40						10			
Con. Peds			0			50			50			0
Ped Button	(Y/N) Y 14.5 s						(Y/N) Y 19.0 s					
Arr Type	3	3						3	3			
RTOR Vols			0						0			
Prop. Share	0		0				0		0			
Prop. Prot.									62			
Assign Perm	0						0					

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	*				NB Left				
Thru	*				Thru	*			
Right					Right	*			
Peds	*				Peds	*			
WB Left					SB Left				
Thru					Thru				
Right					Right				
Peds	*				Peds	*			
NB Right	*				EB Right				
SB Right					WB Right				
Green	52.0P				Green	30.0P			
Yellow/A-R	4.0				Yellow/A-	4.0			
Lost Time	3.0				Lost Time	3.0			

Cycle Length: 90.0 secsPhase combination order: #1 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	LT	3748	6365	0.77	0.59	11.2	B	11.2	B
NB	T	1160	3369	0.17	0.34	15.6	C	9.8	B
	R	1360	1360	0.08	1.00	0.0	A		

Intersection Delay = 11.1 sec/veh Intersection LOS = B

Lost Time/Cycle, L = 6.0 sec Critical v/c(x) = 0.546

HCM: SIGNALIZED INTERSECTION SUMMARY 04-06-1995

Center For Microcomputers In Transportation

Streets: (E-W) King Street (N-S) Smtih Street
Analyst: PJR File Name: 1PMPROJ.HC9
Area Type: CBD 4-6-95 PM Peak
Comment: Cumulative Plus Project Conditions

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes		> 4						2	1			
Volumes	131	2143						349	240			
PHF or PK15	0.95	0.95						0.95	0.95			
Lane Width		12.0						12.0	12.0			
Grade		0						3				
% Heavy Veh	0	0						0	0			
Parking	(Y/N) N						(Y/N) N					
Bus Stops			40						10			
Con. Peds			0			50			50			0
Ped Button	(Y/N) Y	14.5 s					(Y/N) Y	19.0 s				
Arr Type	3	3						3	3			
RTOR Vols			0						0			
Prop. Share	0		0				0		0			
Prop. Prot.									62			
Assign Perm	0						0					

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left	*				NB Left				
Thru	*				Thru	*			
Right					Right	*			
Peds	*				Peds	*			
WB Left					SB Left				
Thru					Thru				
Right					Right				
Peds	*				Peds	*			
NB Right	*				EB Right				
SB Right					WB Right				
Green	52.0P				Green	30.0P			
Yellow/A-R	4.0				Yellow/A-	4.0			
Lost Time	3.0				Lost Time	3.0			

Cycle Length: 90.0 secsPhase combination order: #1 #5

Intersection Performance Summary

	Lane Mvmts	Group: Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	LT	3748	6365	0.70	0.59	10.3	B	10.3	B
NB	T	1160	3369	0.33	0.34	16.7	C	10.1	B
	R	1360	1360	0.19	1.00	0.0	A		

Intersection Delay = 10.2 sec/veh Intersection LOS = B

Lost Time/Cycle, L = 6.0 sec Critical v/c(x) = 0.566

HCM: SIGNALIZED INTERSECTION SUMMARY 09-07-1995

Parsons Engineering Science, Inc.

Streets: (E-W) King Street (N-S) Nuuanu Avenue
Analyst: PJR File Name: 2AMEX.HC9
Area Type: CBD 4-6-95 AM Peak
Comment: Existing Conditions

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes		4 <								1 >	2	
Volumes		1587	363							420	719	
Lane Width		12.0								10.0	10.0	
RTOR Vols			0									0

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left					NB Left				
Thru	*				Thru				
Right	*				Right				
Peds	*				Peds	*			
WB Left					SB Left	*			
Thru					Thru	*			
Right					Right				
Peds	*				Peds	*			
NB Right	*				EB Right				
SB Right					WB Right				
Green	52.0P				Green	30.0P			
Yellow/A-R	4.0				Yellow/A-	4.0			
Lost Time	3.0				Lost Time	3.0			

Cycle Length: 90.0 secsPhase combination order: #1 #5

Intersection Performance Summary

	Lane Group: Mvmts	Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	TR	3673	6237	0.61	0.59	9.3	B	9.3	B
SB	L	448	1301	0.86	0.34	32.0	D	26.0	D
	LT	1072	3112	0.80	0.34	23.2	C		

Intersection Delay = 15.2 sec/veh Intersection LOS = C

Lost Time/Cycle, L = 6.0 sec Critical v/c(x) = 0.707

HCM: SIGNALIZED INTERSECTION SUMMARY 09-07-1995
Parsons Engineering Science, Inc.

Streets: (E-W) King Street (N-S) Nuuanu Avenue
Analyst: PJR File Name: 2PMEX.HC9
Area Type: CBD 4-6-95 PM Peak
Comment: Existing Conditions

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes		4	<							1	> 2	
Volumes		1622	280							310	529	
Lane Width		12.0								10.0	10.0	
RTOR Vols			0									0

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left					NB Left				
Thru	*				Thru				
Right	*				Right				
Peds	*				Peds	*			
WB Left					SB Left	*			
Thru					Thru	*			
Right					Right				
Peds	*				Peds	*			
NB Right	*				EB Right				
SB Right					WB Right				
Green	52.0P				Green	30.0P			
Yellow/A-R	4.0				Yellow/A-	4.0			
Lost Time	3.0				Lost Time	3.0			

Cycle Length: 90.0 secsPhase combination order: #1 #5

Intersection Performance Summary

	Lane Group: Mvmts	Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	TR	3711	6301	0.59	0.59	9.1	B	9.1	B
SB	L	448	1301	0.64	0.34	20.9	C	19.6	C
	LT	1072	3111	0.59	0.34	19.0	C		

Intersection Delay = 12.2 sec/veh Intersection LOS = B
Lost Time/Cycle, L = 6.0 sec Critical v/c(x) = 0.609

HCM: SIGNALIZED INTERSECTION SUMMARY 09-07-1995

Parsons Engineering Science, Inc.

Streets: (E-W) King Street (N-S) Nuuanu Avenue
Analyst: PJR File Name: 2AMCUM.HC9
Area Type: CBD 4-6-95 AM Peak
Comment: Cumulative Conditions

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes		4	<							1	> 2	
Volumes		1901	445							503	891	
Lane Width		12.0								10.0	10.0	
RTOR Vols			0									0

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left					NB Left				
Thru	*				Thru				
Right	*				Right				
Peds	*				Peds	*			
WB Left					SB Left	*			
Thru					Thru	*			
Right					Right				
Peds	*				Peds	*			
NB Right	*				EB Right				
SB Right					WB Right				
Green	52.0P				Green	30.0P			
Yellow/A-R	4.0				Yellow/A-	4.0			
Lost Time	3.0				Lost Time	3.0			

Cycle Length: 90.0 secsPhase combination order: #1 #5

Intersection Performance Summary

	Lane Group: Mvmts	Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	LOS
EB	TR	3673	6237	0.74	0.59	10.8	B	10.8	B
SB	L	448	1301	1.06	0.34	72.7	F	48.6	E
	LT	1074	3118	0.97	0.34	37.7	D		

Intersection Delay = 24.4 sec/veh Intersection LOS = C

Lost Time/Cycle, L = 6.0 sec Critical v/c(x) = 0.856

HCM: SIGNALIZED INTERSECTION SUMMARY 09-07-1995
Parsons Engineering Science, Inc.

Streets: (E-W) King Street (N-S) Nuuanu Avenue
Analyst: PJR File Name: 2PMCUM.HC9
Area Type: CBD 4-6-95 PM Peak
Comment: Cumulative Conditions

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes		4	<							1	> 2	
Volumes		1943	337							371	696	
Lane Width		12.0								10.0	10.0	
RTOR Vols			0									0

Signal Operations

Phase Combination	1	2	3	4		5	6	7	8
EB Left					NB Left				
Thru	*				Thru				
Right	*				Right				
Peds	*				Peds	*			
WB Left					SB Left	*			
Thru					Thru	*			
Right					Right				
Peds	*				Peds	*			
NB Right	*				EB Right				
SB Right					WB Right				
Green	52.0P				Green	30.0P			
Yellow/A-R	4.0				Yellow/A-	4.0			
Lost Time	3.0				Lost Time	3.0			

Cycle Length: 90.0 secsPhase combination order: #1 #5

Intersection Performance Summary

	Lane Group: Mvmts	Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	Approach: LOS
EB	TR	3711	6301	0.71	0.59	10.4	B	10.4	B
SB	L	448	1301	0.81	0.34	27.6	D	23.6	C
	LT	1077	3128	0.74	0.34	21.7	C		

Intersection Delay = 14.4 sec/veh Intersection LOS = B
Lost Time/Cycle, L = 6.0 sec Critical v/c(x) = 0.747

```
HCM: SIGNALIZED INTERSECTION SUMMARY                              09-07-1995
                  Parsons Engineering Science, Inc.
=============================================================================
Streets: (E-W) King Street                    (N-S) Nuuanu Avenue
Analyst: PJR                                  File Name: 2AMPROJ.HC9
Area Type: CBD                                4-6-95 AM Peak
Comment: Cumulative Plus Project Conditions
=============================================================================
          |   Eastbound    |   Westbound    |   Northbound   |   Southbound   |
          |  L    T    R   |  L    T    R   |  L    T    R   |  L    T    R   |
          | ---- ---- ---- | ---- ---- ---- | ---- ---- ---- | ---- ---- ---- |
No. Lanes |       4  <     |                |                |  1  > 2       |
Volumes   |    1908  488   |                |                |  503  963     |
Lane Width|    12.0        |                |                |10.0 10.0      |
RTOR Vols |            0   |                |                |            0  |
-----------------------------------------------------------------------------
                          Signal Operations
Phase Combination 1     2     3     4 |              5     6     7     8
EB  Left                              |NB  Left
    Thru          *                   |    Thru
    Right         *                   |    Right
    Peds          *                   |    Peds      *
WB  Left                              |SB  Left      *
    Thru                              |    Thru      *
    Right                             |    Right
    Peds          *                   |    Peds      *
NB  Right         *                   |EB  Right
SB  Right                             |WB  Right
Green          52.0P                  |Green     30.0P
Yellow/A-R      4.0                   |Yellow/A- 4.0
Lost Time       3.0                   |Lost Time 3.0
Cycle Length:  90.0 secsPhase combination order: #1 #5
-----------------------------------------------------------------------------
                  Intersection Performance Summary
      Lane   Group:   Adj Sat    v/c     g/C                    Approach:
      Mvmts   Cap      Flow     Ratio   Ratio   Delay   LOS    Delay   LOS
      -----  -----   -------    -----   -----   -----   ---    -----   ---
EB    TR      3673     6237     0.76    0.59    11.1     B     11.1     B
SB    L        448     1301     1.11    0.34    95.3     F     62.8     F
      LT      1079     3132     1.02    0.34    48.1     E
              Intersection Delay =   29.9 sec/veh Intersection LOS = D
Lost Time/Cycle, L =     6.0 sec   Critical v/c(x)     = 0.886
-----------------------------------------------------------------------------
```

HCM: SIGNALIZED INTERSECTION SUMMARY 09-07-1995
Parsons Engineering Science, Inc.

Streets: (E-W) King Street (N-S) Nuuanu Avenue
Analyst: PJR File Name: 2PMPROJ.HC9
Area Type: CBD 4-6-95 PM Peak
Comment: Cumulative Plus Project Conditions

	Eastbound L	Eastbound T	Eastbound R	Westbound L	Westbound T	Westbound R	Northbound L	Northbound T	Northbound R	Southbound L	Southbound T	Southbound R
No. Lanes		4	<							1	> 2	
Volumes		1991	345							371	709	
Lane Width		12.0								10.0	10.0	
RTOR Vols			0									0

Signal Operations

Phase Combination	1	2	3	4			5	6	7	8
EB Left					NB	Left				
Thru	*					Thru				
Right	*					Right				
Peds	*					Peds	*			
WB Left					SB	Left	*			
Thru						Thru	*			
Right						Right				
Peds	*					Peds	*			
NB Right	*				EB	Right				
SB Right					WB	Right				
Green	52.0P				Green		30.0P			
Yellow/A-R	4.0				Yellow/A-		4.0			
Lost Time	3.0				Lost Time		3.0			

Cycle Length: 90.0 secsPhase combination order: #1 #5

Intersection Performance Summary

	Lane Group: Mvmts	Cap	Adj Sat Flow	v/c Ratio	g/C Ratio	Delay	LOS	Approach: Delay	Approach: LOS
EB	TR	3711	6301	0.73	0.59	10.7	B	10.7	B
SB	L	448	1301	0.82	0.34	28.4	D	23.9	C
	LT	1079	3132	0.75	0.34	21.9	C		

Intersection Delay = 14.7 sec/veh Intersection LOS = B
Lost Time/Cycle, L = 6.0 sec Critical v/c(x) = 0.762

Level-of-Service Analysis Using Operational Method

Intersection	Condition	AM Peak Hour			PM Peak Hour		
		V/C[1]	LoS[2]	Delay[3]	V/C[1]	LoS[2]	Delay[3]
King St. at Smith St.	Existing	0.445 (0.387)	B (A)	9.50 (NA)	0.448 (0.416)	B (A)	9.10 (NA)
	Cumulative	0.533 (0.438)	B (A)	10.9 (NA)	0.537 (0.462)	B (A)	10.2 (NA)
	Cumulative Plus Project	0.546 (0.449)	B (A)	11.1 (NA)	0.566 (0.490)	B (A)	10.2 (NA)
King St. at Smith St.	Existing	0.707 (0.722)	C (C)	15.2 (NA)	0.609 (0.517)	B (A)	12.2 (NA)
	Cumulative	0.856 (0.738)	C (C)	24.4 (NA)	0.747 (0.646)	B (B)	14.4 (NA)
	Cumulative Plus Project	0.886 (0.775)	D (C)	29.9 (NA)	0.762 (0.660)	B (B)	14.7 (NA)

NOTES:
(1) V/C = Volume-to-Capacity Ratio
(2) LoS = Level-of-Service
(3) Delay is average vehicle delay in seconds.
(0.0) Denotes Volume-to-Capacity Ratio or Level-of-Service using Planning Method as presented in the TIAR.
(NA) Not Available. The planning method does not provide delay as an output.

95-01145

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

'95 MAR 2 PM 2 38
DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

JEREMY HARRIS
MAYOR

KENNETH E. SPRAGUE
Acting DIRECTOR AND CHIEF ENGINEER

DARWIN J. HAMAMOTO
DEPUTY DIRECTOR

ENV 95-078

March 2, 1995

MEMORANDUM:

TO: PATRICK T. ONISHI, ACTING DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: for KENNETH E. SPRAGUE
ACTING DIRECTOR AND CHIEF ENGINEER

SUBJECT: ENVIRONMENTAL ASSESSMENT (EA)
BANK OF HAWAII - ANNEX TOWER
TAX MAP KEY: 1-7-02: 02

We have reviewed the subject EA and have the following comments:

1. A drainage report/plan should be submitted for review.

2. Frontage improvements should be constructed in accordance with City standards as well as the Chinatown Special Design District guidelines.

3. Access improvements should comply with the Americans with Disabilities Act Accessibility Guidelines.

4. Adequate on-site parking for employees, customers and vendors should be provided.

5. Recommend ingress and egress for the project be located off the main street.

6. The Department of Public Works, City and County of Honolulu, should be included in the list of Agencies/Interested Parties Consulted.

7. Section V. Summary of Major Impacts: Address potential pollution resulting from construction activities (during and post-construction periods) and include proposed best management practices (BMPs) to mitigate impacts. The

specific concerns are construction dewatering, contractor housekeeping practices during concrete pours, and separation of storm runoff from other effluent sources during post-construction period.

8. The EA should also address potential impact on water quality in the receiving waters (Honolulu Harbor).

Should you have any questions, please contact Mr. Alex Ho, Environmental Engineer, at Local 4150.

Stringer Tusher Architects Incorporated AIA

October 23, 1995

Mr. Kenneth E. Sprague
Acting Director and Chief Engineer
Department of Public Works
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Sprague:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
Tax Map Key 1-7-02:02

Thank you for your letter of March 2, 1995 concerning the above-referenced project. Following are responses to your comments in the order they were presented in your letter.

1) A drainage report for the project will be submitted with construction documents.

2) Frontage improvements will be constructed in accordance with City standards as well as the Chinatown Special Design District guidelines.

3) Access improvements will comply with the Americans with Disabilities Act Accessibility Guidelines.

4) Approximately 600 parking stalls are proposed to be located on-site for employees, customers and vendors. (Note: the Land Use Ordinance specifies that in BMX-4 zones, office use requires one stall for every 600 square feet of floor area over 4,000 square feet. Thus, the proposed building's floor area of 280,000 square feet will require 460 parking stalls.)

5) The ingress and egress to the on-site parking lot will be located off of Smith Street.

6) The Department of Public Works has been included in the list of Agencies/Interested Parties Consulted.

7) The project will include six underground floors and a mat foundation, the construction of which will require dewatering. A Notice of Intent (NOI) to be covered under the National Pollutant Discharge Elimination System (NPDES) General Permit will be filed with and must be approved by the State of Hawaii Department of Health (DOH) Clean Water Branch before any dewatering activities begin. The permit application will include Best Management Practices (BMPs) for construction dewatering, storm water pollution control, and good housekeeping practices.

Stringer Tusher Architects Incorporated AIA

Potential adverse impacts from project construction activities include suspended sediments in storm water runoff from the site, suspended sediments in dewatering effluent discharges to Honolulu Harbor, offsite tracking of soil by construction equipment, and contamination of soil, storm water, and groundwater by construction equipment. However, when the NOI is approved and the site BMPs are followed, there should be no significant adverse impacts on site soils, storm water runoff quality, or Honolulu Harbor water quality due to construction activities. A summary of the proposed construction BMPs for the site is attached.

8) Although site construction activities could introduce sediment contamination into Honolulu Harbor, the implementation of BMPs and treatment of dewatering effluent will mitigate the possibility of such an occurrence. As outlined in the attached BMPs, no historic contamination is known to exist at the site. Construction and dewatering equipment will be maintained so as not to introduce contamination into dewatering effluent, some of which may be discharged into Honolulu Harbor. Onsite leaks and spills are not anticipated during construction, but will be contained and cleaned immediately with contaminated materials contained and taken off the site for appropriate disposal. Although suspended sediments are anticipated in dewatering effluent, before dewatering effluent is discharged via the state highway storm drain system to Honolulu Harbor, it will be treated to remove sediments. Dewatering effluent will be visually checked several times daily and sampled weekly to ensure that it is of suitable quality for discharge to Honolulu Harbor. The attached BMP plan summarizes each of these BMPs to control potential adverse impacts on water quality in Honolulu Harbor.

We appreciate your taking time to review the document. Should you have any questions about the information provided above, please contact me.

Sincerely,

Terry Tusher

BANK OF HAWAII ANNEX TOWER

BEST MANAGEMENT PRACTICES (BMPs) PLAN

1. Project Summary.

   The project site at 800 Nuuanu Avenue (Tax Map Key 1-7-02:2) covers approximately 0.9 acres and is bounded by Nimitz Highway, Smith Street, Marin Street, and Nuuanu Avenue. Site elevations range from approximately 7 feet to 11 feet above mean sea level (msl). Honolulu Harbor lies directly across Nimitz Highway west of the site. Map 1 shows the project location.

   The project will involve construction of an approximately 280,000 Square Foot (SF), 21-story office/commercial building with a six story underground parking garage. Construction of the underground floors will require dewatering with discharge either to groundwater by reinjection wells or to Honolulu Harbor via storm drains under Nimitz Highway. Honolulu Harbor is a Class A water and eligible to receive uncontaminated dewatering discharges from groundwater.

   A Notice of Intent (NOI) to be covered under the National Pollutant Discharge Elimination System (NPDES) General Permit will be filed with and approved by the State of Hawaii Department of Health (DOH) Clean Water Branch before any dewatering discharges begin. Permission will also be obtained from the State of Hawaii Department of Transportation (DOT) for discharge to the state highway storm drain system. To mitigate potential adverse construction impacts on storm water runoff quality or Honolulu Harbor waters, BMPs will be implemented throughout the course of the project. With the approved NOI and adherence to BMPs during construction activities, there should be no significant impact on the quality of storm water runoff or Honolulu Harbor. BMPs for the project are summarized below.

2. General.

   a. Responsibility. The contractor's onsite project manager will have overall responsibility for the proper implementation of BMPs before and during construction activities.

   b. Worker Awareness. Workers at the job site will be trained to follow BMPs.

3. Dewatering System Best Management Practices.

a. Operations Plan. The dewatering system, which is designed for groundwater recharge, will be operated continuously during below grade construction work. The dewatering pumps will be operated at the rate required to maintain the excavation in a dry condition without draw down outside the project limits. Groundwater draw down will be controlled through use of the recharge system consisting of perforated pipes discharging to a gravel bed surrounding the project site.

Water not absorbed in groundwater recharge will be discharged to Honolulu Harbor via DOT storm drains under Nimitz Highway. The only type of pollutants expected to be present in construction dewatering discharges are suspended sediments. Prior to discharge, all dewatering effluent will be treated to remove suspended sediment using a combination of filtration and settling. Figure 1 shows a schematic of the dewatering extraction, treatment, and disposal system. Map 2 shows the storm drains that will convey treated effluent to Honolulu Harbor.

b. Maintenance Plan. To prevent potential contamination due to dewatering equipment, this equipment will be properly operated and maintained. All dewatering equipment will be inspected daily by the contractor's Quality Control Engineer. Any component requiring maintenance will be serviced immediately to ensure that no pollutants are introduced into the groundwater discharge. Dewatering pumps will be taken out of service for maintenance in accordance with the manufacturer's recommendations.

c. Good Housekeeping Plan. Areas around the dewatering system will be maintained in a neat and orderly condition to assure that no contaminants are conveyed in the discharge stream.

d. Sediment Handling and Disposal Plan. Sediment removed from dewatering effluent will collect in the junction boxes of the effluent treatment system. Sediment will be removed from the junction boxes as required to maintain effluent quality and when sediments reach a depth of 2 feet in the junction boxes. The boxes will be monitored every 2 hours at the start of the dewatering operation, with the schedule adjusted thereafter based on the quantity of sediments collected during the operation of the system. Sediments removed will be disposed of on-site or hauled off-site and disposed of at an approved landfill facility.

e. Monitoring Plan. The Project Quality Control Engineer will collect samples from each junction box at least once a week to assure compliance with water quality requirements. Samples will be submitted for the analyses required by the NOI permit. Results will be reported as required by the DOH.

f. Visual Inspection Plan. The groundwater discharge will be visually inspected at the junction box by the project Quality Control Engineer once each working day generally in the morning upon arrival at the site, following start up of the dewatering operation. The inspections will check for color changes or for the presence of scum or foam in the discharge. The accumulation of sediments within the junction box will also be monitored.

g. Cessation of Discharge, Revise Effluent Control and/or Mitigative Measures Plan.

Long Term: The discharge is from construction dewatering and is of a temporary duration. Upon completion of the below grade construction within the groundwater table, the dewatering and discharge thereof to the storm drain system will be discontinued. No long term effluent control or mitigative measures plan is required since the dewatering is not a long-term or continuous operation.

Short Term: Upon observation of a dewatering system malfunction, such as a turbid or colored discharge, the rate of groundwater withdrawal will be reduced. Total cessation will not be feasible, but the rate will be decreased while inspection of each dewatering well is completed. Once the source of the problem is determined, the well will be taken out of service and maintenance performed or mitigative action taken.

h. Record Keeping. Record Keeping will be continuous and thorough throughout the duration of the dewatering activity.

i. Prohibited Practices: Excavation will not occur when the groundwater level is above the working surface elevation. Excavation will proceed only when the water table is BELOW the bottom of the excavation. This requirement will be in effect so that the excavation activity does not increase the amount of suspended solids in the groundwater being pumped out of the wells at any time during the project.

4. Construction Best Management Practices.

No preexisting contamination is known or anticipated at the site. To prevent site construction activities causing onsite contamination, the contractor will follow BMPs throughout the course of the project.

a. Spillage or leaks. Spills and leaks during refueling and equipment maintenance are not anticipated. Extra care will be taken during these operations to avoid spills. However, if a spill or leak does occur, it will be contained and all contaminated soil immediately removed. Contaminated materials will be disposed in a safe and legal manner.

   Each equipment operator will make a daily inspection of their piece of equipment to uncover conditions that could cause breakdowns or possible contamination of the groundwater. The inspection will generally be performed at the start of each working day.

   No special equipment or materials will be stationed at the site to respond to spills and/or leaks. Construction equipment already on site should be adequate to address any spills or leaks.

b. Waste Disposal. All solid and all liquid wastes will be containerized at all times. Wastes will be properly transported and disposed of at an offsite, licensed disposal facility.

   No treatment is required as there will be no onsite disposal.

c. Drainage from Raw Material Storage or Stockpiling Areas. Due to the nature of the site, runoff from storage of materials to offsite will not occur. During the subsurface construction phase, all runoff will be contained within the project site within the confines of the excavation. Once the structure is above grade, material storage will be within completed portions of the building.

   Materials stored onsite will be those normally used in building construction, and generally will not be hazardous in nature. All chemical containers used at the job site will be placed in pans to catch fluid leaks or spills that might occur.

   No treatment of runoff from material storage areas is proposed.

d. Runoff from Dust Control Measures. To mitigate air quality impacts during site demolition and construction activities, clean, potable water will be used to spray stockpiles, exposed dirt, rubble, and other potential dust sources. Sufficient water will be sprayed to control dust but not enough water to cause ponding and offsite runoff. Sprayed water will either evaporate or percolate into the ground.

e. Sediment Tracking. A stabilized gravel or hardstand surface will be provided at the construction site driveways. Hosing off of vehicle tires will be undertaken to avoid depositing mud and debris in off-site areas. Water from the hosing operation will percolate into the subgrade and be discharged as part of the treated dewatering system effluent, after passing through the settlement tank.

5. **Storm Water Runoff Management During Site Construction.**

BMPs will be implemented to prevent contamination of storm water runoff due to site construction activities. The potential storm water contaminants due to site construction activities are sediments. As discussed above in section 4, preexisting contamination is not anticipated at the site and good housekeeping measures will be implemented to prevent chemical contamination during site construction activities. To prevent storm water runoff from carrying sediments off site during construction activities, storm water control BMPs will be implemented.

Since the area adjacent to the property line slopes away from the site, no offsite runoff will enter the project excavation or flow through the project area. The main project earthwork will be below grade and offsite transport of surface materials is anticipated during most construction. Surface water runoff will collect in the bottom of the excavation.

A plywood construction fence installed along the curbline will serve as a barrier for runoff from the site. This fence will retain water that falls within the site during construction. If sediment-bearing surface water runoff is expected from the site, an onsite retention basin will be installed. Water from the retention basin will percolate into the subgrade or be discharged to the dewatering effluent treatment system for sedimentation and filtration prior to offsite discharge.

No erosion control plan is required for the project by the City and County of Honolulu Department of Public Works since there is no grading under the project and the work site is less than one acre.

6. Post-Construction Storm Water Runoff Management.

During the post-construction period, storm water runoff from the site will remain separate from contact potential sediment and other pollution sources.

a. Sediment Sources. The entire site will be covered by structures, impervious paving, or landscaping. Erosion during topsoiling operations for the landscape areas will be controlled by use of filter fabric until vegetation is established.

b. Exposure of Construction-Related Materials and Wastes to Storm Water. During the post-construction period, any remaining construction-related materials will be contained inside of the building and hence be separate from storm water runoff.

b. Removal of Storm Water Control Measures. The plywood construction fence installed along the curbline that serves as a barrier for site runoff will only be removed after exterior construction activities are substantially complete. The use of any onsite retention basins to intercept surface water runoff from the site will be discontinued only after the potential for sediment or other contamination in site runoff has ceased.

533.0400/002-1

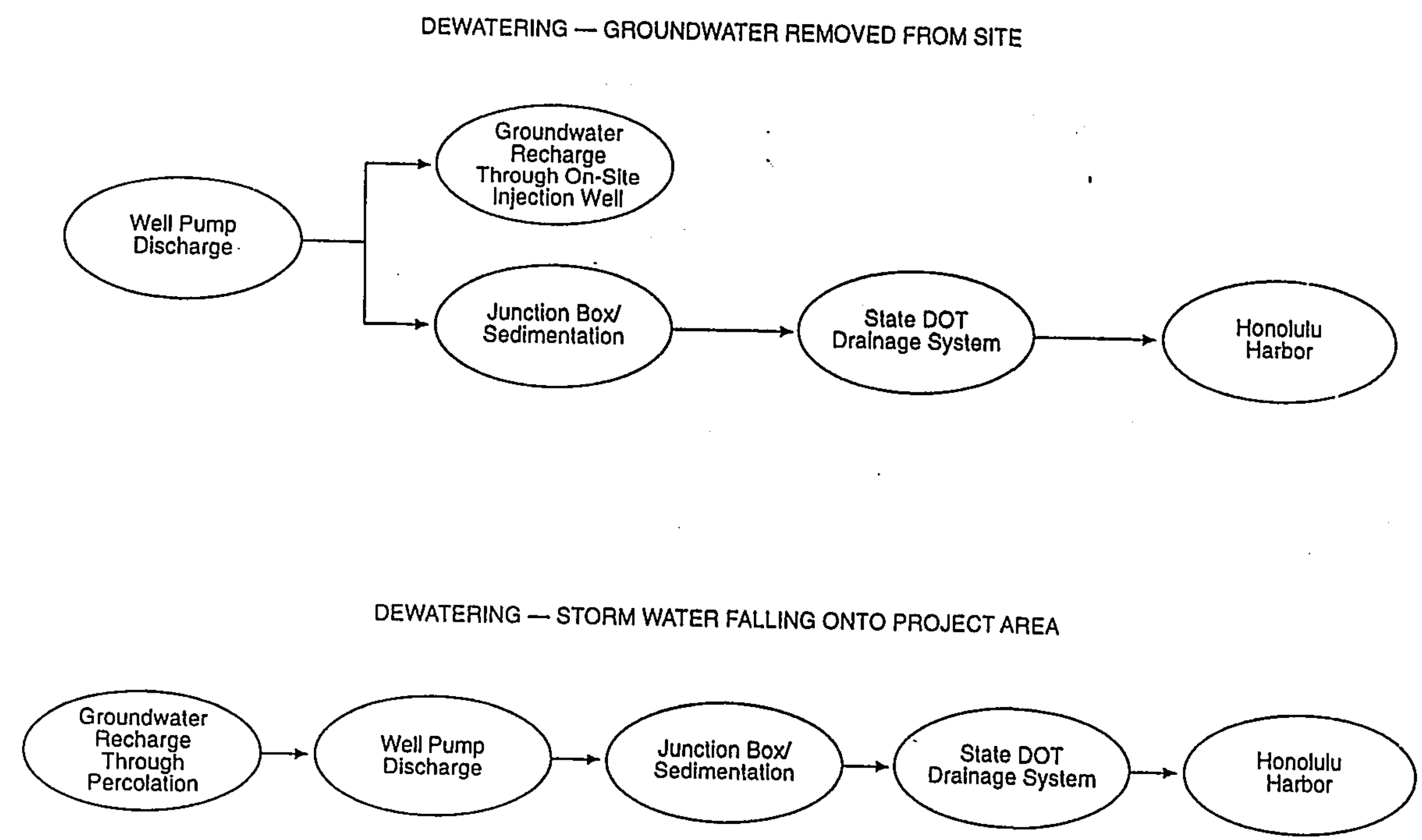
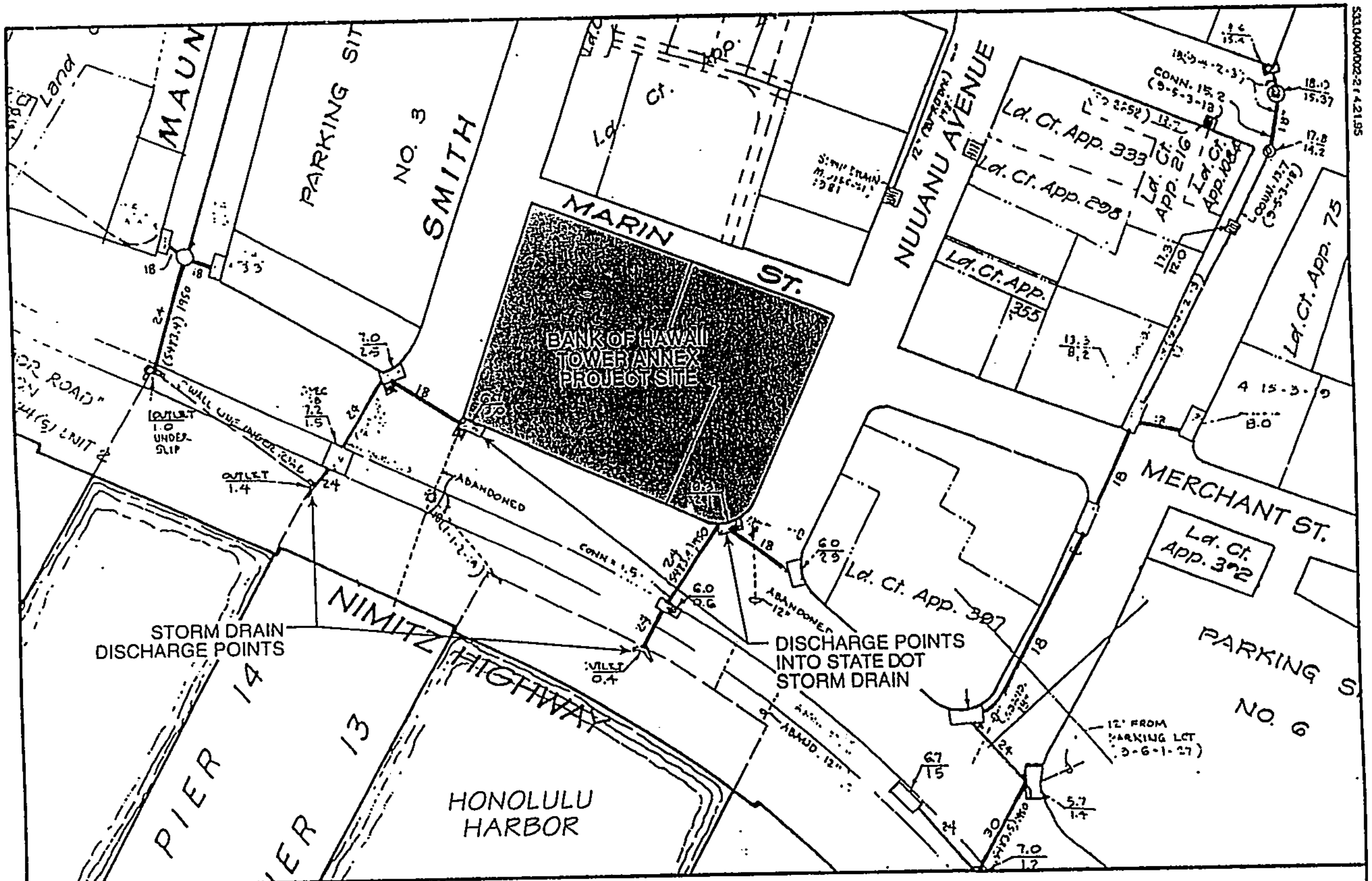


Figure 1
DEWATERING FLOW CHART

Bank of Hawaii Tower Annex
Prepared By: Belt Collins Hawaii
April 1995

533.0400/002-2 r 4.21.95



Map 1
DISCHARGE LOCATION MAP

Bank of Hawaii Tower Annex
Prepared By: Belt Collins Hawaii

95-0126

BOARD OF WATER SUPPLY
CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96843

March 6, 1995

'95 MAR 9 AM 8 22
DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

TO: PATRICK T. ONISHI, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

ATTN: ARDIS SHAW-KIM

FROM: RAYMOND H. SATO, MANAGER AND CHIEF ENGINEER
BOARD OF WATER SUPPLY

SUBJECT: YOUR MEMORANDUM OF FEBRUARY 7, 1995 ON THE DRAFT ENVIRONMENTAL ASSESSMENT (DEA), CHAPTER 343, HRS (SHORELINE SETBACK AREA) FOR THE BANK OF HAWAII ANNEX TOWER, HONOLULU
TMK: 1-7-02: 02

Thank you for the opportunity to review and comment on the DEA for the proposed commercial development.

We have the following comments to offer:

1. The existing off-site water system is presently adequate to accommodate the proposed development.

2. The availability of water will be determined when the Building Permit Application is submitted for our review and approval. If water is made available, the applicant will be required to pay our Water System Facilities Charges for source development, transmission and daily storage. The developer may also be required to pay a special downtown on-site assessment charge.

3. If a three-inch or larger water meter is required, the construction drawings showing the installation of the meter should be submitted for our review and approval.

4. There is an existing two-inch water meter serving the project site.

5. Board of Water Supply (BWS) approved reduced pressure principle backflow prevention assemblies (RPs) are required installations immediately after all domestic water meters. In addition, BWS RPs are required for any fire services that utilize chemicals for fire suppression.

If you have any questions, please contact Barry Usagawa at 527-5235.

Stringer Tusher Architects Incorporated AIA

October 23, 1995

Mr. Raymond H. Sato
Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawaii 96843

Dear Mr. Sato:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
Tax Map Key 1-7-02:02

Thank you for your letter of March 6, 1995 concerning the above-referenced project. Following are responses to your comments in the order they were presented in your letter.

1) The Final Environmental Assessment for the project has been revised to reflect the adequacy of the existing off-site water system to serve the proposed development.

2) The applicant acknowledges the requirement to pay Water System Facilities Charges, as well as the possibility that a special downtown on-site assessment charge may be required.

3) If a three-inch or larger water meter is determined to be needed, construction drawings showing the installation of the meter will be submitted for your review and approval.

4) We acknowledge that there is an existing two-inch water meter serving the project site.

5) We acknowledge that reduced pressure principle backflow prevention assemblies (Rps) are required for any fire services that utilize chemicals for fire suppression.

We appreciate your taking time to review the document. Should you have any questions about the information provided above, please contact me.

Sincerely,

Terry Tusher

95-00892

OFFICE OF STATE PLANNING

Office of the Governor

MAILING ADDRESS: P.O. BOX 3540, HONOLULU, HAWAII 96811-3540
STREET ADDRESS: 250 SOUTH HOTEL STREET, 4TH FLOOR
TELEPHONE: (808)587-2846, 587-2800

Benjamin J. Cayetano, Governor
FAX: Director's Office 587-2848
Planning Division 587-2824

Ref. No. C-1040

February 14, 1995

'95 FEB 17 AM 10 12
DEPT OF LAND UTILIZATION

The Honorable Patrick T. Onishi, Director
City and County of Honolulu
Department of Land Utilization
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Onishi:

We have reviewed the draft Environmental Assessment for the proposed Bank of Hawaii-Annex Tower project, and do not have any serious environmental concern relevant to our statutory responsibilities (Chapter 205A, HRS).

If there are any questions, please contact our CZM program at 587-2876.

Sincerely,

Gregory G.Y. Pai, Ph.D.
Director

Stringer Tusher Architects Incorporated AIA

October 23, 1995

Mr. Gregory G.Y. Pai, Director
Office of State Planning
Office of the Governor
State of Hawaii
P.O. Box 3540
Honolulu, Hawaii 96811-3540

Dear Mr. Pai:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
Tax Map Key 1-7-02:02

Thank you for your letter of February 14, 1995 concerning the above-referenced project. We appreciate your taking time to review the document. Should you have any questions about the project, please contact me.

Sincerely,

Terry Tusher

95-01241

POLICE DEPARTMENT
CITY AND COUNTY OF HONOLULU
801 SOUTH BERETANIA STREET
HONOLULU, HAWAII 96813 - AREA CODE (808) 529-3111

'95 MAR 7 PM 3 26
DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

JEREMY HARRIS
MAYOR

MICHAEL S. NAKAMURA
CHIEF

HAROLD M. KAWASAKI
DEPUTY CHIEF

OUR REFERENCE BS-DL

March 3, 1995

TO: PATRICK T. ONISHI, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: MICHAEL S. NAKAMURA, CHIEF OF POLICE
HONOLULU POLICE DEPARTMENT

SUBJECT: ENVIRONMENTAL ASSESSMENT, CHAPTER 343, HRS, PROJECTS WITHIN THE SHORELINE SETBACK

This is in response to your memorandum of February 7, 1995, requesting for comments on a Draft Environmental Assessment for the Bank of Hawaii Annex Tower in Chinatown.

This project should have no significant impact on operations of the Honolulu Police Department.

Thank you for the opportunity to review this document.

MICHAEL S. NAKAMURA
Chief of Police

By [signature]
EUGENE UEMURA, Assistant Chief
Administrative Bureau

Stringer Tusher Architects Incorporated AIA

October 23, 1995

Mr. Eugene Uemura, Assistant Chief
Administrative Bureau
Police Department
City and County of Honolulu
801 South Beretania Street
Honolulu, Hawaii 96813

Dear Chief Uemura:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
<u>Tax Map Key 1-7-02:02</u>

Thank you for your letter of March 3, 1995 concerning the above-referenced project. We appreciate your taking time to review the document. Should you have any questions about the project, please contact me.

Sincerely,

Terry Tusher

95-01193

DEPARTMENT OF WASTEWATER MANAGEMENT

CITY AND COUNTY OF HONOLULU

650 SOUTH KING STREET
HONOLULU, HAWAII 96813

'95 MAR 6 AM 8 40

DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

JEREMY HARRIS
MAYOR

FELIX B. LIMTIACO
DIRECTOR

CHERYL K. OKUMA-SEPE
DEPUTY DIRECTOR

WPP 95-64

March 3, 1995

MEMORANDUM

TO: MR. PATRICK T. ONISHI, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: FELIX B. LIMTIACO, DIRECTOR
DEPARTMENT OF WASTEWATER MANAGEMENT

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT, CHAPTER 343, HRS
BANK OF HAWAII - ANNEX TOWER, TMK: 1-7-02:02

Thank you for the opportunity to review the subject document. We have reviewed the draft environmental assessment in regard to our municipal wastewater facilities and conclude that the existing sewer system is inadequate to serve the proposed development. As stated on the February 22, 1995, "Sewer Connection Application" submitted for the project, both the 28-inch sewer line in Nimitz Highway and the 32- to 36-inch sewer line in Ala Moana Boulevard are inadequate to accommodate flows from this project.

Should you have any questions, please contact Wes Yokoyama of the Division of Planning and Service Control at 523-4551.

Cheryl K. Okuma-Sepe
for FELIX B. LIMTIACO
Director

Stringer Tusher Architects Incorporated AIA

October 23, 1995

Mr. Felix B. Limtiaco, Director
Department of Wastewater Management
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Limtiaco:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
Tax Map Key 1-7-02:02

Thank you for your letter of March 3, 1995 concerning the above-referenced project. The applicant will continue to work with your department to appropriately size and improve public sewer lines serving the project. Completion of a wastewater relief line on Nimitz Highway (presently in its design phase) may provide new capacity for the downtown area. In addition, the rerouting of wastewater flow in the King Street/Punchbowl Street area to provide more capacity for the downtown area has been discussed with your staff and a preliminary conceptual design of such a rerouting has been approved, with the capacity gained reserved for the proposed project.

We appreciate your taking time to review the document. We look forward to continuing to work with your staff to resolve wastewater-related issues. Should you have any questions about the project, please contact me.

Sincerely,

Terry Tusher

95-00853

'95 FEB 15 PM 2 12

OF LAND UTILIZATION
HONOLULU

DOWNTOWN IMPROVEMENT ASSOCIATION • 700 BISHOP STREET / SUITE 1005 • HONOLULU, HAWAII 96813 • PHONE (808) 531-2061

February 13, 1995

Mr. Patrick T. Onishi, Director
Department of Land Utilization
650 South King Street
Honolulu, Hawaii 96813

Re: 95/ED-001 (ASK)

Dear Mr. Onishi:

The DIA Board of Directors reviewed the plans for Bank of Hawaii Annex Tower last November and voted unanimously to support the project.

The Board thought the design was well suited to the site which bridges the Financial District and the Chinatown District Historic Area. We see no traffic or access problems and believe that market-driven timing is appropriate, given current conditions. The project's size of 280,000 square feet (gross) coincides with Downtown's average annual absorption rate for new office space.

We do not believe the project would produce impacts significant enough to warrant preparation of an Environment Impact Statement.

Very truly yours,

W A Grant

William A. Grant, AIA
Executive Director

WAG:kdc

xc: L.W. Paxton, Bank of Hawaii
Terry Tusher, AIA, Stringer Tusher Architects
Phil Russell, Graham Murata Russell

Stringer Tusher Architects Incorporated AIA

October 23, 1995

Mr. William A. Grant
Executive Director
Downtown Improvement Association
700 Bishop Street, Suite 1005
Honolulu, Hawaii 96813

Dear Mr. Grant:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
<u>Tax Map Key 1-7-02:02</u>

Thank you for your letter of February 13, 1995 concerning the above-referenced project. We appreciate your taking time to review the document. Should you have any questions about the project, please contact me.

Sincerely,

Terry Tusher

95-00934

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

MICHAEL D. WILSON, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTY
GILBERT COLOMA-AGARAN

'95 FEB 21 AM 8 33

DEPT OF LAND UTILIZATION
HONOLULU

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND ENVIRONMENTAL AFFAIRS
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION DIVISION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

February 14, 1995

LOG NO: 13871
DOC NO: 9502TD11

Mr. Patrick T. Onishi, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Onishi:

SUBJECT: **Environmental Assessment (EA), Chapter 343, HRS Projects within the Shoreline Setback, Bank of Hawaii-Annex Tower Honolulu, Kona, O`ahu**
TMK: 1-7-2: 2

Thank you for the opportunity to review this EA, which includes our comments on the project and our recommendations concerning the historic preservation review process. The EA indicates that the necessary historic preservation review steps have been provided for in both the budget and schedule for the project.

If you have any questions please call Tom Dye at 587-0014.

Sincerely yours,

DON HIBBARD, Administrator
State Historic Preservation Division

TD:amk

Stringer
Tusher
Architects
Incorporated AIA

October 23, 1995

Mr. Don Hibbard, Administrator
State Historic Preservation Division
Department of Land and Natural Resources
State of Hawaii
33 South King Street, 6th Floor
Honolulu, Hawaii 96813

Dear Mr. Hibbard:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
Tax Map Key 1-7-02:02

Thank you for your letter of February 14, 1995 concerning the above-referenced project. We concur with your assessment of the historic/archaeological attributes of the subject property and are committed to compliance with the requirements of your division for proper archaeological inventory survey and data recovery procedures. We appreciate your taking time to review the document. Should you have any questions about the project, please contact me.

Sincerely,

Terry Tusher

95-01056

BENJAMIN J. CAYETANO
GOVERNOR
SEIJI F. NAYA
DIRECTOR
RICK EGGED
DEPUTY DIRECTOR

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

DIRECTOR'S OFFICE
Central Pacific Plaza, 220 South King Street, 11th floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 586-2355
Fax: (808) 586-2377

Ref. No. W-1932

February 15, 1995

Mr. Patrick T. Onishi, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Mr. Onishi:

Thank you for the opportunity to review and comment on the Draft Environmental Assessment (EA) for the proposed Bank of Hawaii - Annex Tower located at 800 Nuuanu Avenue, Chinatown, Oahu.

We offer the following comments:

1. The Draft EA indicates that development of the project will facilitate views toward the waterfront area as well as provide design solutions to break down existing barriers between the waterfront and adjoining areas of the City. In this regard, we strongly support and encourage these efforts and request that the owner consider the following:

   a. provide commercial store-front space on the ground floor which opens onto both Nimitz Highway and Smith Street rather than the construction of a sterile concrete wall;

   b. examine design options to increase mauka/makai linkages and public access to the waterfront (i.e., pedestrian bridge); and

   c. utilize design elements which are sensitive to the surrounding environment and which capture the historic themes of Chinatown and the Honolulu waterfront area.

2. The Draft EA indicates that preliminary engineering investigations have concluded that existing infrastructure for the project is adequate. It is recommended that the owner consult with the City and County of Honolulu, Department of Wastewater Management with regard to future sewer hook-ups given the City's ongoing efforts to upgrade East Mamala Bay Wastewater Facilities (i.e., Hart Street WWPS force main replacement, Nimitz Highway sewer relief line, etc.) to meet existing and future loads.

3. It is recommended that the owner provide screening for air conditioning chillers and other mechanical equipment located on the roof of the main tower to maintain a high degree of aestheticism when viewed from the waterfront.

4. It is suggested that the owner consider providing interpretive displays of potential archaeological resources within the proposed landscaped pedestrian plaza to create a more stimulating "people-oriented gathering place" and to increase historic linkages to the waterfront area.

5. It is recommended that archaeological monitoring work be conducted subsequent to inventory survey excavations or further intensive excavations to insure the recovery of potentially significant archaeological resource data. However, monitoring work should be restricted to the excavation of the cultural soil layer for the project site.

Again, thank you for the opportunity to comment. If you have any questions please call Mr. Chris Chung, Project Manager, Honolulu Waterfront Project, at 586-2534.

Sincerely,

Rick Egged
Interim Director

Stringer Tusher Architects Incorporated AIA

October 23, 1995

Mr. Rick Egged, Interim Director
Dept. of Business, Economic Development & Tourism
State of Hawaii
Central Pacific Plaza
220 South King Street, 11th Floor
Honolulu, Hawaii 96813

Dear Mr. Egged:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
Tax Map Key 1-7-02:02

Thank you for your letter of February 15, 1995 concerning the above-referenced project. Following are responses to your comments in the order they were presented in your letter.

1a) As discussed in the Final Environmental Assessment for the project, commercial store-front space will be provided on the ground floor with access from Nimitz Highway, Nuuanu Avenue and Marin Street. Although some commercial frontage may also be provided on Smith Street, this side of the building will be the location of the parking garage entrance and loading areas, therefore, space will be somewhat limited.

1b) The proposed plan emphasizes mauka-makai linkages by improving the character and size of walkways along Nuuanu Avenue. However, a pedestrian bridge is not presently included in the project plan.

1c) The proposed project has been designed to comply with the Chinatown Special Design District guidelines, which includes sensitivity to the historic themes and character of the surrounding area.

2) Consultations with the City's Department of Wastewater Management are ongoing to address the project's wastewater collection needs.

3) Air conditioning chillers and other mechanical equipment located on the proposed building's roof will be screened wherever practicable.

4) Interpretive displays of artifacts that may be recovered during the archaeological work to be done on-site are being proposed by the owner, if such artifacts prove to be of interest to the public.

5) We acknowledge and concur with your recommendations concerning archaeological work. All such work will be conducted in compliance with the requirements of the State Historic Preservation Division.

Stringer Tusher Architects Incorporated AIA

We appreciate your taking time to review the document. Should you have any questions about the project, please contact me.

Sincerely,

Terry Tusher

95-01138

PLANNING DEPARTMENT
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET
HONOLULU, HAWAII 96813

'95 MAR 2 AM 9 59
DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

JEREMY HARRIS
MAYOR

CHERYL D. SOON
CHIEF PLANNING OFFICER

CAROLL TAKAHASHI
DEPUTY CHIEF PLANNING OFFICER

TH 2/95-0216

March 1, 1995

MEMORANDUM

TO: PATRICK T. ONISHI, DIRECTOR
DEPARTMENT OF LAND UTILIZATION

FROM: CHERYL D. SOON, CHIEF PLANNING OFFICER
PLANNING DEPARTMENT

SUBJECT: DRAFT ENVIRONMENTAL ASSESSMENT (EA) FOR THE PROPOSED BANK OF HAWAII ANNEX TOWER, 800 NUUANU AVENUE, HONOLULU, OAHU, HAWAII, TAX MAP KEY: 1-7-02: 02

In response to your memorandum of February 7, 1995, we have reviewed the subject EA and offer the following comments:

1. The proposed project site is designated Commercial Emphasis Mixed Use on the Development Plan (DP) Land Use Map for the Primary Urban Center. Furthermore, the proposed project site is within the Downtown Special Area which has a general height limit of 350 feet as specified under Section 24-2.2(b)(1)(I) of the DP Special Provisions for the Primary Urban Center.

2. The DP Public Facilities Map for the Primary Urban Center indicates proposed sewer improvements along the portion of Nimitz Highway fronting the subject property. Therefore, we recommend that the applicant's design and construction activities be coordinated with the City's Department of Wastewater Management and Department of Public Works.

3. Section III(1) and (2) of the Draft EA indicates that the proposed project will be approximately 250 feet in height and incorporate terraced building forms and a landscaped pedestrian plaza. In order to promote a more pleasing urban environment, the applicant should provide pedestrian amenities, such as seating areas within the plaza. To further facilitate views of Honolulu Harbor, we recommend that the project's tower be designed with a mauka-makai orientation in accordance with Section 24-2.1(C)(6) of the DP Special Provisions for the Primary Urban Center.

The Final EA should include a proposed site plan to help illustrate the proposed features mentioned above. Additionally, the existing Location Map (Figure 1) and the Existing Site Plan (Figure 4) should be relocated to Section III for easier reference.

4. The Draft EA does not adequately describe proposed mitigation measures given the project's close proximity to the waterfront and surrounding buildings. Specifically, the Final EA should describe how potential noise, fugitive dust, stormwater runoff, and traffic impacts will be mitigated or controlled during the site preparation and construction phases.

Thank you for the opportunity to comment on this matter. Should you have any questions, please contact Tim Hata of our staff at 527-6070.

Cheryl D. Soon
CHERYL D. SOON
Chief Planning Officer

CDS:js

Stringer
Tusher
Architects
Incorporated AIA

October 23, 1995

Ms. Cheryl D. Soon
Chief Planning Officer
Planning Department
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

Dear Ms. Soon:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
Tax Map Key 1-7-02:02

Thank you for your letter of March 1, 1995 concerning the above-referenced project. Following are responses to your comments in the order they were presented in your letter.

1) We concur with your determination of the project's location and applicable height controls.

2) Consultations with the City's Department of Wastewater Management are ongoing to address the project's wastewater collection needs.

3) Pedestrian amenities such as seating areas are being proposed within the ground floor plaza. As designed, the office tower is oriented toward Honolulu Harbor. The Final EA includes a site plan as well as an architectural rendering and several views and sections to aid the reader in understanding the proposed plan. The illustrative figures are presented in the document's section entitled Project Description. The entire document has been reformatted for easier reference.

4) The Final EA has been expanded to include a full discussion of all significant project impacts, as well as recommended mitigation measures, for issues including traffic, construction impacts, air and noise quality and other environmental concerns.

We appreciate your taking time to review the document. Should you have any questions about the project, please contact me.

Sincerely,

Terry Tusher

95-01417

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 5TH FLOOR
HONOLULU, HAWAII 96813
PHONE: (808) 523-4427 • FAX: (808) 527-5498

'95 MAR 14 PM 3 06
DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

JEREMY HARRIS
MAYOR

RONALD S. LIM
DIRECTOR

ROLAND D. LIBBY, JR.
DEPUTY DIRECTOR

March 10, 1995

MEMORANDUM

TO: Patrick T. Onishi, Director
Department of Land Utilization

FROM: Ronald S. Lim, Director

SUBJECT: Bank of Hawaii - Annex Tower
800 Nuuanu Avenue, Chinatown, Oahu
Draft Environmental Assessment

The Department of Housing and Community Development (DHCD) has reviewed the Draft Environmental Assessment (DEA) for the Bank of Hawaii Annex Tower Project bordered by Nuuanu Avenue, Nimitz Highway and Smith Street. The project involves demolition of an existing 5-story office building and construction of a new 21-story office building, six levels of below-grade parking and a public plaza along Nuuanu Avenue.

Several mixed-use, residential and commercial projects developed by the City are situated near the proposed project area. These include the Harbor Village at the corner of River Street and Nimitz Highway; the Marin Tower, adjacent to the proposed development, on Maunakea Street, Smith Street and Nimitz Highway; Chinatown Gateway Plaza between Nuuanu Avenue and Bethel Street; Harbor Court bounded by Bethel Street, Nuuanu Avenue, Merchant Street and Nimitz Highway; and the ongoing Kekaulike Revitalization Project on the two blocks bounded by Hotel, Maunakea and King Streets. The project consists of two phases (Ewa and Diamond Head Blocks) and the conversion of part of Kekaulike Street into a pedestrian mall.

Traffic generated by the project will have impacts on the surrounding roadway system. However, as indicated in the DEA, the level of service falls within an acceptable level and no mitigative measures to accommodate project-related traffic are required. Necessary measures to ensure the least amount of impact of traffic related problems to the surrounding area as recommended in the report, particularly along Smith Street and Nuuanu Avenue during construction, should be implemented.

Should you have any questions, please call Charlotte Yoshioka of our Planning and Analysis Division at x 5090.

Thank you for the opportunity to comment.

RONALD S. LIM
Director

Mr. Ronald S. Lim, Director
Department of Housing and Community Development
City and County of Honolulu
650 South King Street, 5th Floor
Honolulu, Hawaii 96813

Dear Mr. Lim:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
Tax Map Key 1-7-02:02

Thank you for your letter of March 10, 1995 concerning the above-referenced project. We appreciate your taking time to review the document. Should you have any questions about the project, please contact Mr. Terry Tusher at 531-5967.

Very truly yours,

T.T.

Stringer Tusher Architects Incorporated AIA

October 23, 1995

Mr. Ronald S. Lim, Director
Department of Housing and Community Development
City and County of Honolulu
650 South King Street, 5th Floor
Honolulu, Hawaii 96813

Dear Mr. Lim:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
Tax Map Key 1-7-02:02

Thank you for your letter of March 10, 1995 concerning the above-referenced project. We appreciate your taking time to review the document. The Final Environmental Assessment includes the following discussion:

Based on the traffic analyses performed, the proposed project has no significant adverse impact upon traffic conditions. Therefore, no specific mitigation measures are warranted because the LOS will not be decreased below LOS D on any of the streets or roadways in the vicinity of the project site as a result of the proposed project.

However, in response to recommendations raised by the DOT and the DTS, the following measures will be taken:

1. *All vehicular access points will be constructed as standard City and County dropped driveways. New sidewalks, curbs and gutters per standard City and County standards will replace existing driveways that will not be used by the proposed project;*

2. *Driveway grades will be 5 percent or less for a minimum distance of 35 feet from the curb line and adequate sight distance to pedestrians and other vehicles will be provided and maintained;*

3. *Parking entry controls will be recessed into the project and the type and method of parking fee collection will be designed to minimize vehicular queuing on Smith Street;*

4. *All street modifications, sidewalks, signals and other traffic modifications will be designed in compliance with DOT and DTS requirements and standards;*

5. *The developer will continue to work closely with DOT and DTS during the early stages of the project to determine the extent of street improvements that will be necessary to support the project;*

Stringer Tusher Architects Incorporated AIA

6. *The General Contractor will be required to implement a program to reduce the parking impacts of construction worker vehicles in the area. This program could involve the bussing of workers from a centralized parking area or pick-up area to the job-site; and*

7. *The owner will appoint a Transportation Coordinator to implement a transportation management system (TSM) that could include ridesharing, commuter information networks, transit and carpool/vanpool management, City and County bus service coordination, parking fee incentives that encourage carpooling vanpooling and the provision of secure bike racks for bike riders. The goal of the TSM will be to reduce peak-hour trips, especially by employees in the building.*

Should you have any questions about the project, please contact me.

Sincerely,

Terry Tusher

95-01387

University of Hawai'i at Manoa

Environmental Center
A Unit of Water Resources Research Center
Crawford 317 • 2550 Campus Road • Honolulu, Hawai'i 96822
Telephone: (808) 956-7361 • Facsimile: (808) 956-3980

'95 MAR 13 PM 3 23
DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

March 10, 1995
EA:0110

Ms. Ardis Shaw-Kim
City and County of Honolulu
Department of Land Utilization
650 South King Street
Honolulu, Hawaii 96813

Dear Ms. Shaw-Kim:

Draft Environmental Assessment (EA)
Bank of Hawaii - Annex Tower
Honolulu, Hawaii

The applicant, Bank of Hawaii, proposes to demolish an existing five-story building and construct a 21-story office building and six-levels of below-grade parking at 800 Nuuanu Avenue in downtown Honolulu. The project will include approximately 280,000 square feet of floor area and 600 below-grade parking stalls. The main portion of the tower will be approximately 250 feet tall and centrally located within the property. Terraced building forms will be used.

We have reviewed this document with the assistance of Frank Peterson, Geology and Geophysics, and Malia Akutagawa of the Environmental Center.

Inadequate Document

The document is wholly inadequate and unacceptable as a Draft EA. Although HRS 343 was triggered due to the project's location in the Chinatown Special District which is listed on the National Historic Register, this does not mean that the Draft EA need only contain information as to the site's historical and archaeological significance. Once HRS 343 is triggered, the Draft EA must address all relevant issues such as environmental, social, and cultural impacts in addition to archaeological and historical aspects of the project. Section 11-200-12 of the Hawaii Administrative Rules (HAR) sets forth the criteria needed to determine whether impacts of a given project are significant, thereby requiring the production of an Environmental Impact Statement (EIS). The document's unfounded blanket assertions of no significant impact do not adequately meet the criteria of Section 11-200-12, HAR. It is impossible to assess the impacts when the document fails to describe the existing physical and biological characteristics of the project site.

No Assessment of Geologic, Soil, and Groundwater Conditions

Since the project site is near the ocean, and six-levels of below-grade parking are planned, geologic, soil, and groundwater conditions must be assessed. However, no description of any of these is given. No mention is made of impacts on subsurface soil and geologic conditions from excavation. Impacts on groundwater and hence compaction and possible ground subsidence associated with de-watering must be determined, along with consideration of need for an NPDES Permit for discharge of dewatering effluent.

Air Quality, Dust, and Noise Impacts

There is no discussion on air quality, dust, and noise impacts arising from demolition of the Iron Works building and construction of the proposed building. In addition, no mention is made of possible air quality problems due to inadequate ventilation of the six-level sub-grade parking structure.

Traffic Assessment

Although a Traffic Impact Analysis is appended, there is no description of potential traffic impacts, nor are the recommendations set forth in the report integrated in the document.

Project Alternatives and Mitigation Measures

The sections on "Alternatives Considered" and "Mitigation" are inadequate. The document discusses various uses considered in the proposed building; however, there is no discussion of whether or not the proposed building should be constructed at all, or of alternate uses of the property itself.

Ms. Ardis Shaw-Kim
March 10, 1995
Page 3

Conclusion

The document is unacceptable as a Draft EA; we recommend that it be revised so that a proper assessment of the environmental impacts can be made.

Thank you for the opportunity to review this Draft EA.

Sincerely,

John T. Harrison
Environmental Coordinator

cc: OEQC
Roger Fujioka
Bank of Hawaii
Stringer Tusher Architects, Inc.
Frank Peterson
Malia Akutagawa

Stringer Tusher Architects Incorporated AIA

October 23, 1995

Mr. John T. Harrison, Coordinator
Environmental Center
University of Hawaii at Manoa
Crawford 217
2550 Campus Road
Honolulu, Hawaii 96822

Dear Mr. Harrison:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
Tax Map Key 1-7-02:02

Thank you for your letter of March 10, 1995 concerning the above-referenced project. Following are responses to your comments in the order they were presented in your letter.

Inadequate Document The Final Environmental Assessment has been completely reformatted and expanded to fully address the requirements of Chapter 343 as well as Section 11-200, Hawaii Administrative Rules. The physical and environmental characteristics of the project area have been included in the document and all significant impacts have been discussed.

No Assessment of Geologic, Soil, and Groundwater Conditions The Final EA has been revised to fully describe the existing conditions relating to geology, soils and groundwater, assess the potential impacts of the project upon these conditions, and recommend mitigation measures, if warranted, to ensure that no significant adverse impacts occur.

Air Quality, Dust, and Noise Impacts An air quality impact analysis and noise impact analysis have been conducted for the project and are presented as appendices to the Final EA. The impacts of demolition have been fully assessed in the Final EA. The proposed ventilation system for the project's parking garage is described and evaluated for both air quality and noise impacts.

Traffic Assessment The project's potential traffic impacts are fully discussed in the Final EA. The findings of the report have been integrated into the main body of the document.

Project Alternatives and Mitigation Measures The document's section on alternatives has been expanded. The entire document has also been reformatted to present a discussion of potential impacts for each subject area, followed immediately by a discussion of recommended mitigation measures.

Mr. John T. Harrison
October 23, 1995
Page 2

Stringer Tusher Architects Incorporated AIA

We appreciate your taking time to review the document. Should you have any questions about the project, please contact me.

Sincerely,

Terry Tusher

95-0179

BENJAMIN J. CAYETANO
Governor of Hawaii

'95 MAR 13 PM 1 44

DEPT OF LAND UTILIZATION
CITY & COUNTY OF HONOLULU

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. Box 621
Honolulu, Hawaii 96809

Chairperson
MICHAEL D. WILSON
Board of Land and Natural Resources

Deputy Director
GILBERT COLOMA-AGARAN

Aquaculture Development
Aquatic Resources
Boating and Ocean Recreation
Bureau of Conveyances
Conservation and Environmental Affairs
Conservation and Resources Enforcement
Forestry and Wildlife
Historic Preservation
Land Management
State Parks
Water and Land Development

REF:OCEA:SOR

FILE NO.: 95-371

Honorable Patrick T. Onishi, Director
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

MAR 9 1995

Dear Mr. Onishi:

SUBJECT: Shoreline Setback (95/ED-001): Bank of Hawaii-Annex Tower, Honolulu, Oahu, TMK: 1-7-02: 2

We have reviewed the application information for the subject project transmitted by your letter dated February 7, 1995, and provide the following:

Historic Preservation Division

The Historic Preservation Division comments that this Draft Environmental Assessment (DEA) includes their comments on the subject project as well as their recommendations concerning the historic preservation process. The DEA indicates that the necessary historic preservation review steps have been provided for in both the budget and schedule for this project.

We have no further comment to offer at this time. Thank you for the opportunity to comment on this matter.

Please feel free to contact Steve Tagawa at our Office of Conservation and Environmental Affairs, at 587-0377, should you have any questions.

Aloha,

Michael D. Wilson

MICHAEL D. WILSON

Mr. Michael D. Wilson, Chairman
Board of Land and Natural Resources
P.O.Box 621
Honolulu, Hawaii 96809

Dear Mr. Wilson:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
Tax Map Key 1-7-02:02

Thank you for your letter of March 9, 1995 concerning the above-referenced project. We appreciate your taking time to review the document. Should you have any questions about the project, please contact Mr. Terry Tusher at 531-5967.

Very truly yours,

T.T.

Stringer Tusher Architects Incorporated AIA

October 23, 1995

Mr. Michael D. Wilson, Chairman
Board of Land and Natural Resources
State of Hawaii
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Wilson:

Draft Environmental Assessment
Bank of Hawaii Annex Tower
Tax Map Key 1-7-02:02

Thank you for your letter of March 9, 1995 concerning the above-referenced project. We appreciate your taking time to review the document. Should you have any questions about the project, please contact me.

Sincerely,

Terry Tusher

APPENDIX A:
SOILS REPORT

PRELIMINARY FOUNDATION INVESTIGATION
AND DEWATERING CONSULTATION
PROPOSED BANK OF HAWAII ANNEX TOWER
HONOLULU, OAHU, HAWAII

Tax Map Key: 1-7-02:02

Dames & Moore Job Number 21581-001-011
September 13, 1991

DAMES & MOORE

DAMES & MOORE A PROFESSIONAL LIMITED PARTNERSHIP
1144 10TH AVENUE, SUITE 200, HONOLULU, HAWAII 96816-2497 (808) 735-3585

FACSIMILE NO.: (800) 732-6077

September 13, 1991
21581-001-011

Bancorp Hawaii, Inc.
c/o Stringer, Tusher & Associates
841 Bishop Street, Suite 2201
Honolulu, Hawaii 96813

Attention: Mr. Richard Dahl

Gentlemen:

Four (4) copies of the report, "Preliminary Foundation Investigation and Dewatering Consultation, Proposed Bank of Hawaii Annex Tower, Honolulu, Oahu, Hawaii, Tax Map Key: 1-7-02:2" are submitted herewith. The scope of our work was defined in our proposal dated October 12, 1990. This foundation investigation was performed in general accordance with the scope described in our proposal.

Our findings and recommendations for this preliminary investigation are presented in the body of the report. For a convenient reference, a summary is provided on the first page.

Selected soil samples were used in laboratory testing; the remaining samples will be kept for a period of time for possible examination. Unless requested otherwise, the samples will be discarded three months from this date.

A supplementary foundation investigation can be scheduled once the existing building is demolished.

It has been a pleasure performing this assignment for you. We look forward to completing the supplementary investigation for this project. If you have any questions regarding this report, please do not hesitate to contact us at your convenience.

Yours very truly,

DAMES & MOORE
A Professional Limited Partnership

S.K. Djou, P.E.
Partner (Ltd.)

SKD/GYL/KKF/DWD/ln(002B.an:21581-001-011)
(4 copies submitted)

cc: Stringer Tusher & Associates
Attention: Mr. David Ayer

<u>TABLE OF CONTENTS</u>

SUMMARY

Three exploratory borings were advanced to depths of about 111.5 to 126.5 feet for this preliminary foundation investigation. Subsurface conditions encountered generally consist of a thin layer of surficial fill and volcanic cinder overlying coralline deposits. The coralline deposits consist of weakly to moderately cemented coral ledges, sands and gravels. These deposits are underlain by alluvium consisting of clayey silts interbedded with frequent sand and gravel layers.

A supplemental foundation investigation, consisting of additional borings, is planned to explore the subsurface conditions over the western half of the site following the demolition of the existing building.

Based on the available subsurface information, it is believed that the proposed tower can be supported on either a pile or a mat foundation (depending somewhat on the number of subsurface garage levels). Excavation for a multiple basement scheme is technically feasible. However, excavation and construction adjacent to the property line will require careful coordination. Dewatering cut-off walls and/or soldier piles with lagging, and earth anchors will be required to support the side of the excavation.

More detailed discussions and recommendations are presented in the text of this report.

1.0 INTRODUCTION

This report presents the results of a preliminary foundation investigation and dewatering consultation for the proposed Bank of Hawaii Annex Tower to be located in Honolulu, Oahu, Hawaii. The site is located at the northeast corner of Nimitz Highway and Nuuanu Avenue and is designated as Tax Map Key: 1-7-02, Lot 2. The approximate location of the site is shown on Plate 1, Map of Area.

The project site encompasses an area of approximately 38,200 square feet and is currently occupied by an existing Bank of Hawaii building and parking lot. The proposed structure consists of an 18-story office tower with a 3-story podium. The building is expected to be constructed of reinforced concrete with underground parking over the entire site. At this time, the number of underground basement levels have not been set; as many as 5 subsurface levels may be used. The tower will be approximately 290 feet in height with the podium approximately 45 feet in height. Because the design is still in the preliminary stages, building loads are not available. A layout of the existing site is shown on Plate 2, Plot Plan.

2.0 PURPOSE AND SCOPE OF WORK

The purpose of this preliminary foundation investigation was to explore the subsurface conditions in accessible areas of the project site, and to provide preliminary recommendations for foundation designs including an evaluation of the feasibility of constructing a multiple level basement/parking garage. Dames & Moore was also asked to comment on dewatering design for the basement excavation.

Specifically, the scope of work consisted of the following:

1. Data Review - Available data, including previous nearby Dames & Moore projects, and other available information on general geology, hydrogeology, dewatering, and subsurface conditions in the area, was reviewed.

2. Field Exploration - Subsurface conditions were explored by advancing three (3) soil test borings to depths ranging from 111.5 to 126.5 feet below the ground surface. The drilling was performed under the technical supervision of a Dames & Moore engineering geologist, who maintained logs of the borings. Soil samples and rock cores were recovered from the borings for further evaluation and testing.

   In-situ permeability tests was performed at each boring location to obtain information for preliminary dewatering considerations. One of the borings was converted to an observation well at the completion of drilling to monitor ground water levels. A description of the field investigation program and the logs of borings are presented in Appendix A.

3. Laboratory Testing - Soil samples and rock cores recovered during the boring program were returned to the Dames & Moore laboratory for further evaluation and testing. Selected soil samples were tested to evaluate their physical properties and engineering characteristics. The results of the laboratory tests are presented in Appendix A.

4. Engineering Analysis - Based on the results of the field exploration and laboratory testing program, and preliminary recommendations regarding site preparation, foundation design, and lateral earth pressures were developed. An evaluation of the anticipated basement excavation construction and dewatering techniques were also developed.

5. Report - The results of the field exploration program, laboratory tests, and preliminary evaluation and recommendations were summarized and are presented in this report.

3.0 SITE CONDITIONS

3.1 SURFACE CONDITIONS

The site is located at the northeastern corner of Nuuanu Avenue and Nimitz Highway in Honolulu, Oahu, Hawaii. It is bounded on the north by Smith Street, on the south by Nuuanu Avenue, on the east by Marin Street and on the west by Nimitz Highway. The northern half of the site is currently occupied by a 4-story Bank of Hawaii building, while the southern half presently consists of a paved parking lot.

Topographically, the site slopes down gently to the west towards Nimitz Highway. Ground surface elevations are estimated to be between 12 to 17 feet, Mean Sea Level (MSL). All elevations in this report referenced to this datum.

3.2 SUBSURFACE CONDITIONS

Geologically, the site is underlain by the Honolulu Series basalt flows. The basalts were probably weathered in-place, and later covered by a layer of brown clayey silt alluvium. Subsequent to the Ice Age, the sea level rose. Coralline sands and gravels were deposited over the alluvium in a backreef environment. A coral reef was formed over the coralline sands and gravel. The reef was composed of recemented and algal coral. Volcanic cinder sand from the eruption of Tantalus and Punchbowl covered the coral reef.

As noted earlier, a series of three (3) soil test borings were advanced on the project site to explore the subsurface conditions. Two (2) borings were advanced within the project proper; a third boring was drilled just outside the site area, on Marin Street. The locations of the borings are shown on Plate 2. A generalized soil profile showing the approximate subsurface conditions at the site is presented on Plate 3. Because the borings are widely spaced, subsurface conditions between the borings may vary significantly.

In general, subsurface conditions consist of a thin layer of surficial silty sand and gravel fill ranging from about 1.5 to 4.5 feet in thickness, overlying a weak to moderately cemented coral ledge ranging from approximately 5 to 9 feet in thickness. Thin layers of volcanic cinder sand and clayey silt were noted beneath the fill in Boring 1. The coral ledge is underlain by loose to dense backreef deposits consisting of silty coralline sand and gravel for depths of about 8 to 70 feet below the ground surface. Underlying this backreef deposit, the soils consisted of generally medium stiff to very stiff alluvial clayey silt interbedded with silty sand and gravel overlying dense basaltic gravel, cobbles, and boulders to the bottom of the explorations. Groundwater was encountered at depths of about 16.1 feet in Boring 1, 13.2 feet in Boring 2, and 12.1 feet in Boring 3 during the field investigation. Because of the close proximity of the site to the harbor, it is anticipated that the groundwater level will fluctuate with the tide. Field classifications as well as other pertinent data from specific boring locations are provided on the enclosed test boring logs (Plate Nos. A-1.1 through A-1.3.2).

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 GENERAL

The subsurface information obtained from the subsurface exploration program performed at the site is fairly typical of the general subsurface conditions in the downtown area. We have previously provided foundation design recommendations for the Century Square building with a 4-level parking basement at the corner of Bishop and Beretania Street, the Pan Pacific Plaza with a 5½-level basement at Fort Street and Union Mall, the Alii Place with a 2-level basement at Hotel and Alakea Streets, and the *1100 Alakea Street Plaza* with a 6-level basement at Hotel and Alakea Streets. The basement excavations for these projects reached depths ranging from approximately 25 to 60 feet below the street level. All of these buildings are on mat foundations.

Currently, five basement schemes ranging from one- to five-level basements are being evaluated for the proposed project. Based on the subsurface conditions encountered, it is believed to be technically feasible to construct multiple level basements at the site. The selection of the appropriate basement levels requires a balance of economics and development needs with the natural constraints imposed by the subsurface conditions at the site.

Close construction monitoring and strict control of the excavation will be required for constructing the basement close to the property line. Underground utilities at the periphery of the site should be relocated prior to basement construction. Construction easements will need to be obtained from the City and County of Honolulu along Smith and Marin Streets, Nuuanu Avenue and Nimitz Highway if earth anchors are to be installed beyond the property line. In addition, obtaining temporary usage of side walk space on these streets during construction will probably be necessary.

4.2 SITE PREPARATION

Prior to construction, a topographic plan of the site, and a photographic survey of existing nearby buildings and structures should be developed. All existing damage to the surrounding structures should be noted. The preconstruction survey should also include establishing settlement points on existing nearby buildings, structures, and roadways. A survey benchmark should be established sufficiently far away from the site to be unaffected by any settlements related to the excavation. The photographs and settlement points would be valuable records in the event claims for damage arise during construction of the new facility.

The existing building will be demolished during the process of developing the site. Excavation of soil materials at the site can probably be performed by conventional earth moving equipment. Excavation into hard coral will likely require a hoeram or the use of heavy ripping equipment. Removal of concrete slabs and foundations will also be required in areas occupied by existing structures.

4.3 BASEMENT SCHEMES

Five basements schemes are being evaluated for the proposed building. The excavation and foundation aspects of each scheme is discussed in the following sections:

4.4 ONE-LEVEL BASEMENT

4.4.1 Excavation Considerations

An excavation depth of approximately 10 to 12 feet is anticipated. The excavation will extend to or slightly below the groundwater level. Dewatering can probably be accomplished using trench drains and sump pits with pumps.

Excavation in the hard coral is expected to stand vertically without lateral support. However, the soil materials above and below the hard coral should be shored to prevent raveling. Soldier piles and lagging, commonly used in Honolulu, would be a suitable temporary shoring system.

4.4.2 Foundation Support

Excavation for constructing a one-level basement will effectively remove most of the coral ledge encountered near the upper portion of the site. The removal of this coral ledge coupled with high anticipated building loads would require that a deep foundation system be used. A driven pile foundation system extending to depths of 100 to 150 feet below the ground surface will be appropriate for this basement scheme.

4.5 TWO-LEVEL BASEMENT

4.5.1 Excavation Considerations

An excavation depth of approximately 20 to 25 feet is anticipated for this scheme. The excavation will extend to a depth of approximately 7 to 12 feet below the groundwater level. Lateral support will be required for the sides of the excavation above and below the coral ledge. Lateral support can be derived using soldier piles, earth anchors, and wood lagging.

4.5.2 Dewatering

Dewatering will be needed to maintain a relatively dry excavation. Locally, many projects have been successfully completed with dewatering of 20 feet or more below the groundwater level using large diameter dewatering wells. These dewatering wells are generally installed at the periphery of the excavation. A pump test should be conducted by the contractor prior to construction to provide a basis for the dewatering system design. Pending on the permeability of the subsurface strata, a cut off wall may need to be incorporated into the dewatering system.

4.5.3 Foundation Support

Excavation for a two-level basement will extend into the back reef deposits of coralline sands and gravels. The consistency of these materials range from loose to very dense. A deep foundation consisting of driven piles will probably be needed to transfer the building loads to a deeper stratum.

4.6 THREE- TO FIVE-LEVEL BASEMENT

The excavation condition and foundation support considerations are similar for three-, four-, and five-level basement schemes. The difference between various deep basement schemes lies mainly in the depth of excavation, cost, and lateral support requirements. To avoid repetition, excavation considerations and foundation support for these basement schemes are discussed jointly in the following sections.

4.6.1 Excavation Conditions

The excavation depths will be approximately 30 to 35 feet for a three-level basement, 40 to 45 feet for a four-level basement, and 50 to 55 feet for a five-level basement. These excavation depths correspond to depths below the groundwater level of approximately 17 to 22 feet for a three-level basement, 27 to 32 feet for a four-level basement, and 37 to 42 feet for a five-level basement.

4.6.2 Feasibility of Deep Basement Construction

As noted in Section 4.1, Dames & Moore has previously provided foundation design recommendations for various high-rise buildings with multiple level basements in downtown Honolulu area. Excavation shoring for these buildings were generally accomplished using soldier piles with wood lagging and earth anchor tie backs. Dewatering of the excavations were performed using deep perimeter wells installed inside the excavations.

Based on past experience at nearby construction projects, dewatering for the project site is expected to require a combination of cutoff walls and conventional deep well pumping. Due to the proximity of the site to the harbor, and the high permeability of the subsurface soils, it will be difficult to lower the water table adequately using dewatering wells alone. A cut-off curtain should be installed to retard the lateral migration of groundwater. It is believed that the foundation construction of three or more basement levels at this site will present a major challenge to the local building industry. However, using a combination of the latest construction techniques, a three- to five-level basement scheme for this project is believed to be technically feasible.

4.6.3 Deep Basement Construction

Basement excavation, temporary shoring and dewatering for building construction are the contractor's responsibility. To assist with the master planning considerations, the following comments and ideas for basement construction are provided.

- A slurry diaphragm cut off wall system would be required to provide the necessary lateral support for the anticipated deep excavation and to control the underground seepage flow for dewatering.

- A slurry diaphragm wall can be constructed by excavating a trench 2 to 3 feet in width along the perimeter of the excavation using a special excavator. The excavator is usually mounted on a narrow gauge rail system for mobility and alignment control.

- In the area of the hard coral ledge, fracturing of the coral by means of special cutting heads may be necessary as an excavator clamshell bucket may not be capable of breaking up the coral. The slurry diaphragm wall is usually excavated in segments.

- During excavation, the trench is stabilized with bentonite slurry. Because bentonite slurry is heavier than water, it will exert a positive pressure on the faces of the trench, to limit cave-ins, but still allow free movement of an excavator clamshell bucket.

- For this project, the diaphragm wall segment should be excavated into the old alluvium formation to a depth of about 100 feet below the ground surface. Upon completion of the excavation, a reinforcing steel cage can then be lowered into the trench and concrete pumped into the trench by "tremie method" to form the segment of the permanent basement wall. This construction procedure can then be repeated in alternating panels around the perimeter of the site until the site is fully enclosed by a thick reinforced concrete diaphragm wall.

- The diaphragm wall will need to be designed to provide the necessary lateral support of the excavation. If necessary, bracing should be added.

- After the completion of the diaphragm wall, we believe that dewatering for the site can be handled sufficiently using the deep well pumping method. Excavation of the site can proceed in the conventional manner once the groundwater level has been drawn down sufficiently. Due to the limited space of the site, excavated material can best be removed by a clam shell or hopper type equipment.

- As a variation to the slurry diaphragm wall, overlapping circular drilled shafts or soil-mix well can also be considered.

4.6.4 Foundation Support

The proposed high rise building with the various deep basement parking schemes can be supported on a mat foundation. The net foundation pressure imposed by the building will vary with each basement scheme. The net foundation pressure is defined as the total mat foundation pressures induced by the dead, live, and wind loads of the building, subtracting the permanent buoyancy pressure and the overburden pressure removed from foundation excavation. Based on a building load estimate of 200 pounds per square foot (psf) per floor for dead plus live, and wind load conditions, we anticipate that the net bearing pressure will be on the order of 2,000 psf for a three-level basement scheme, 1,000 psf for a four-level basement scheme and a fully compensated condition for a five-level basement scheme.

For calculating buoyancy effects and for waterproofing design, a design high water level of 3 feet above mean sea level should be used.

4.6.5 Foundation Preparation

The bottom of the excavation is expected to be wet and disturbed. It is recommended that at least 12 inches of the subgrade soils below the bottom of the mat be overexcavated and replaced with a No.2 coarse basaltic gravel base course. Deeper overexcavation may be required in portions of the subgrade where the soil is loose or when unsuitable material is encountered. The use of a geotextile in conjunction with the base course is advisable in soft subgrade areas. The contractor should proofroll the gravel base course surface with a smooth drum roller with minimum static weight of 10 tons. Soft and loose soils observed by the proofrolling should be overexcavated and replaced with additional No. 2 coarse basaltic gravel. The proofrolling should be performed under the observation of the soils engineer.

It is recommended that the contractor install a mud slab consisting of 2 to 3 inches of lean concrete over the base course as soon as practical after the proofrolling. The mud slab will reduce loosening and softening of the soils at the bottom of the excavation due to rain and construction traffic, and provides a firm surface on which the waterproofing can be installed. After installing the waterproofing, another layer of mud slab should be installed to protect the waterproofing membrane. Following this procedure, the construction mat may then be installed.

4.7 BASEMENT WALLS

A lateral earth pressure diagram for the preliminary design of the basement wall is presented on Plate 4 for three-, four-, and five-level basement conditions. The hydrostatic water pressures have been included in this diagram. Surcharge effects of the buildings along Nuuanu Avenue, Smith Street and Marin Street would be minimal because of the set back distances from the new basement.

Lateral loads will be resisted by passive pressures and by friction acting along the base of the slab. Soil property values to be utilized in the design of laterally loaded structures can be provided upon completion of the supplementary investigation.

4.8 EVALUATION OF BASEMENT SCHEMES

A tabulation of factors affecting the basement excavations and foundation types for the different basement schemes is shown on Table 1. The factor for each scheme is rated on a relative degree of difficulty in accomplishing the construction.

Based on the totals indicated in the last column of Table 1, it is apparent that the level of difficulty, and therefore costs, increase as the number of basement level increase. It is also apparent that for one- and two-level basement schemes, construction cost uncertainties can be minimized because conventional construction techniques currently practiced in Hawaii can be utilized. For basement schemes in excess of two levels, a specialty foundation contractor will probably be needed to perform the slurry diaphragm wall construction.

4.9 INSTRUMENTATION

Because the excavation will be made close to the property line, it is recommended that the contractor install instrumentation to monitor the excavation. The purpose of the instrumentation program is to provide an early warning to permit modification of the excavation procedures in the event soil and shoring movements become excessive. The instrumentation should monitor soil and shoring movements, and groundwater levels. Soldier piles and lagging movement can be monitored by installing inclinometer casing directly outside the excavation. Groundwater levels could be monitored by installing either standpipe or pneumatic piezometers. The volume of water being pumped and the possibility of the removal of fines by the dewatering activities should also be monitored. Conventional surveying techniques can be used to monitor the horizontal and vertical movements of the soldier piles, tops of the inclinometer casings, and points established on the ground outside the excavation.

5.0 SUPPLEMENTARY INVESTIGATION

The recommendations presented in this report should be refined further with additional input from the design team and, possibly from the general contractor. A supplementary investigation should be conducted after the demolition of the existing building, when the site is accessible to the drilling equipment. Additional subsurface information is needed to further define the subsurface conditions at this site.

Subsequent to the demolition of existing building and if more than one basement level is desired, it is recommended that the general contractor perform a test excavation and a test dewatering to further evaluate and improve on the conceptual construction procedures presented in this report. A full-scale pump test should be conducted to evaluate the permeabilities of the underlying materials at the site to provide parameters for dewatering and slurry diaphragm wall design.

6.0 LIMITATIONS

Dames & Moore have prepared this preliminary report for Bancorp Hawaii, Inc., and its architect, designers, and engineers in accordance with generally accepted soils and foundation engineering practices. No other warranty, expressed or implied, is made as to the professional advice included in this report. This report does not reflect variations which may occur in subsurface conditions between borings. The nature and extent of variations in the subsurface conditions and actual as-built conditions may not become evident until construction. The recommendations provided in this report are contingent upon the completion of the second phase of the foundation investigation following building demolition. This preliminary report does not contain sufficient information for the design and construction of the proposed structure nor does it contain sufficient information for other parties or other uses.

Based on the acceptance of our proposal dated October 12, 1990, Bancorp Hawaii, Inc. had also acknowledged and agreed:

1. That the engineering technology of dewatering involves the prediction of geological and hydrological characteristics over large areas within and outside the project site where the actual geological and hydrological conditions are unknown;

2. That opinions and/or recommendations concerning dewatering will necessarily be based on assumption and engineering data available which cannot be confirmed because of economic, legal and practical prohibitions;

3. That any opinions and/or recommendations concerning dewatering, while based on the engineering data and techniques available within the above parameters, may vary significantly from the actual conditions incurred;

4. That because of the foregoing factors, it will be difficult, if not impossible, to determine that exact cause or causes of any possible damages to structures and/or facilities or bodily injuries arising out of the proposed dewatering;

5. That as a result of the foregoing, Dames and Moore will not make any recommendations or opinions concerning dewatering without a clear and unequivocal indemnification from Bancorp Hawaii, Inc.

In consideration of Dames & Moore's submission of this preliminary report, and except for any damage to property or bodily injury caused by or resulting from the sole negligence of willful misconduct of Dames & Moore, Bancorp Hawaii, Inc. hereby agrees to indemnify, defend and hold Dames & Moore, its officers and employees harmless, to the fullest extent permissible by law, against any and all liability for loss or damages (including but not limited to, costs of defense and all attorneys' fees incurred by counsel of Dames & Moore's choice) with respect to any claimed or actual damages to any structures or facilities, or any bodily injury, arising out of the proposed dewatering.

- oOo -

The following Plates, Table and Appendix are attached and complete this preliminary foundation investigation report.

Plate 1	-	Map of Area
Plate 2	-	Plot Plan
Plate 3	-	Generalized Subsurface Cross-Section A-A'
Plate 4	-	Lateral Earth Pressures for Basement Wall Design
Table 1	-	Factors Influencing Basement Excavation and Foundation Types
Appendix A	-	Field Exploration and Laboratory Testing

Yours very truly,

DAMES & MOORE
A Professional Limited Partnership

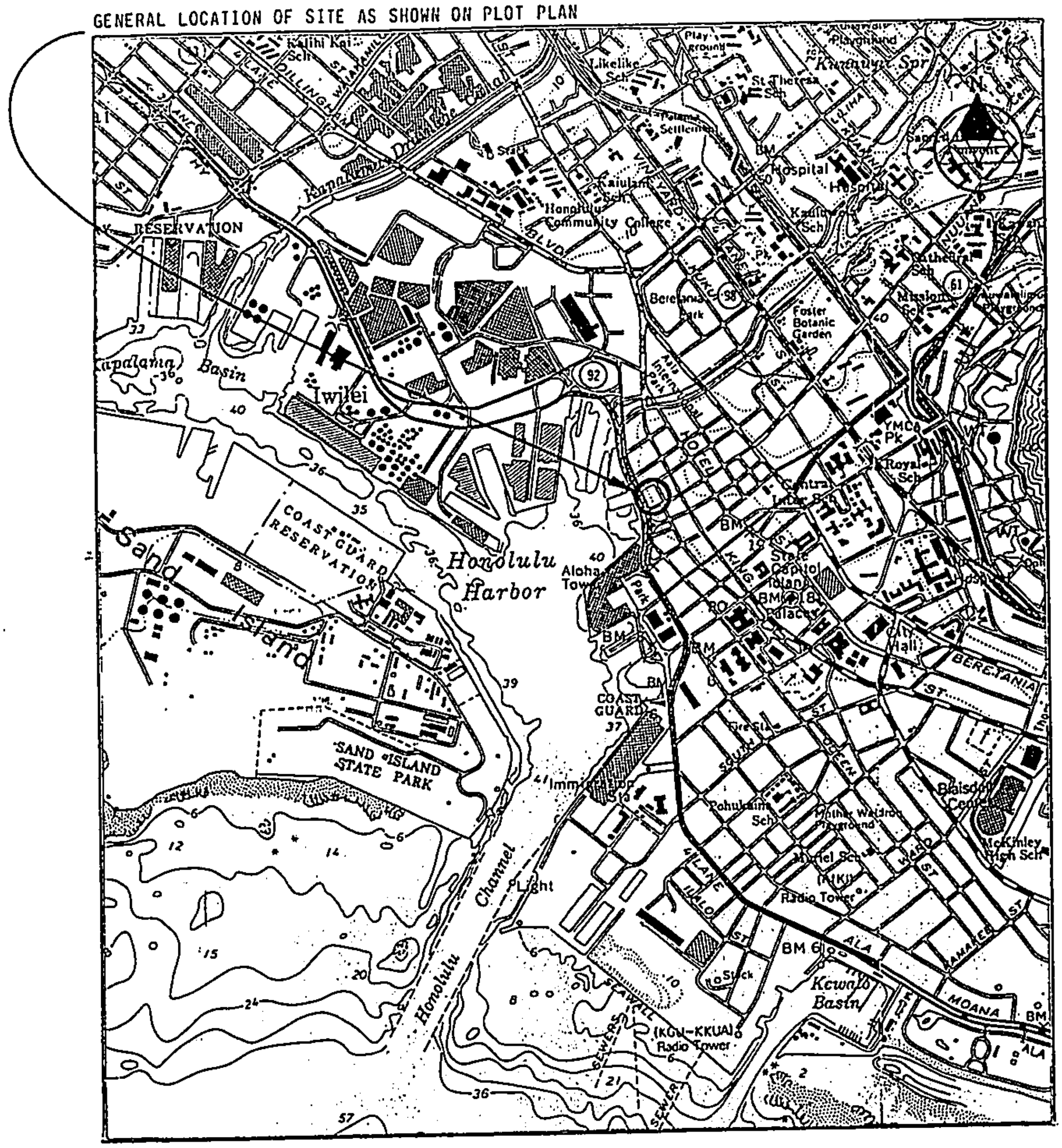
S.K. Djou, P.E.
Partner (Ltd.)

SIH-KONG DJOU
REGISTERED PROFESSIONAL ENGINEER
No. 3587-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

SKD/KKF/DWD/ln(002B.an:21581-001-011)

GENERAL LOCATION OF SITE AS SHOWN ON PLOT PLAN



MAP OF AREA

SCALE 1:24000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

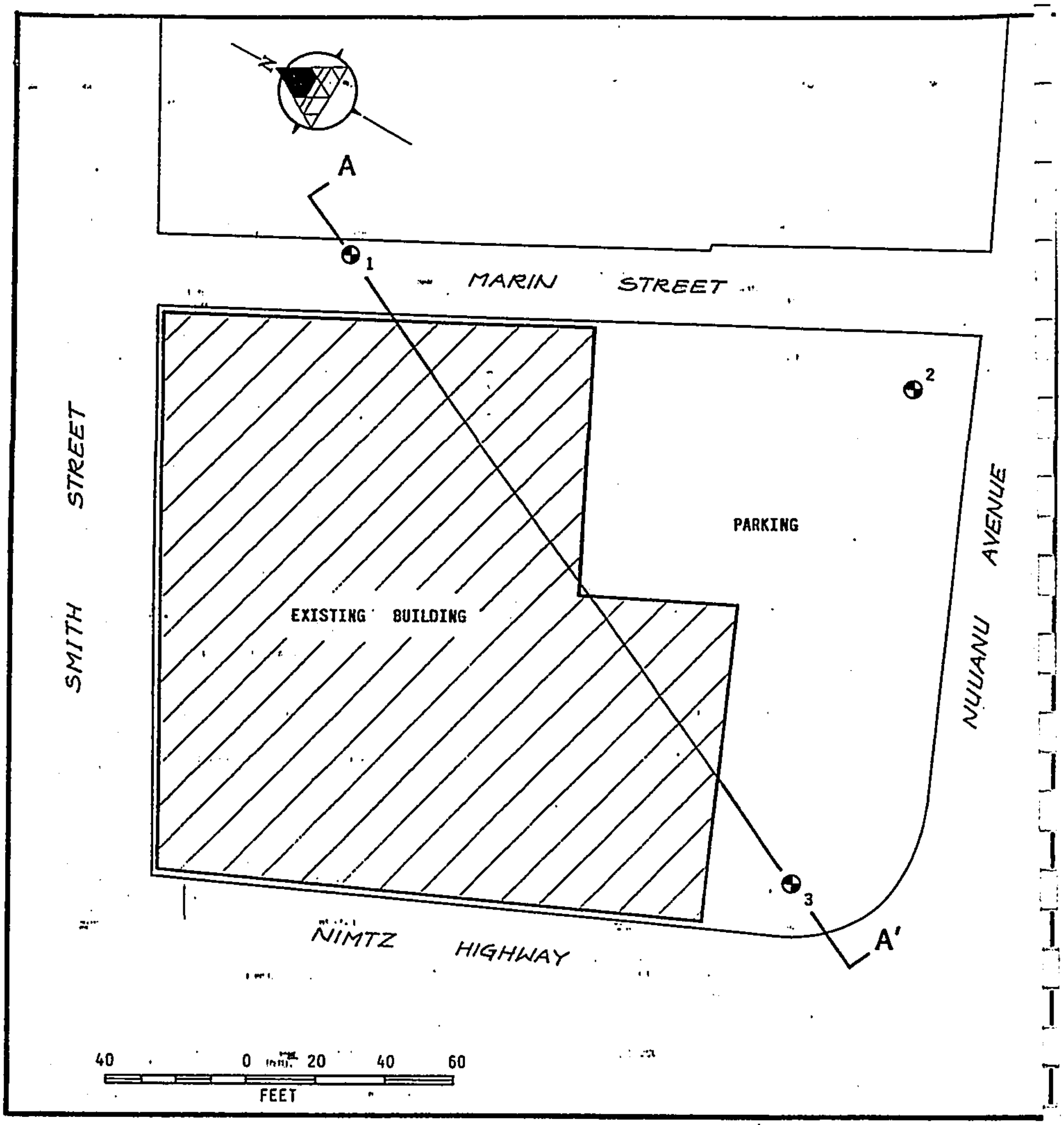
CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 20-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

Reference:
U.S.G.S. Topographic Map
Honolulu, Oahu, Hawaii (1983)

DAMES & MOORE

PLATE 1

CHECKED BY
DATE 1/18/90
FILE 21581-001-011



Legend:

⊕ Dames & Moore Boring Location

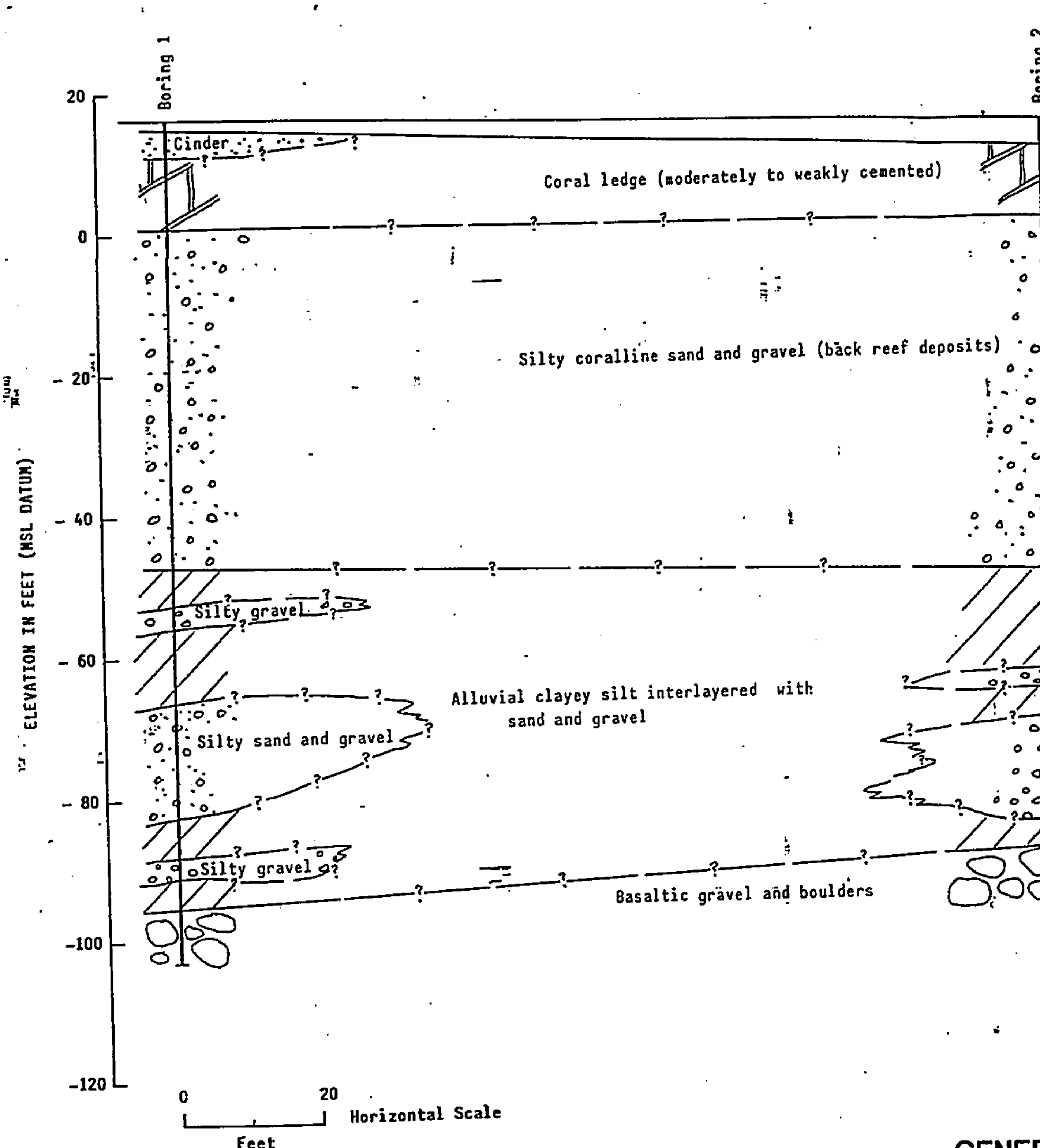
PLOT PLAN

Reference:
Tax Map Key: Oahu 1-7-02:2
Printed Sept. 8, 1989

Dames & Moore

PLATE 2

A



NOTE: The conditions illustrated between borings are based on geological interpretations.
While these are believed to be generally correct, the conditions may vary locally from those indicated.

GENER

REVISIONS
BY ____ DATE ____ TO EO ____
BY ____ DATE ____ TO EO ____

21581-001-011

BY ____ DATE 5/2/01
CHECKED BY ____
COPY TO EO ____

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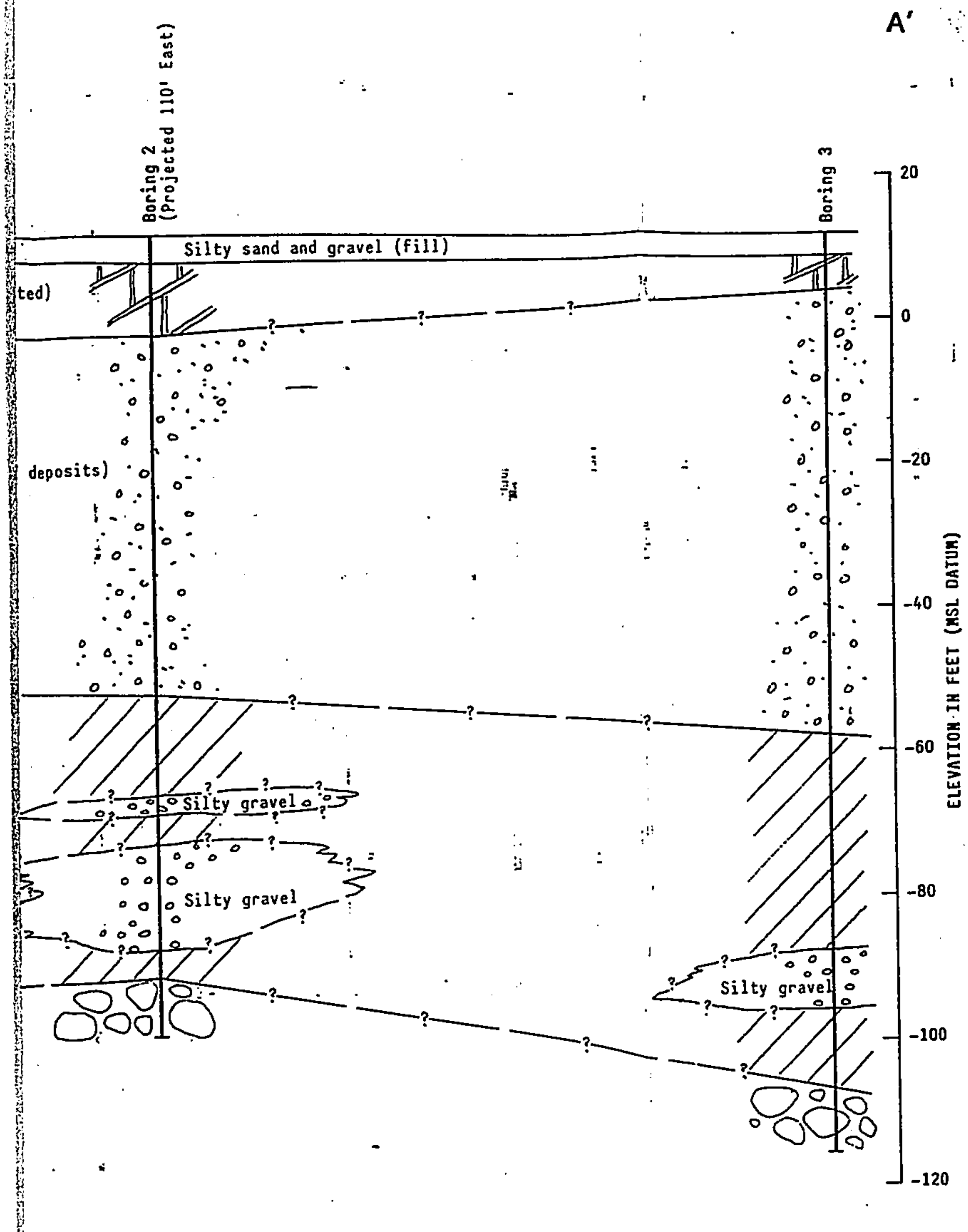
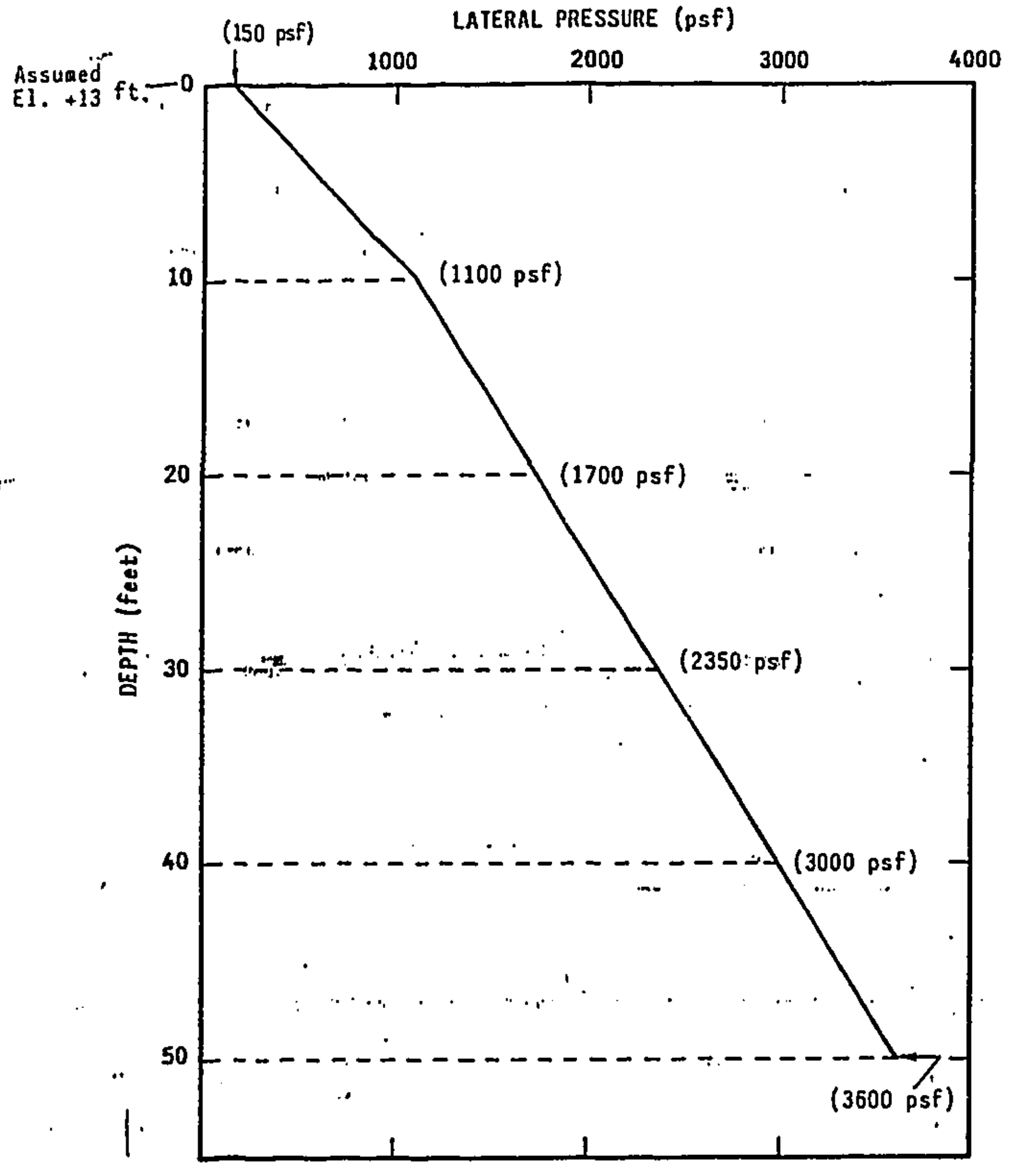


GENERALIZED SUBSURFACE CROSS-SECTION A-A'

Dames & Moore



Notes:
1. Assumed restrained, non-yielding basement walls.
2. Hydrostatic water pressure and traffic surcharge have been included in the above diagram.
3. Ground surface assumed to be at elevation +13 feet, MSL. (Mean Sea Level).
4. High water level assumed to be at elevation +3 feet, MSL.

LATERAL EARTH PRESSURE FOR BASEMENT WALL DESIGN

TABLE 1

FACTORS INFLUENCING BASEMENT EXCAVATION AND FOUNDATION TYPES

Basement Scheme	Excavation	Temporary Excavation Support	Dewatering	Deep Foundation (Piles)	Mat Foundations	Water-proofing	Totals
OneLevel Basement	2	1	1	2	0	1	7
TwoLevel Basement	3	2	2	2	0	2	11
Three Level Basement	4	4	4	0	3	3	18
Four Level Basement	5	4	5	0	3	4	21
Five Level Basement	5	5	5	0	4	5	24

Key: Relative Degree of Difficulty in Performing the Construction

0 - Not Required
1 - Easy) Within Local Construction
2 - Moderately Difficult) Contractors Capabilities
3 - Difficult
4 - Very Difficult) May Need
5 - Extremely Difficult) Specialty Subcontractors

(0002B:21581-001-011)

APPENDIX A

FIELD EXPLORATION AND LABORATORY TESTING

FIELD EXPLORATION

Subsurface conditions at the site were explored by advancing three (3) borings to depths of 111.5 to 126.5 feet, on and near the project site. This field work was performed during the period of November 5, through 14, 1990. Prior to drilling, Dames & Moore obtained permits from various government agencies in order to work on Marin Street. The various utility companies were contacted to "tone" for underground utilities.

The drilling was performed using a truck-mounted rotary drill rig. The field investigation was performed under the technical supervision of an engineering geologist, who logged the soils encountered and obtained relatively undisturbed and disturbed soil samples, and rock cores for further evaluation and laboratory testing.

Soil samples were obtained using a Dames & Moore Type "U" sampler driven with a 140-pound hammer falling 30 inches. The sampler was driven for a total of 18 inches, and the blow counts for each 6 inches of penetration was recorded. Generally, blow counts for the last 12 inches of penetration are noted on the Logs of Borings, Plates A-1.1 through A-1.3.2. A description of the sampler is presented on Plate A-2.

Graphical representations of the soils encountered are presented on the boring logs. Soils were visually classified in accordance with the Unified Soil Classification System as described on Plate A-3. Coralline rock was classified according to the Calcareous Rock Classification System for Hawaii as described on Plate A-4.

A PQ-size core barrel was used to obtain samples of coral and basaltic boulders. The rock quality indicator (RQI) for PQ cores, along with the percentage of core recovery, are indicated on the boring logs. RQI is defined as the total length of recovered core pieces 4-inches or longer expressed as a percentage of the length of the total core run.

Seven (7) in-situ permeability tests were performed in the test borings to obtain information for preliminary dewatering design. The permeability tests conducted include falling head test in the clayey silt stratum and pumping tests in the coralline sand and gravel stratum. Results of the tests are listed on the next page.

Boring No	Test Interval (ft)	Soil Type	Permeability (cm/sec)
1	20 to 25	Silty sandy coralline gravel	1.2×10^{-1}
1	45 to 50	Silty sandy coralline gravel	8.6×10^{-2}
1	75 to 76.7	Clayey silt	4.3×10^{-3}
2	20 to 25	Silty sandy coralline gravel	1.7×10^{-1}
2	40 to 45	Silty sand	2.3×10^{-2}
3	15.5 to 18.5	Silty sand	5.4×10^{-2}
3	25.6 to 28.5	Silty sand	5.2×10^{-2}

At the completion of drilling, Boring 2 was "developed" into an observation well for future water level monitoring.

LABORATORY TESTING

General - Selected soil samples were tested to evaluate pertinent classification and engineering properties. The tests included moisture content and dry density determinations, consolidation testing, triaxial compression tests, and gradation determinations. The tests and their results are described in the following paragraphs.

Moisture Content and Dry Density - Relatively undisturbed samples were tested to determine their in-situ moisture contents and dry densities. Results of the tests are presented on the Logs of Borings at the appropriate sample depths.

Gradation Analysis - Nine (9) gradation analyses were performed by sieve method in accordance with ASTM D422-84. The results of these tests are presented on Plates A-5.1 through A-5.4.

Consolidation Tests - Three (3) consolidation tests were performed on samples of materials from Boring 1 at 75.5 feet and 110.5 feet, and Boring 2 at 75.5 feet, below the ground surface. The graphs depicting the test data are shown on Plates A-6.1 through A-6.3, Consolidation Test Data. The method of performing the tests is described on Exhibit A-1, Method of Performing Consolidation Test.

Triaxial Compression Tests - Triaxial Unconsolidated - Undrained Compression tests were performed on one soil sample at field moisture conditions. The method of performing this test is described on Exhibit A-2, Method of Performing Unconfined Compression and Triaxial Compression Tests. The results of the test are listed below.

Boring No.	Depth (ft)	Confining Pressure (psf)	Peak Shear Strength (psf)
2	70.5	0	1320

-oOo-

The following Exhibits and Plates are attached and complete this Appendix:

Plate A-1.1 through A-1.3.2	-	Logs of Borings, Borings 1 through 3
Plate A-2	-	Dames & Moore Type "U" Sampler
Plate A-3	-	Unified Soil Classification System
Plate A-4	-	Calcareous Rock Classification System for Hawaii
Plate A-5.1 through A-5.4	-	Gradation Test Data
Plate A-6.1 through A-6.3	-	Consolidation Test Data
Exhibit A-1	-	Method of Performing Consolidation Tests
Exhibit A-2	-	Method of Performing Unconfined Compression Tests

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Boring 1

Surface Elevation 16 ± Feet
MSL Datum

LABORATORY TEST DATA: Tests Reported Elsewhere	LABORATORY TEST DATA: Moisture Content in %	LABORATORY TEST DATA: Dry Density in PCF	Blows/Ft. on Sampler	Core and % Recovery	Samples and/or Cores	Depth in Feet	Graph Symbol	Letter Symbol	Description
									2-inch asphaltic concrete
	6	88	24					GM	Grayish brown silty sandy basaltic gravel, medium dense, moist (fill)
								SM	Dark brown silty sand, medium dense, moist (fill)
								SP	Black cinder sand, loose, moist
			40/2"					ML	Brown clayey silt, very stiff, with some sub-rounded basaltic gravel, moist
			RQI 72%	PQ 100%					Tannish white recemented coral reef, hard, moderately fractured (Type II Coral)
			RQI 50%	PQ 96%		10			
									grades to Type I Coral
			RQI 6%	PQ 20%					(Water level at 1040 hours on 11-12-90)
								GW/ GM	Tannish brown sandy coralline gravel, dense, saturated
	15	113	118			20			
			38						
			58			30			grades medium dense and silty
			9						grades loose
	22	105	24			40			grades light brown
			7						
			15			50			
			13					SM	Light brown silty sand, medium dense, saturated
	53	69	17			60			grades gravelly
								ML	Tannish brown clayey silt, medium stiff, saturated

53	69	17		■	60		grades gravelly
		6		◪		ML	Tannish brown clayey silt, medium stiff, saturated
		19		⊠	70	GM	Light gray silty sandy coralline gravel, loose, saturated
						ML	Brown clayey silt, very stiff, with fine rounded basaltic gravel, saturated
59	68	27		■			
		29		⊠	80		
						GM	Light brown silty sandy coralline gravel, loose, saturated
		22		⊠		SM	Light brown silty sand, loose, with some gravel, saturated
		10		◪	90		
		11		⊠			
						ML	Brown clayey silt, very stiff, saturated
		23		◪	100		
		38/1"		⊠		GM	Grayish brown coralline gravel, very dense, with some brown clayey silt, saturated
						ML	Brown sandy silt, hard, saturated
52	92	101		■	110		
		RQI 0	PQ 67%	I			Dark gray basalt, medium hard, highly fractured, with some brown clayey silt, frequent boulders
		RQI 0	PQ 80%	I			
		82/6"		⊠		GM	Dark gray basaltic gravel, very dense, saturated

Boring completed at 118.0 feet on 11-14-90

NOTES:

- ■ – depth at which undisturbed sample was taken
- ⊠ – depth at which disturbed sample was taken
- □ – depth at which sample was lost during extraction
- I – depth and length of core run

Driving Energy – 140 -lb. weight dropping 30 inches

◪ – standard penetration test sample (split-spoon sampler)

LOG OF BORINGS

Dames & Moore

Boring 2

Surface Elevation 13 ± Feet
MSL Datum

LABORATORY TEST DATA: Tests Reported Elsewhere	LABORATORY TEST DATA: Moisture Content in %	LABORATORY TEST DATA: Dry Density in PCF	Blows/Ft. on Sampler	Core and % Recovery	Depth in Feet	Letter Symbol	Description
							2-inch asphaltic concrete
			20			GM	Gray silty sandy basaltic gravel, medium dense, moist
						SM	Brown and tan silty sand, loose, moist (fill)
			RQI 15%	PQ 76%			Tannish brown coral, hard, moderately to highly fractured (Type II Coral)
							grades highly fractured
			RQI 44%	PQ 90%	10		grades moderately fractured
			70/4"				(Water level at 1400 hours on 11-07-90)
			RQI 0	PQ 20%		GM	Tan silty sandy coralline gravel, very dense, saturated
			100/4"		20		
			RQI 0	PQ 30%			
			36				grades tannish white and dense
			34/2"		30		grades very dense
			32				grades dense
			37		40	SM	Tan silty sand, medium dense, with coralline gravel, saturated
			10				grades loose
	13	118	19		50		
						SM	Light brown silty sand, loose, with some gravel, saturated
			12				grades medium dense
			40		60		
	58	69	37			ML	Brown sandy silt, very stiff, saturated

		40			
58	69	37		ML	Brown sandy silt, very stiff, saturated
		46			
53	74	51			
				GM	Light grayish brown silty sandy coralline gravel, loose, with some clayey silt, saturated
		20		ML	Light grayish brown clayey silt, stiff, with some coralline gravel, saturated
		30		GM	Light grayish brown silty coralline gravel, medium dense, saturated
		9		ML	Brown clayey silt, medium stiff, saturated
				GM	Brown silty sandy coralline gravel, loose, with some clayey silt, saturated
47	80	24			grades sandy
		21		ML	Grayish brwon clayey silt, very stiff, saturated
				GM	Black basaltic gravel, very dense, with brown clayey silt, saturated
		54			
					grades with cobbles and boulders, highly fractured
		RQI 0	PQ 27%		

Boring completed at 111.5 feet on 11-09-90

LOG OF BORINGS

NOTES:

- ■ - depth at which undisturbed sample was taken
- ⊠ - depth at which disturbed sample was taken
- □ - depth at which sample was lost during extraction
- I - depth and length of core run

Driving Energy - 140 -lb. weight dropping 30 inches

▨ - standard penetration test sample (split-spoon sampler)

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PLATE A-1.2

Boring 3 (Page 1 of 2)

Surface Elevation 12 ± Feet
MSL Datum

LABORATORY TEST DATA									
Tests Reported Elsewhere	Moisture Content in %	Dry Density in PCF	Blows/Ft. on Sampler	Core and % Recovery	Samples and/or Cores	Depth in Feet	Graph Symbol	Letter Symbol	Description
									2-inch asphaltic concrete
			50/3"		⊠			SP	Tan coralline sand, dense, moist
			50/6"		⊠			GM	Tannish brown silty sandy coralline gravel, very dense, moist (fill)
			RQI 0	PQ 40%	⊠				Tannish brown coral, highly fractured, moderately hard (Type II Coral)
			10		⊠	10		GM	Tannish brown silty sandy coralline gravel, medium dense, moist
									(Water level at 1020 hours on 11-05-90)
			8		⊠			SM/GM	Tannish brown silty sand, medium dense, with coralline gravel, saturated
			61		⊠	20			
			43		⊠				grades tannish white and dense
			70/6"		⊠	30			grades light brown
			RQI 0	PQ 10%					
			26		⊠				grades tan and medium dense
			46		⊠	40			grades dense
			43		⊠				
	40	82	17		■	50			grades medium dense, with trace fine gravel and shell fragments
			16		■				
					■	60			
			30		⊠				grades light brown

Blows	Sample	Depth (ft)	Soil group	Description
	■	60		grades light brown
30	⊠			
13/6"	⊠	70	ML	Light brown sandy clayey silt, stiff, with shell fragments, saturated
10/6"	■			
		80		continued . . .

LOG OF BORINGS

NOTES:

- ■ - depth at which undisturbed sample was taken
- ⊠ - depth at which disturbed sample was taken
- ▢ - depth at which sample was lost during extraction
- I - depth and length of core run

Driving Energy - 140 -lb. weight dropping 30 Inches

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Boring 3 (PAGE 2 OF 2)

LABORATORY TEST DATA: Tests Reported Elsewhere	LABORATORY TEST DATA: Moisture Content in %	LABORATORY TEST DATA: Dry Density in PCF	Blows/Ft. on Sampler	Core and % Recovery	Samples and/or Cores	Depth in Feet	Graph Symbol	Letter Symbol	Description
			12/6"		⊠				
			16/6"		⊠				grades very stiff
	66	62	16/6"		■	90		ML	Brown and gray sandy silt, very stiff, saturated
			12/6"		■			ML	Brown sandy silt, very stiff, saturated
			70/4" RQI 10%	PQ 40%	⊠	100		GM	Tannish brown silty sandy coralline gravel, very dense, with cemented sand, saturated
			26/6"		⊠				grades light brown and medium dense
			40/6"		■	110		ML	Brown sandy silt, very stiff, saturated
			35/6"		■			SP	Brown sand, medium dense, with trace silt, saturated
			70/3" RQI 0	PQ 26%	□	120		GM	Dark gray silty sandy basaltic gravel, very dense, saturated
			125/9"		⊠				grades with brown silty sand

Boring completed at 126.5 feet on 11-07-90

LOG OF BORINGS

NOTES:

- ■ – depth at which undisturbed sample was taken
- ⊠ – depth at which disturbed sample was taken
- □ – depth at which sample was lost during extraction
- I – depth and length of core run

Driving Energy – 140 -lb. weight dropping 30 inches

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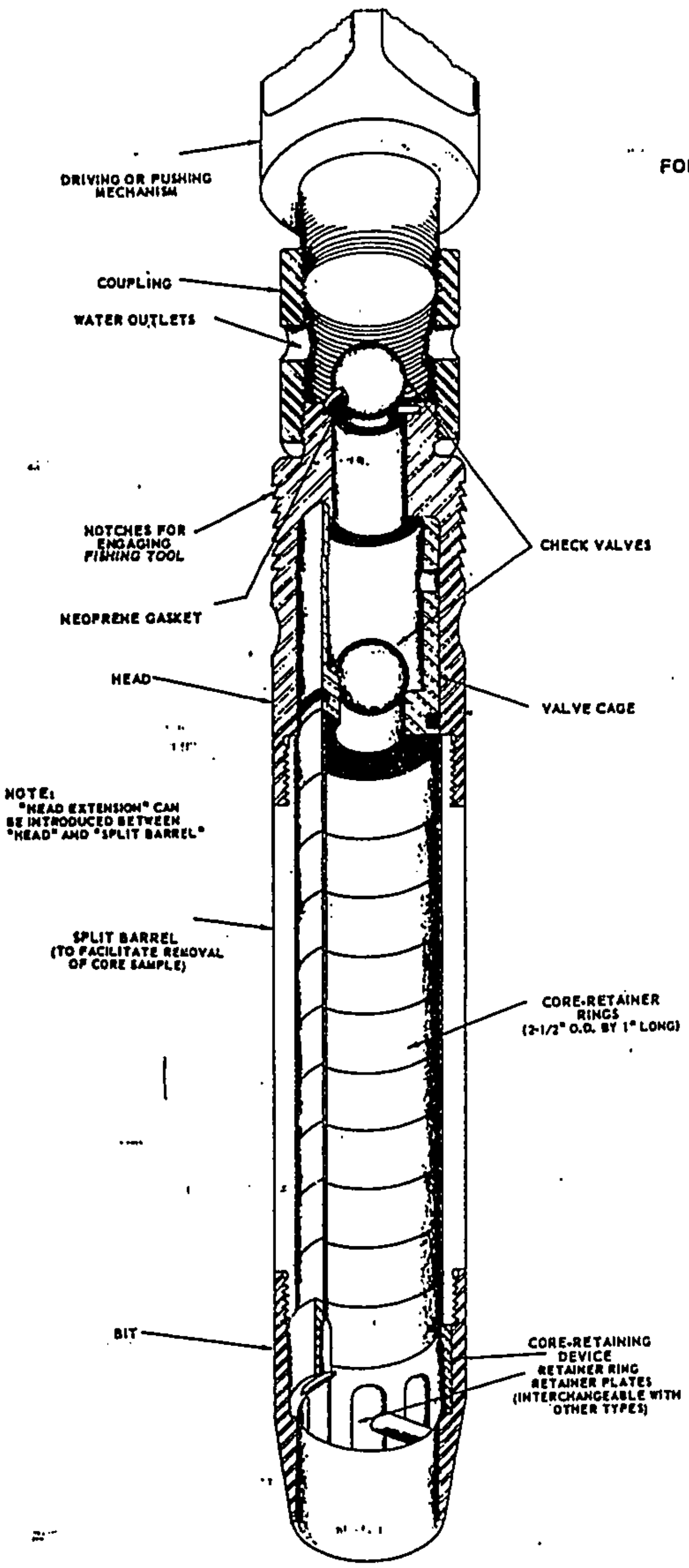
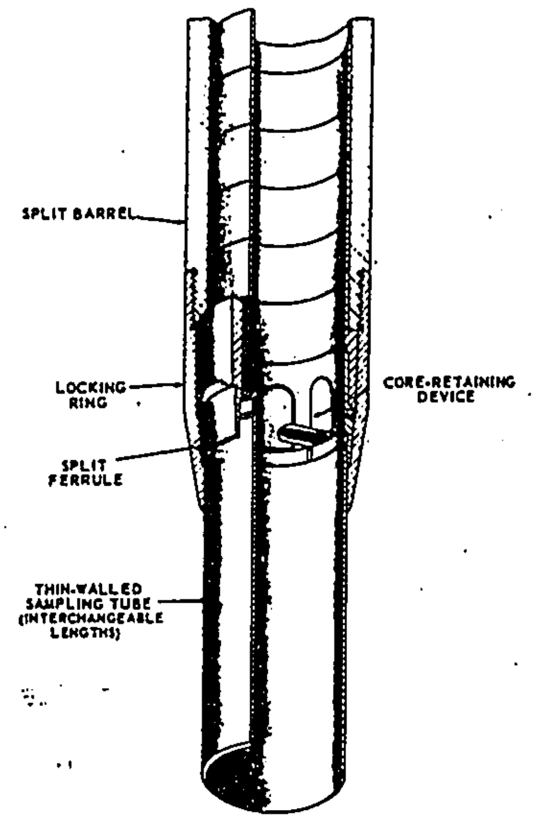
PLATE A-1.3.2

SOIL SAMPLER TYPE U

FOR SOILS DIFFICULT TO RETAIN IN SAMPLER



ALTERNATE ATTACHMENTS



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Dames & Moore
PLATE A-2

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED SAND MIXTUR FINES
				GP	POORLY-GRAD GRAVEL-SAND OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVE SILT MIXTURE
				GC	CLAYEY GRAV CLAY MIXTUR
	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL-GRADEI SANDS, LITTL
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE				SP	POORLY-GRA LY SANDS, LI
	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, MIXTURES
				SC	CLAYEY SAND MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC S SANDS, ROCK CLAYEY FINE SILTS WITH S
				CL	INORGANIC C MEDIUM PLAS CLAYS, SAND CLAYS, LEAN
				OL	ORGANIC SIL SILTY CLAYS
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC S DIATOMACEO SILTY SOILS
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE				CH	INORGANIC C PLASTICITY,
				OH	ORGANIC CLA HIGH PLASTI
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS HIGH ORGAN

NOTES:

1. DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE CLASSIFICATIONS.
2. WHEN SHOWN ON THE BORING LOGS, THE FOLLOWING TERMS ARE USED TO DESCRIBE THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE COMPACTNESS OF COHESIONLESS SOIL

COHESIVE SOILS

	(APPROXIMATE SHEARING STRENGTH IN KSF)
VERY SOFT	LESS THAN .25
SOFT	0.25 TO 0.5
MEDIUM STIFF	0.5 TO 1.0
STIFF	1.0 TO 2.0
VERY STIFF	2.0 TO 4.0
HARD	GREATER THAN 4.0

COHESIONLESS SOILS

VERY LOOSE
LOOSE
MEDIUM DENSE
DENSE
VERY DENSE

THESE ARE U BASED ON AN TION OF SOIL PENETRATION ANCE, AND SO DATA.

TION CHART

GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
	SM	SILTY SANDS, SAND-SILT MIXTURES
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES
	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

FOR LABORATORY CLASSIFICATION OF FINE-GRAINED SOILS

LASSIFICATIONS.
RMS ARE USED TO DESCRIBE THE
OMPACTNESS OF COHESIONLESS SOILS.

COHESIONLESS SOILS

RY LOOSE
OSE
EDIUM DENSE
NSE
RY DENSE

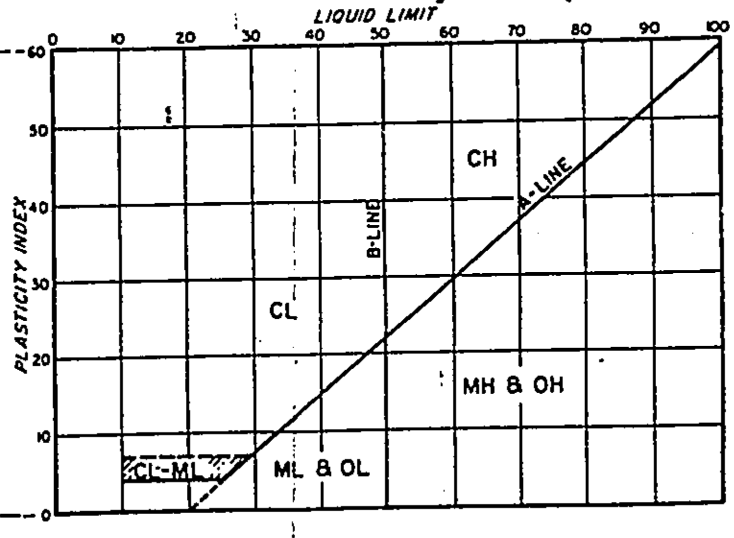
THESE ARE USUALLY BASED ON AN EXAMINATION OF SOIL SAMPLES, PENETRATION RESISTANCE, AND SOIL DENSITY DATA.

GRADATION CHART

MATERIAL SIZE		PARTICLE SIZE			
		LOWER LIMIT		UPPER LIMIT	
		MILLIMETERS	SIEVE SIZE●	MILLIMETERS	SIEVE SIZE●
SAND	FINE	.074	#200●	0.42	#40●
	MEDIUM	0.42	#40●	2.00	#10●
	COARSE	2.00	#10●	4.76	#4●
GRAVEL	FINE	4.76	#4●	19.1	3/4"▪
	COARSE	19.1	3/4"▪	76.2	3"▪
COBBLES		76.2	3"▪	304.8	12"▪
BOULDERS		304.8	12"▪	914.4	36"

● U.S. STANDARD ▪ CLEAR SQUARE OPENINGS

PLASTICITY CHART



SAMPLES

■ INDICATES UNDISTURBED SAMPLE
⊠ INDICATES DISTURBED SAMPLE
□ INDICATES SAMPLING ATTEMPT WITH NO RECOVERY
I INDICATES LENGTH OF CORING RUN

NOTE:
DEFINITIONS OF ANY ADDITIONAL DATA REGARDING SAMPLES ARE ENTERED ON THE FIRST LOG ON WHICH THE DATA APPEAR.

UNIFIED SOIL CLASSIFICATION SYSTEM

Dames & Moore

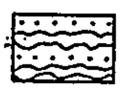
CALCAREOUS ROCK CLASSIFICATION SYSTEM FOR HAWAII

Basic Types of Calcareous Rock

TYPE I INSITU REEF ROCK

Composed largely of undisturbed *coralline skeletons. The skeletons are cemented together during accretion. The cementing agents are calcium compounds secreted by the marine organisms. The joined skeletons form a structural framework. Coralline and other calcareous debris commonly fill the framework interstices.

TYPE II SECONDARY ROCK



Composed essentially of cemented fragments of coralline skeletons and/or calcareous shells. Cementation is believed to occur primarily after accretion is completed and the marine deposit begins to emerge above sea level. The common types of secondary rock are listed below.

1. Conglomerate - Cemented, non-uniform sand- and gravel-size particles of cementd coralline skeletons and/or calcareous shells. The skeletons and shells are originally deposited in near-shore waters. The cementing agent is calcium carbonate precipitated primarily from percolating ground water.

2. Shell Rock - Cemented shells and shell fragments that have accumulated in protected shallow sea water. The shells are often cemented in a clay- and silt-size matrix. Cementation develops from calcium carbonate deposited by ground water.

3. Dune Rock - Cemented dune sand. The cementing agent is generally calcium carbonate precipitated from percolating ground water. Dune rock generally has a relatively low density because the constituent sand grains are loosely packed and often poorly cemented.

TYPE III CHALK

Poorly cemented mass of calcareous clay- and silt-size particles, believed to be precipitated from shallow sea water and associated with near-shore environments.

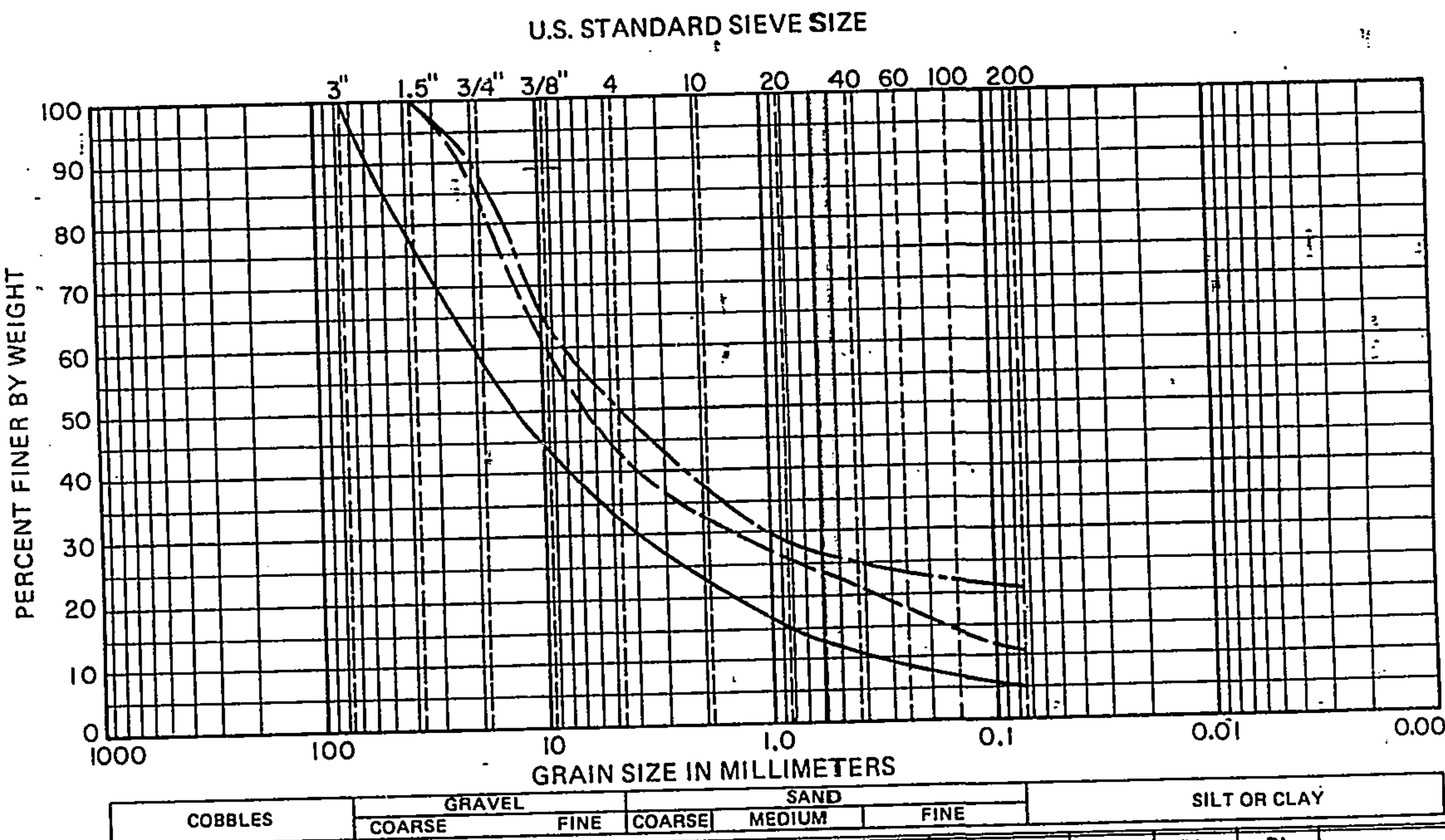
* The term coralline is used to indicate coral and /or other calcium compound secreting organisms.

o O o

(CORAL.DOC)06MAR1990

BY ________ DATE ________
CHECKED BY ________ DATE ________

BY ________ DATE ________



BORING	DEPTH		CLASSIFICATION	NAT. W C	LL	PL	PI	
1	20.5 ft.	GW	Tannish brown sandy coralline gravel					————
1	40.5 ft.	GW/GM	Tannish brown silty sandy coralline gravel					— — —
1	50.5	GM	Tannish brown silty sandy coralline gravel					—— - ——

GRADATION CURVE

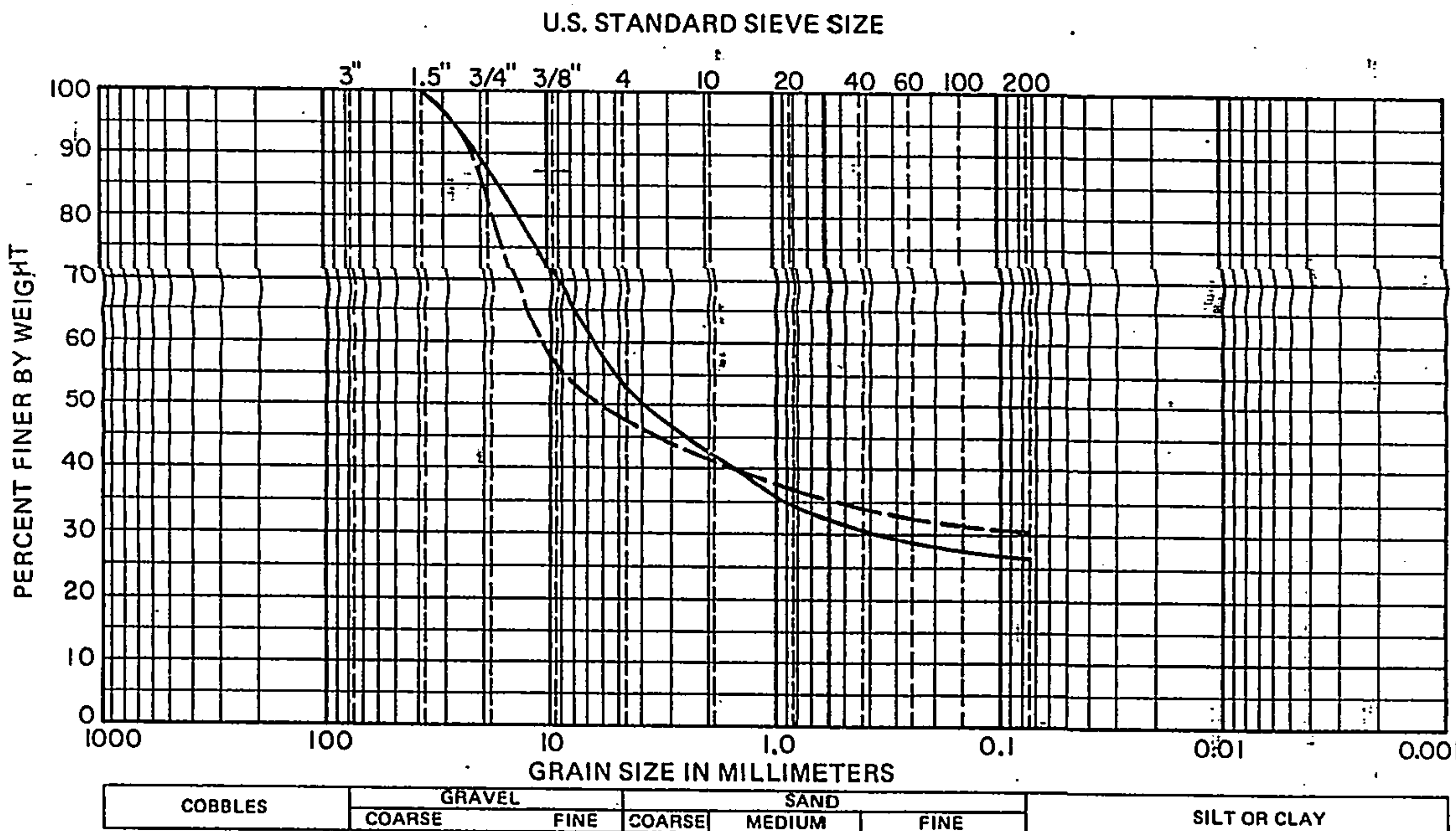
Dames & Moore

PLATE A-5.1

[redacted]

BY ______ DATE ______ BY ______ DATE ______

CHECKED BY ______ DATE ______ BY ______ DATE ______



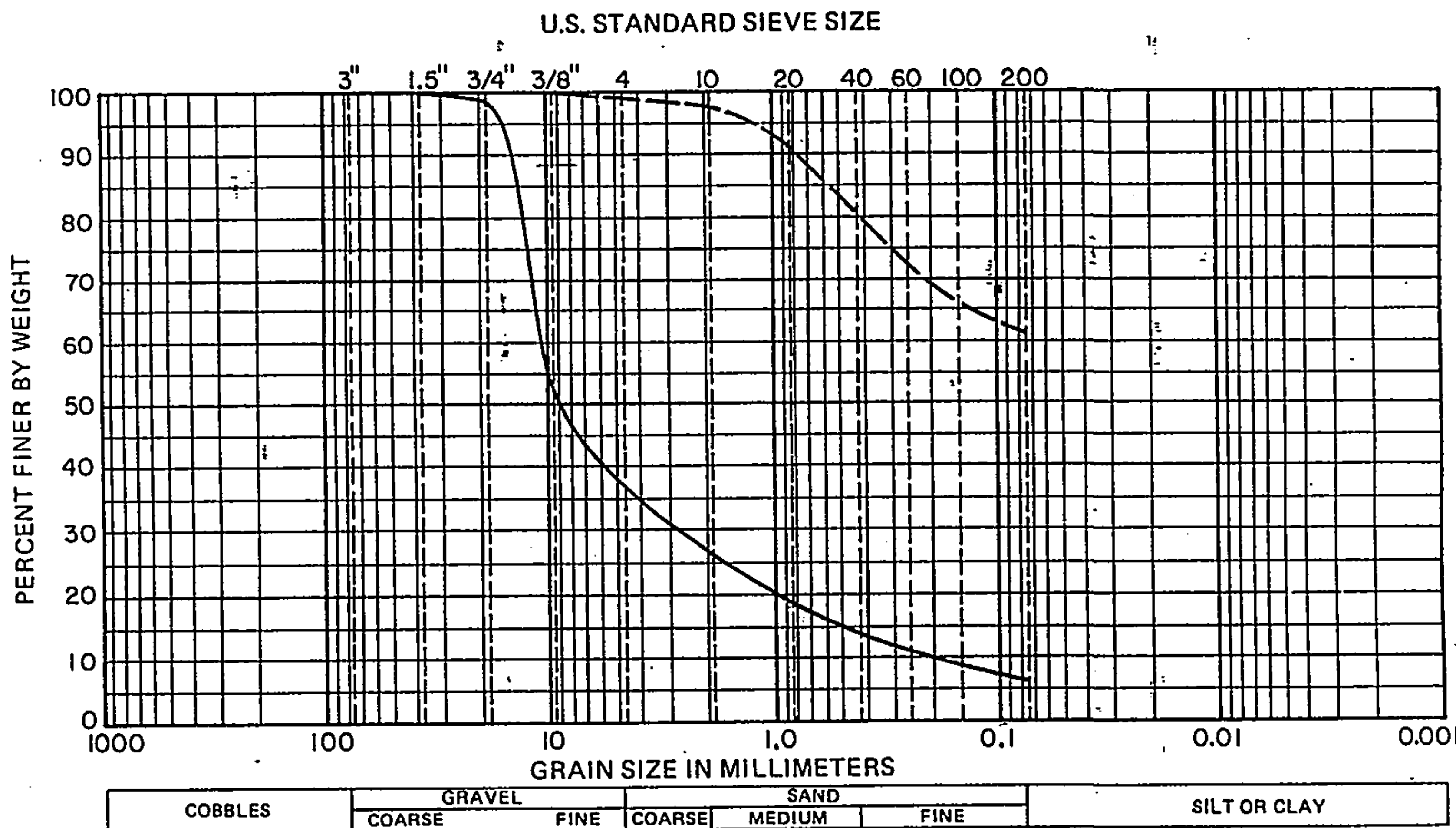
BORING	DEPTH		CLASSIFICATION	NAT. W C	LL	PL	PI	
2	26.2 ft.	GM	Tannish-white silty sandy coralline gravel					———
2	40.5 ft.	SM	Tan silty sand with coralline gravel					— — —

GRADATION CURVE

Dames & Moore

PLATE A-5.2

CHECKED BY______ DATE ______ BY______ DATE______



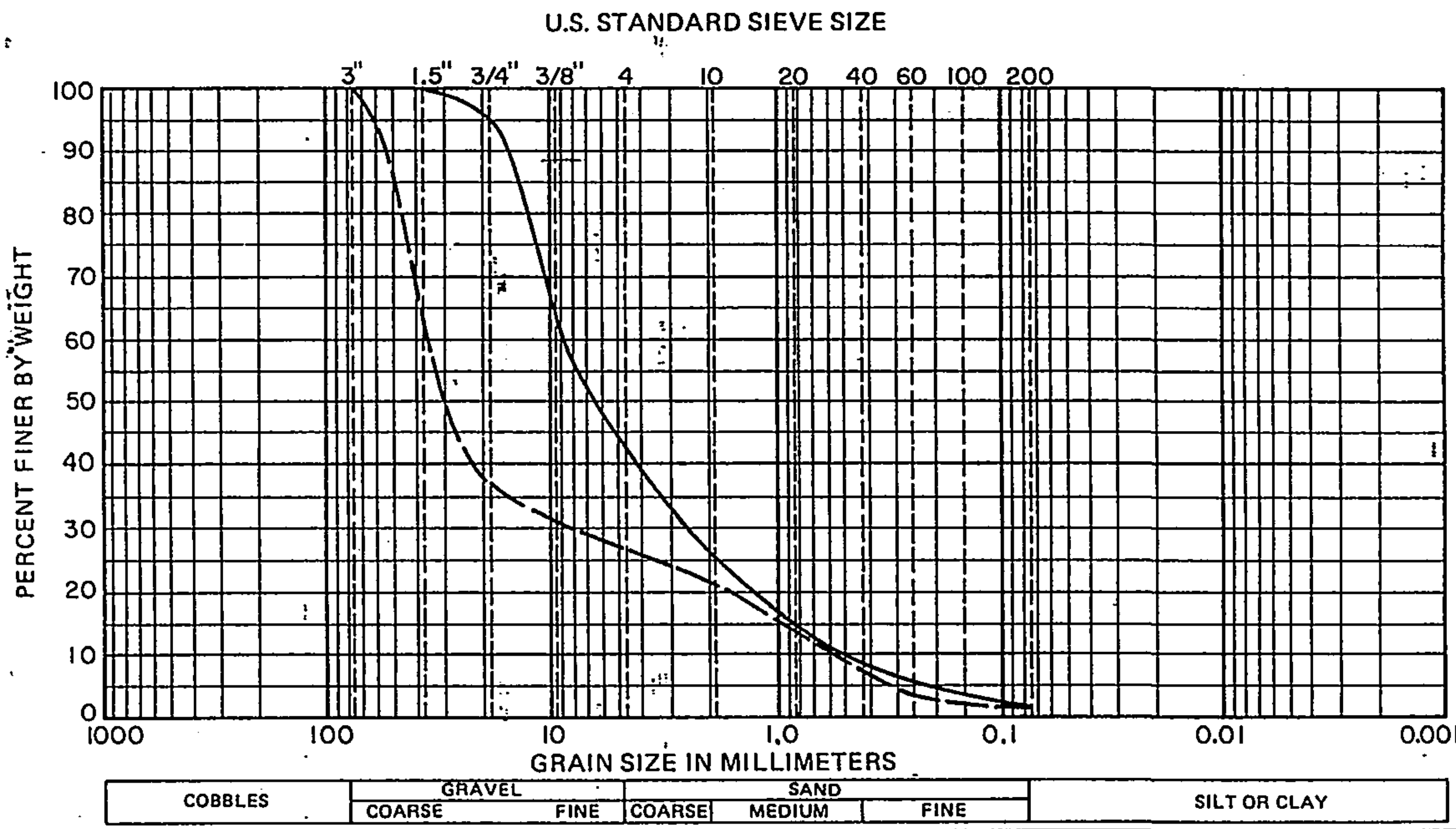
BORING	DEPTH	CLASSIFICATION		NAT. W C	LL	PL	PI	
2	50.5 ft:	SH	Light brown silty sand with gravel					————
2	65.5 ft.	ML	Brown sandy silt					— — —

GRADATION CURVE

Dames & Moore

PLATE A-5.3

BY ______ DATE ______ BY ______ DATE ______
CHECKED BY ______ DATE ______ BY ______ DATE ______

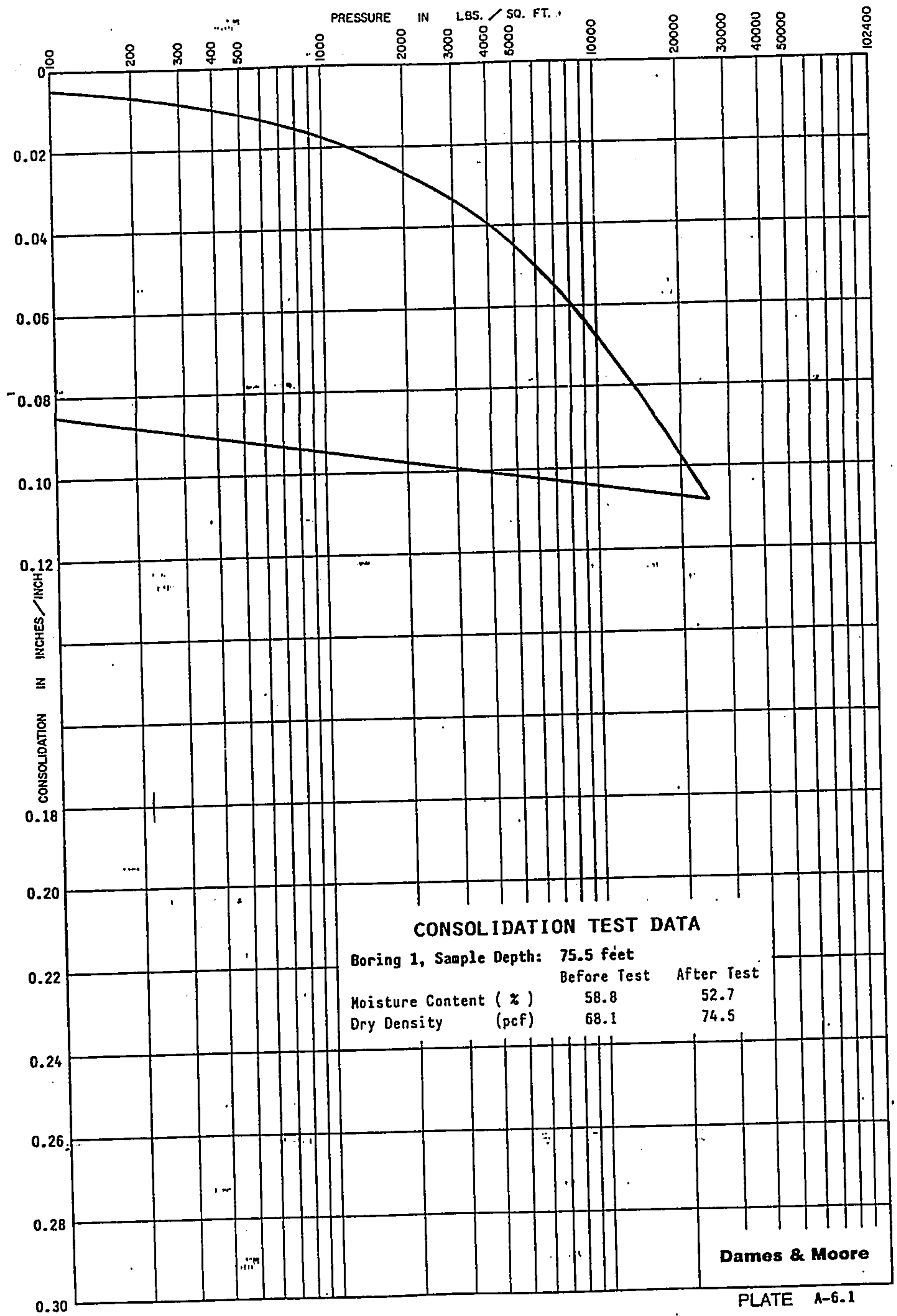


BORING	DEPTH		CLASSIFICATION	NAT. W C	LL	PL	PI	
3	15.5 ft.	SM	Tannish brown silty sand					———
3	25.5 ft.	SM	Tan silty sand					— — —

GRADATION CURVE

Dames & Moore

PLATE A-5.4



CONSOLIDATION TEST DATA

Boring 1, Sample Depth: 75.5 feet

	Before Test	After Test
Moisture Content (%)	58.8	52.7
Dry Density (pcf)	68.1	74.5

Dames & Moore

PLATE A-6.1

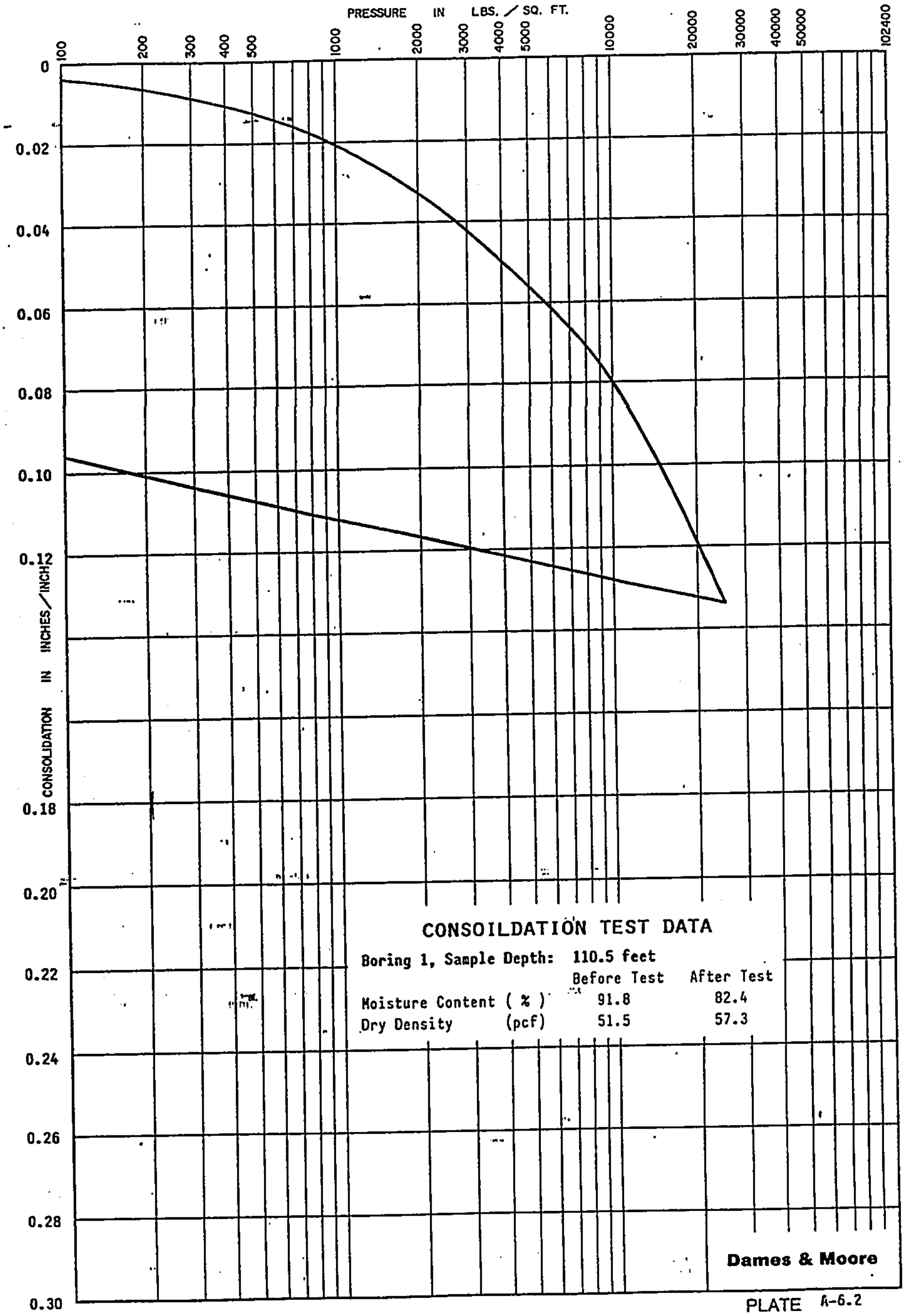
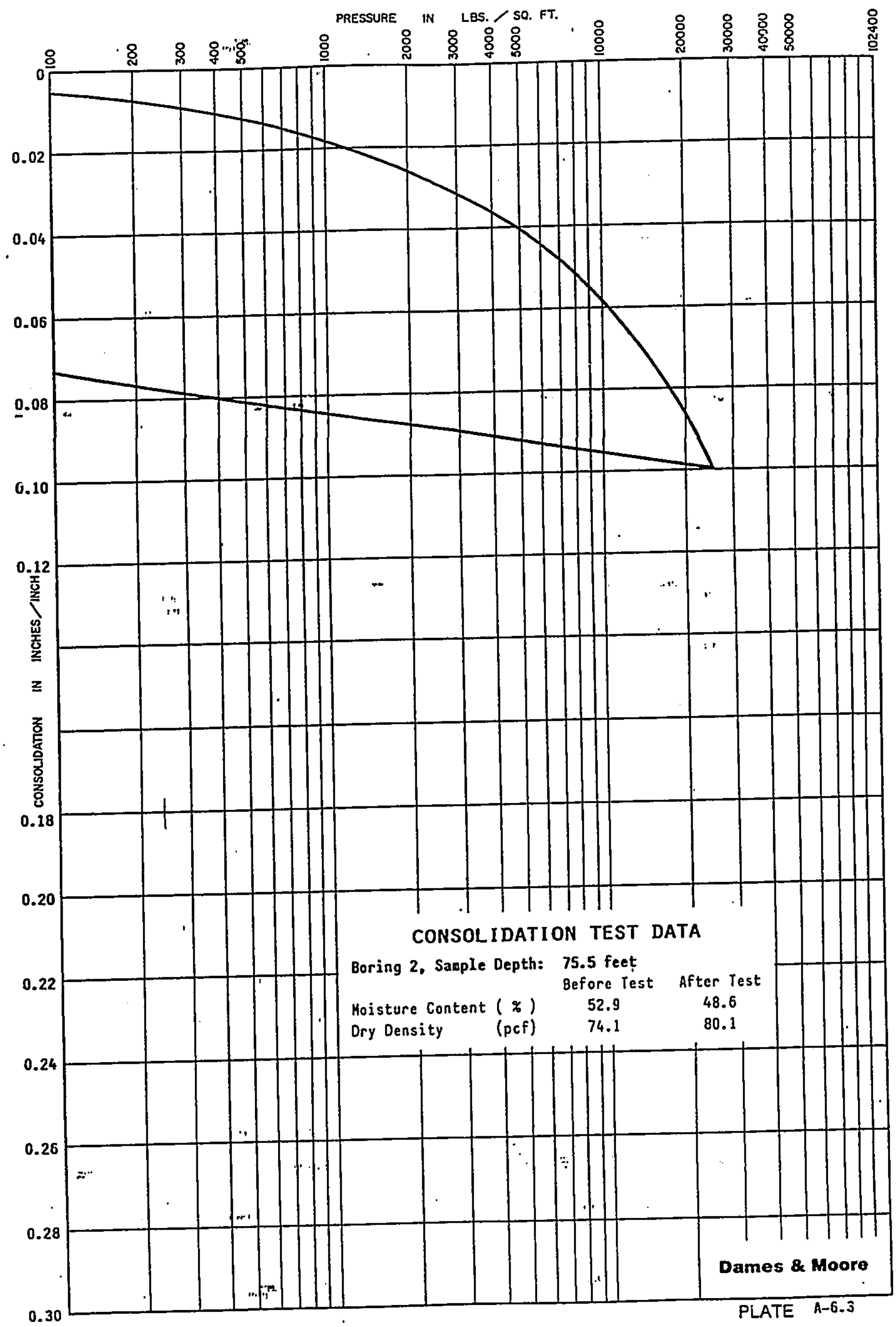

PRESSURE IN LBS. / SQ. FT.
100
200
300
400
500
1000
2000
3000
4000
5000
10000
20000
30000
40000
50000
102400
CONSOLIDATION IN INCHES / INCH
0
0.02
0.04
0.06
0.08
0.10
0.12
0.18
0.20
0.22
0.24
0.26
0.28
0.30
CONSOILDATION TEST DATA
Boring 1, Sample Depth: 110.5 feet
Before Test
After Test
Moisture Content (%) 91.8 82.4
Dry Density (pcf) 51.5 57.3
Dames & Moore

PLATE A-6.2


PRESSURE IN LBS. / SQ. FT.
100
200
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500
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2000
3000
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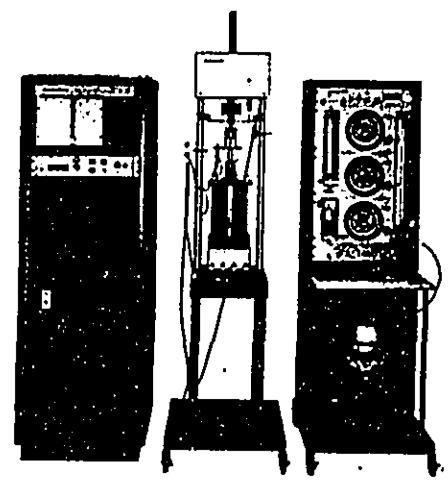
5000
10000
20000
30000
40000
50000
102400
CONSOLIDATION IN INCHES/INCH
0
0.02
0.04
0.06
0.08
0.10
0.12
0.18
0.20
0.22
0.24
0.26
0.28
0.30
CONSOLIDATION TEST DATA
Boring 2, Sample Depth: 75.5 feet
Before Test
After Test
Moisture Content (%) 52.9 48.6
Dry Density (pcf) 74.1 80.1
Dames & Moore

PLATE A-6.3

METHODS OF PERFORMING UNCONFINED COMPRESSION AND TRIAXIAL COMPRESSION TESTS

THE SHEARING STRENGTHS OF SOILS ARE DETERMINED FROM THE RESULTS OF UNCONFINED COMPRESSION AND TRIAXIAL COMPRESSION TESTS. IN TRIAXIAL COMPRESSION TESTS THE TEST METHOD AND THE MAGNITUDE OF THE CONFINING PRESSURE ARE CHOSEN TO SIMULATE ANTICIPATED FIELD CONDITIONS.



TRIAXIAL COMPRESSION TEST UNIT

UNCONFINED COMPRESSION AND TRIAXIAL COMPRESSION TESTS ARE PERFORMED ON UNDISTURBED OR REMOLDED SAMPLES OF SOIL APPROXIMATELY SIX INCHES IN LENGTH AND TWO AND ONE-HALF INCHES IN DIAMETER. THE TESTS ARE RUN EITHER STRAIN-CONTROLLED OR STRESS-CONTROLLED. IN A STRAIN-CONTROLLED TEST THE SAMPLE IS SUBJECTED TO A CONSTANT RATE OF DEFLECTION AND THE RESULTING STRESSES ARE RECORDED. IN A STRESS-CONTROLLED TEST THE SAMPLE IS SUBJECTED TO EQUAL INCREMENTS OF LOAD WITH EACH INCREMENT BEING MAINTAINED UNTIL AN EQUILIBRIUM CONDITION WITH RESPECT TO STRAIN IS ACHIEVED.

YIELD, PEAK, OR ULTIMATE STRESSES ARE DETERMINED FROM THE STRESS-STRAIN PLOT FOR EACH SAMPLE AND THE PRINCIPAL STRESSES ARE EVALUATED. THE PRINCIPAL STRESSES ARE PLOTTED ON A MOHR'S CIRCLE DIAGRAM TO DETERMINE THE SHEARING STRENGTH OF THE SOIL TYPE BEING TESTED.

UNCONFINED COMPRESSION TESTS CAN BE PERFORMED ONLY ON SAMPLES WITH SUFFICIENT COHESION SO THAT THE SOIL WILL STAND AS AN UNSUPPORTED CYLINDER. THESE TESTS MAY BE RUN AT NATURAL MOISTURE CONTENT OR ON ARTIFICIALLY SATURATED SOILS.

IN A TRIAXIAL COMPRESSION TEST THE SAMPLE IS ENCASED IN A RUBBER MEMBRANE, PLACED IN A TEST CHAMBER, AND SUBJECTED TO A CONFINING PRESSURE THROUGHOUT THE DURATION OF THE TEST. NORMALLY, THIS CONFINING PRESSURE IS MAINTAINED AT A CONSTANT LEVEL, ALTHOUGH FOR SPECIAL TESTS IT MAY BE VARIED IN RELATION TO THE MEASURED STRESSES. TRIAXIAL COMPRESSION TESTS MAY BE RUN ON SOILS AT FIELD MOISTURE CONTENT OR ON ARTIFICIALLY SATURATED SAMPLES. THE TESTS ARE PERFORMED IN ONE OF THE FOLLOWING WAYS:

<u>UNCONSOLIDATED-UNDRAINED:</u> THE CONFINING PRESSURE IS IMPOSED ON THE SAMPLE AT THE START OF THE TEST. NO DRAINAGE IS PERMITTED AND THE STRESSES WHICH ARE MEASURED REPRESENT THE SUM OF THE INTERGRANULAR STRESSES AND PORE WATER PRESSURES.

<u>CONSOLIDATED-UNDRAINED:</u> THE SAMPLE IS ALLOWED TO CONSOLIDATE FULLY UNDER THE APPLIED CONFINING PRESSURE PRIOR TO THE START OF THE TEST. THE VOLUME CHANGE IS DETERMINED BY MEASURING THE WATER AND/OR AIR EXPELLED DURING CONSOLIDATION. NO DRAINAGE IS PERMITTED DURING THE TEST AND THE STRESSES WHICH ARE MEASURED ARE THE SAME AS FOR THE UNCONSOLIDATED-UNDRAINED TEST.

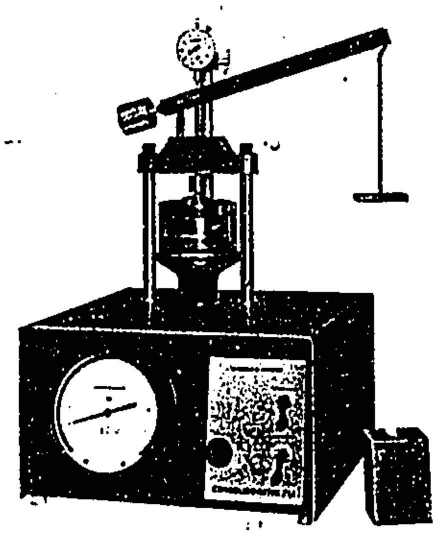
<u>DRAINED:</u> THE INTERGRANULAR STRESSES IN A SAMPLE MAY BE MEASURED BY PERFORMING A DRAINED, OR SLOW, TEST. IN THIS TEST THE SAMPLE IS FULLY SATURATED AND CONSOLIDATED PRIOR TO THE START OF THE TEST. DURING THE TEST, DRAINAGE IS PERMITTED AND THE TEST IS PERFORMED AT A SLOW ENOUGH RATE TO PREVENT THE BUILDUP OF PORE WATER PRESSURES. THE RESULTING STRESSES WHICH ARE MEASURED REPRESENT ONLY THE INTERGRANULAR STRESSES. THESE TESTS ARE USUALLY PERFORMED ON SAMPLES OF GENERALLY NON-COHESIVE SOILS, ALTHOUGH THE TEST PROCEDURE IS APPLICABLE TO COHESIVE SOILS IF A SUFFICIENTLY SLOW TEST RATE IS USED.

AN ALTERNATE MEANS OF OBTAINING THE DATA RESULTING FROM THE DRAINED TEST IS TO PERFORM AN UNDRAINED TEST IN WHICH SPECIAL EQUIPMENT IS USED TO MEASURE THE PORE WATER PRESSURES. THE DIFFERENCES BETWEEN THE TOTAL STRESSES AND THE PORE WATER PRESSURES MEASURED ARE THE INTERGRANULAR STRESSES.

Method Of Performing Consolidation Tests

CONSOLIDATION TESTS ARE PERFORMED TO EVALUATE THE VOLUME CHANGES OF SOILS SUBJECTED TO INCREASED LOADS. TIME-CONSOLIDATION AND PRESSURE-CONSOLIDATION CURVES MAY BE PLOTTED FROM THE DATA OBTAINED IN THE TESTS. ENGINEERING ANALYSES BASED ON THESE CURVES PERMIT ESTIMATES TO BE MADE OF THE PROBABLE MAGNITUDE AND RATE OF SETTLEMENT OF THE TESTED SOILS UNDER APPLIED LOADS.

EACH SAMPLE IS TESTED WITHIN BRASS RINGS TWO AND ONE-HALF INCHES IN DIAMETER AND ONE INCH IN LENGTH. UNDISTURBED SAMPLES OF IN-PLACE SOILS ARE TESTED IN RINGS TAKEN FROM THE SAMPLING DEVICE IN WHICH THE SAMPLES WERE OBTAINED. LOOSE SAMPLES OF SOILS TO BE USED IN CONSTRUCTING EARTH FILLS ARE COMPACTED IN RINGS TO PREDETERMINED CONDITIONS AND TESTED.



DEAD LOAD-PNEUMATIC CONSOLIDOMETER

IN TESTING, THE SAMPLE IS RIGIDLY CONFINED LATERALLY BY THE BRASS RING. AXIAL LOADS ARE TRANSMITTED TO THE ENDS OF THE SAMPLE BY POROUS DISKS. THE DISKS ALLOW DRAINAGE OF THE LOADED SAMPLE. THE AXIAL COMPRESSION OR EXPANSION OF THE SAMPLE IS MEASURED BY A MICROMETER DIAL INDICATOR AT APPROPRIATE TIME INTERVALS AFTER EACH LOAD INCREMENT IS APPLIED. EACH LOAD IS ORDINARILY TWICE THE PRECEDING LOAD. THE INCREMENTS ARE SELECTED TO OBTAIN CONSOLIDATION DATA REPRESENTING THE FIELD LOADING CONDITIONS FOR WHICH THE TEST IS BEING PERFORMED. EACH LOAD INCREMENT IS ALLOWED TO ACT OVER AN INTERVAL OF TIME DEPENDENT ON THE TYPE AND EXTENT OF THE SOIL IN THE FIELD.

APPENDIX B:

MARKET REPORT

THE HALLSTROM GROUP INC.
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RECEIVED APR 18

April 18, 1994

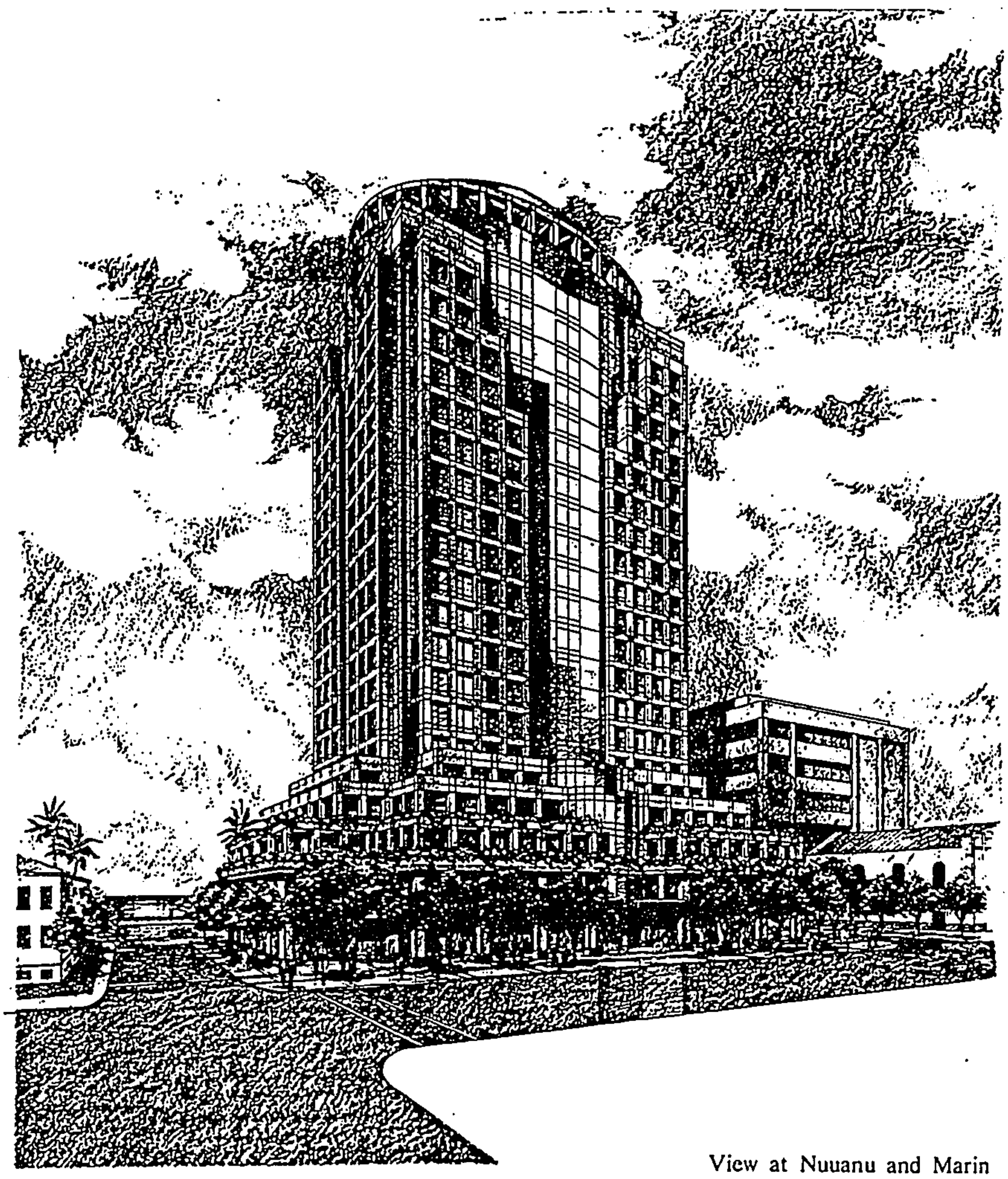
Mr. Phillip Russell
Graham Murata Russell
245 Queen Street, Suite 400
Honolulu, Hawaii 96813

Demand Analysis for the Proposed Bank of Hawaii Annex Tower

Dear Mr. Russell:

At your request, we have completed an investigation and summary analysis of the prevailing and projected demand for Class-A office space in the Downtown Honolulu marketplace. Focusing on modern, full-amenitied business towers comparable to the proposed Bank of Hawaii Annex Tower, the purpose of our study has been to assist in aligning project timing with anticipated future market demand.

The proposed Bank of Hawaii Annex Tower will be a 22-story Class A office structure situated on the 42,353 square foot property (including Marin Street) bounded by Bethel Street, Nimitz Highway, and Nuuanu Avenue. Preliminary plans indicate that it will contain 229,977 square feet of leaseable square feet within 19 office levels, and 607 parking stalls. The contemporary designed complex is currently shown to have the following floor layout and demised areas:



View at Nuuanu and Marin

BANK OF HAWAII
Annex Tower

Level	Net Rentable (in Sq. Ft.)	Use
Basement Levels 1 through 4		Parking
Ground	11,480	Retail/Commercial Leasing
2nd through 4th		Parking
5th	21,363	Office
6th	16,720	Office
7th through 17th	11,405	Office
18th through 19th	11,335	Office
20th through 21st	11,127	Office
22nd	10,035	Office
Total Leaseable	229,977	

According to preliminary plans, Bank of Hawaii will be the major tenant, utilizing approximately 60,000 square feet of new leaseable area; the estimated remaining 170,000 square feet would be leased to tenants at market terms.

Purposes and Function of Letter

The purpose of this letter is to provide a summary insight into the existing and projected supply/demand trends within the Downtown Honolulu Class-A office space lease market as of March 1, 1994. It highlights integral statistical and narrative information to assist in evaluating the market opportunity that exists for the proposed Bank of Hawaii Annex Tower. Data supporting our stated conclusions have been retained in our files.

Our assignment has focused on identifying competing and potentially competitive office projects in the central Downtown area (existing and planned potential supply), and providing an overall analysis of historic, present and forecast market acceptance rates and the factors supporting such absorption (demand). We have not completed an in-depth study of leasing rates and terms, as this time-specific analysis was not part of our assignment. Based on the data gathered and analyzed, we have formulated an opinion as to the optimum timing and need for additional Class A space in the central business district. Our conclusions are not site specific.

All opinions stated in this letter are subject to the attached standard assumptions and limiting conditions of The Hallstrom Group, Inc., in addition to any contained herein. This assignment has been performed in conformance with and is subject to the requirements of the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute and the Uniform Standards of Professional Appraisal Practice.

Format of Letter Presentation

The body of this summary letter is divided into three main sections, outlined as follows:

I. Supply (existing, proposed, available)
II. Historic Demand/Absorption Levels
III. Summary of Current and Forecast Demand

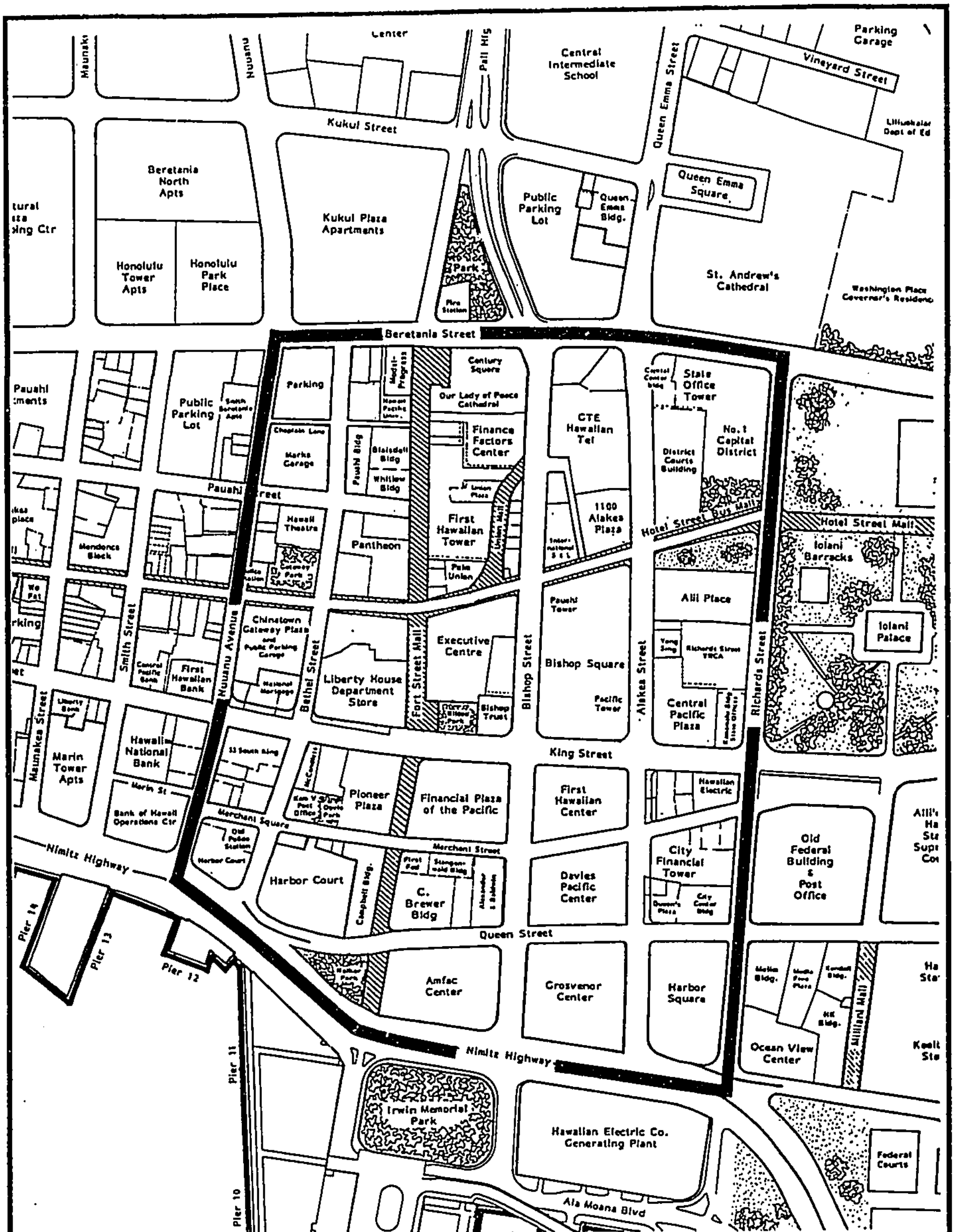
I. SUPPLY

Existing

Downtown Honolulu's Central Business District is the financial hub of the state, and has generally been defined geographically as that area bounded by Nuuanu Avenue, Richards Street, Ala Moana Boulevard/Nimitz Highway, and Beretania Street. Although the subject is situated adjacent to the ewa boundary of the district, it has been included within the study area due to its proposed future use.

The map on the following page depicts the district's borders and relationship to adjoining neighborhoods. Historically, nearly all commercial businesses in Hawaii were situated within the Downtown Honolulu area, which was advantageously located near the harbor, courts, public agency offices, and centrally positioned between the airport and Waikiki.

Downtown Honolulu has experienced a dramatic increase in available office space over the past 13 years, growing by 77 percent since 1980. As of the end of 1993, there was approximately 7,485,648 square feet of leaseable floor area within 53 commercial (office,



DOWNTOWN HONOLULU, HAWAII

retail, service), multi-tenant projects of varying qualities. Table 1 displays the major additions to the Downtown inventory since 1950. As in many major financial centers, there have been fewer, but significantly larger, new development projects over the past two decades.

After reviewing this data, it becomes apparent that the cyclical nature of office space construction is intimately tied to the strength of the general economy. During periods of monetary expansion, new businesses are formed and existing firms emerge/enlarge, creating both demand for and capital to build new projects.

A summary of the major Downtown office buildings completed since 1968 is shown on Table 2. These 25 buildings account for 5,156,010 square feet of gross leaseable area, or 69 percent of the total space available in the district and include almost all of the Class A premises in the area.

Due to the size of the Hawaii financial community, newly completed buildings have invariably resulted in a short-term oversupply of available space, impacting further development until the market overhang abated. From a tenant perspective, the space lease market has been very cyclical--with periods of tight supply and stringent lease terms followed by ones of availability, discounted rents and incentives.

Currently, the market is in a period of ample supply due to the 1992 completion of two large office projects which added over 730,000 square feet of leaseable area, and the 1993 completion of 1100 Alakea which added another 183,936 square feet. Beginning with Alii Place, located at the corner of Alakea and Hotel Streets, an increase of 268,883 square feet of Class-A office space was infused into a market that was suffering from a lack of new space. The second 1992 completion was the First Hawaiian Tower (formerly Pan Pacific Tower) situated on Union Mall and "Bishop Street." This quality project added another 468,000 square feet of available area. With the addition of these two major projects, earlier pent-up demand created in 1990 and 1991 was abated, but the large size of the additions relative to market needs created an oversupply of more than eight percent (of new space). This estimate does not include the premises vacated by firms moving into the new projects from older

TABLE 1

MULTI-TENANT OFFICE INVENTORY
Downtown Honolulu, Oahu, Hawaii

Year Completed	Number of Buildings	Accumulated Total	Leaseable Floor Area Added (Sq. Ft.)	Accumulated Floor Area (Sq. Ft.)
Prior to 1950	9	9	423,500	423,500
1950 thru 1959	5	14	156,600	580,100
1960 thru 1964	6	20	357,600	937,700
1965 thru 1967	7	27	683,000	1,620,700
1968	1	28	72,000	1,692,700
1969	2	30	279,000	1,971,700
1970	3	33	386,100	2,357,800
1971	2	35	261,000	2,618,800
1972	2	37	794,000	3,412,800
1973	0	37	0	3,412,800
1974	0	37	0	3,412,800
1975	2	39	244,000	3,656,800
1976	0	39	0	3,656,800
1977	2	41	254,000	3,910,800
1978	0	41	0	3,910,800
1979	1	42	242,000	4,152,800
1980	1	43	74,500	4,227,300
1981	0	43	0	4,227,300
1982	2	45	456,000	4,683,300
1983	2	47	642,000	5,325,300
1984	0	47	0	5,325,300
1985	0	47	0	5,325,300
1986	0	47	0	5,325,300
1987	0	47	0	5,325,300
1988	0	47	0	5,325,300
1989	1	48	180,600	5,505,900
1990	2	50	322,046	5,827,946
1991	0	50	0	5,827,946
1992	2	52	736,883	6,564,829
1993	1	53	183,936	6,748,765

Source: The Hallstrom Group, Inc., March 1994

TABLE 2

CHARACTERISTICS OF SELECTED DOWNTOWN OFFICE BUILDINGS
Downtown Honolulu, Oahu, Hawaii

No.	Building	Year Completed	Floors	Parking Stalls	Elevators	Type of Space	Area (Sq. Ft.)
1	1100 Alakea	1993	31	370	13	Office	178,000
						Retail	5,936
						Total	183,936
2	First Hawaiian Tower	1992	24	800	13	Office	450,000
						Retail	18,000
						Total	468,000
3	Alii Place	1992	23	1,000	5	Office	250,000
						Retail	18,883
						Total	268,883
4	No. 1 Capitol District	1990	5	Unknown	1	Office	128,971
						Retail	18,075
						Total	147,046
5	Hawaii National Bank	1990	2	98	3	Office	140,000
						Retail	35,000
						Total	175,000
6	City Financial Tower	1989	23	352	5	Office	168,800
						Retail	11,800
						Total	180,600
7	Bishop Square Pauahi Tower	1983	28	916 (1)	10	Office	468,530
						Retail	17,100
						Total	485,630
8	Central Pacific Plaza	1983	22	300	4	Office	203,000
						Retail	10,000
						Total	213,000
9	Grosvenor Center	1982	30	820 (1)	7	Office	274,000
						Total	274,000
10	Century Square (2)	1982	36	361	4	Office	182,000
						Total	182,000
11	Hasegawa Komuten	1980	8	221	2	Office	79,200
						Retail	2,800
						Total	82,000
12	Grosvenor Center PRI Tower	1979	30	820	7	Office	319,400
						Retail	25,470
						Total	344,870
13	Pioneer Plaza	1977	21	365	7	Office	216,000
						Retail	14,000
						Basement	14,000
						Total	244,000
14	1067 Alakea Street (2)	1977	5	0	1	Office	9,000
						Retail	800
						Total	9,800
15	1164 Bishop Street	1975	16	107	5	Office	170,000
						Retail	7,300
						Total	177,300

TABLE 2
(Continued)

CHARACTERISTICS OF SELECTED DOWNTOWN OFFICE BUILDINGS
Downtown Honolulu, Oahu, Hawaii

No.	Building	Year Completed	Floors	Parking Stalls	Elevators	Type of Space	Area (Sq. Ft.)
16	345 Queen St. Building	1975	9	190	2	Office	65,800
						Retail	600
						Total	66,400
17	Davies Pacific Center	1972	22	434	8	Office	292,000
						Retail	30,200
						Basement	13,400
						Total	335,600
18	Bishop Square Pacific Tower	1972	30	916 (1)	8	Office	532,431
						Retail	17,250
						Total	549,681
19	Harbor Square	1971	5	702	2	Office	29,000
						Retail	2,500
						Total	31,500
20	Amfac Building Hawaii Tower	1971	22	462 (1)	8	Office	209,000
						Retail	13,000
						Basement	10,000
						Total	232,000
21	Amfac Building Hawaii Tower	1970	21	462 (1)	8	Office	200,000
						Retail	13,000
						Total	213,000
22	Bishop Trust	1970	15	0	4	Office	133,100
						Total	133,100
23	Kendall Building (HGEA)(3)	1970	9	53	2	Office	40,000
						Total	40,000
24	American Savings	1969	12	87 (1)	2	Office	55,200
						Total	55,200
25	Castle & Cooke (Financial Plaza)	1969	21	87 (1)	7	Office	233,400
						Retail	3,800
						Total	237,200
26	Campbell Building	1968	6	250	2	Office	44,000
						Retail	12,000
						Total	56,000

(1) Shared Parking Facilities
(2) Condominium (Owner Occupied)
(3) Office Condominium
Source: The Hallstrom Group, Inc., March 1994

buildings. With the addition of this space, the "net" vacancy was estimated to be closer to 11 to 12 percent at the end of 1992.

In 1993, the 1100 Alakea project, situated at the corner of Alakea and Hotel Streets, brought another 183,936 square feet of leaseable area into an already oversupplied market. This 31-story, narrow tower, has a small footprint that offers an average size of 5,500 square feet per floor, limiting its potential market to smaller users rather than the typical major tenant looking for larger accommodations (circa 10,000 square feet). As of year end 1993, this project had a vacancy of 92 percent and leasing was extremely slow. At that time, primary downtown building vacancy was estimated at closer to ten percent, with an overall "net" estimate of 14 percent.

Proposed Supply

Currently under construction with an expected completion later this year, is the mixed-use Harbor Court complex at Bethel and Queen Streets, which will feature both office and residential condominium uses. The 18-story office tower will add 172,762 square feet of leaseable area to the Class-A office market. Another affiliated low-rise office project, called the Nuuanu Court, is planned for the site of the former municipal parking lot. The residential condominium component of the project will be situated within adjacent high-rise towers.

Construction has commenced on the block surrounded by Bishop, King, Alakea, and Merchant Streets for the proposed First Hawaiian Center which sits on the former site of the First Hawaiian Bank Building. Scheduled for completion in 1996, this 27-story tower will be the first to capitalize on the recently permitted 450 foot height limit, although due to design constraints, the tower will only reach 430 feet. When completed, the First Hawaiian Center will accommodate an estimated 378,604 square feet of leaseable area and have a capacity for 700 vehicles in a five level underground parking garage. According to developer representatives, approximately 80 percent of the building has already been committed to tenants including the bank.

Mr. Phillip Russell
April 18, 1994
Page 6

Two other projects are currently under construction in the Downtown area, but neither will add any office space to the current inventory. One of these projects is Phase I of the re-creation and renovation of the pier area surrounding the Aloha Tower into a retail-oriented complex focusing on the commercial potential of the docks as ports of call. Dubbed the Aloha Tower Marketplace, it is expected to be completed in late 1994 or early 1995. Plans for Phase II, which will feature a office complex, residential condominium, hotel and maritime building, are currently being studied and reevaluated.

The second project is the nearly completed King Street Garage located on the site of the former King Theater on King Street, next to Pioneer Plaza. Featured within this complex is parking for 190 vehicles and a 4,000 square foot retail arcade. Other potential Downtown Honolulu projects with indefinite time tables are listed below:

Project	Estimated Leaseable Area Sq. Ft.	Expected Date of Completion
AALL Hawaii Inc./C. Brewer	350,000	N/A
Pacific Nations Center	300,000	N/A
Campbell Estate	260,000	N/A
Downtown Post Office	N/A	Delayed

Available Supply

Within the last three years, Class-A office space has gone from a period of marked shortfall to an overwhelming introduction of almost one million square feet in the last three additions. With a current available inventory of approximately 580,000 square feet of leaseable area within the Downtown Class-A structures, and another 186,000 square feet becoming available in a few months, the oversupply will undoubtedly have landlords actively engaged in both retaining their current tenant roster intact and in trying to entice new tenants into their vacant spaces, even if at an initial loss. Due entirely to the delayed timing in recognizing and building for shortfalls, the office building construction cycle has also had its current over-supply problem compounded by the recessionary nature of both the local and national economy. With the addition of the last three new buildings, First Hawaiian Center, Alii Place and 1100

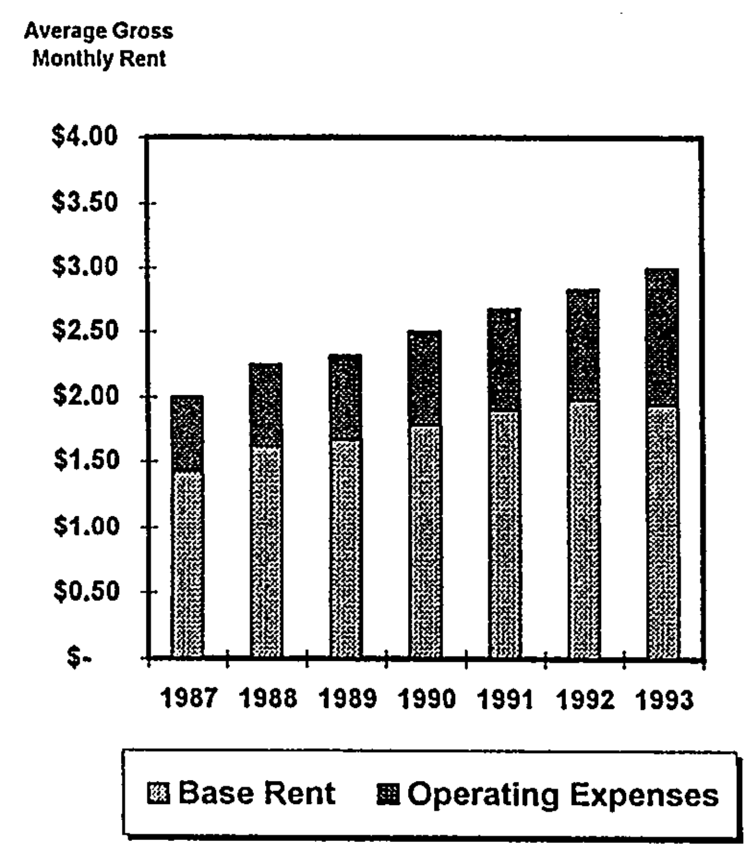
Alakea, the Downtown vacancy rate, as of year end 1993, was close to 18 percent, considering only Class-A Downtown buildings.

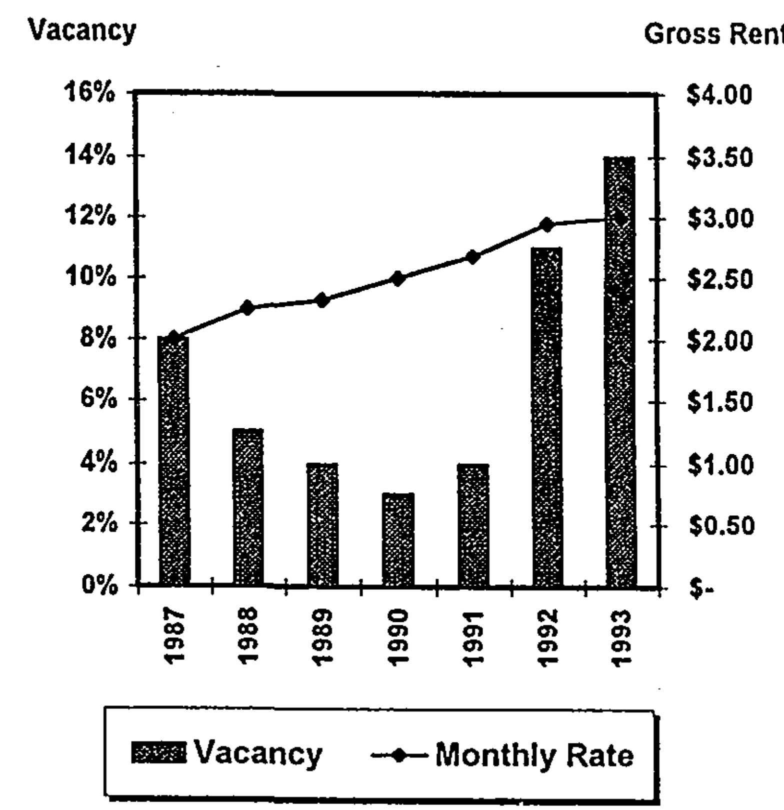
II. HISTORIC DEMAND/ABSORPTION LEVELS

Downtown office space absorption rates since 1970 have ranged annually from a low of 125,000 square feet in 1971 to a high of 450,000 square feet in 1984. As expected, those periods of high absorption followed low inventory intervals and the completion of an abundance of new space into the market. Leasing activity increased significantly during the 1982-83 period when four buildings, including the Grosvenor Center's Mauka Tower, Central Pacific Plaza, Pauahi Tower at Bishop Square and the Century Square office condominium, added over one million square feet of leaseable area. During this period of high competition, generous tenant concessions were aggressively negotiated in an effort to quickly lease up the available space.

That oversupply of office space took approximately two to three years to ratchet down to a vacancy of approximately 10 to 11 percent. During the next five year period beginning in 1984, no new buildings were completed in the Downtown area, and the market gradually changed to a landlord-dominated arena where there was virtually no negotiating of rents, and concessions were unheard of; obviously, rents rose. Since 1986, average full service office rent has increased from $1.89 to $3.01 per square foot per month for a compounded annual growth rate of 6.9 percent. As a result of both the lack of adequate space and the high cost of remaining within the Central Business District, other markets outside of Downtown, primarily the Kapiolani corridor, drew away many disgruntled tenants. In 1989, the City Financial Tower was completed, but most of its 201,000 square feet of quality office space was already leased upon completion due to the pent-up demand created since 1984. Two other buildings added minimal inventory to the market in 1990--one was a renovation of a small project; the other was a new, smaller building with a majority of owner-user space. No new office construction was added in 1991, and the market was still lacking in adequate supply. During this time of national economic turmoil, Downtown Honolulu's office market vacancy rate fell to an envied national low of approximately 2.0 percent.

DOWNTOWN OFFICE RENTS





Within the period 1981 to 1985, annual office space absorption reached a high of nearly 450,000 square feet. The inventory introduced during 1982-83 was steadily absorbed as a result of the combination of landlord concessions and rising demand from businesses expansion. For the next five-year period ending in 1989, because no new space was completed, the market gradually tightened to a vacancy of approximately six percent. Absorption averaged between 250,000 to 350,000 annually based on the competitiveness of the office space market and the vibrant economic climate of the period. New supply in the 1990-91 period was inadequate to meet pent-up demand from past years and the need for new space continued.

The market absorbed approximately 300,000 square feet in 1992 due to the remaining demand left from the previous drought. Although this net amount is higher than the previous average of 250,000 square feet, a lot more space was actually committed. However, many of the potential commitments failed to materialize due to the recessionary atmosphere.

Changes within the market over the past few years have been the result of a combination of radical and unforeseen events. Historically, due to its remote and unique economic base, Hawaii had not previously been as immediately and directly affected by changes within the national economy. Due to the delayed event and effect time, the Hawaii market was better able to withstand the filtered down impact, if any. Recently, however, the global recessionary climate has impacted the island's office space market in the form of reduced staff and office needs for national, as well as local, companies. This recession has resulted in downsizing (smaller space requirements) and the subleasing of excess area no longer utilized (sometimes at a loss in rent). Additionally, Hawaii's declining tourism figures over the past three years have impacted its supporting industries, forcing many to consolidate resources and/or redirect their energies into other market areas. These changes within Hawaii's largest income base have affected the service industries, again, requiring cost cutting measures to be taken which result in reductions of both staff and office space. According to a recent demographic study done on urban office users, approximately 43 percent of those users were categorized as service industries. Followed by the finance, insurance and real estate group, it is evident that the impact of changes affecting the service industries would cause a similar repercussion within the office space market they dominate. Ultimately, the impact of any economic changes to both primary user markets results in a compound effect. It is into this period of a market in flux that the majority of the current market overhang of Class-A office space was introduced and still remains.

Compounded by the continuing drop in tourism, and cautious corporate decisions regarding office space and its future cost, 1993 emerged as another record year--for one of the lowest absorptions within a year of ample, plus new, supply. Only 97,500 "net" square feet of space was actually tenanted and by "net," this figure includes the addition of 1100 Alakea's 183,936 square feet along with the remaining inventory from the other Class-A projects. With this in mind, and the current feeling of slow overall recovery, industry professionals are forecasting another subdued year in office space absorption.

Being a cyclical market based on timing, delays, and economic variances, Downtown office space is now into a period of more-than-ample supply, comparable to that of the 1982-84 period. With this large amount of remaining new inventory competing with existing buildings and the anticipated additions currently under construction, leasing will continue to be a tenant's market with a variety of options open for negotiation. All leasing aspects, both within existing and new projects, are being negotiated and renegotiated under more liberal conditions than ever before. Common terms include a combination of the offering of free rent, which can range from 6 to 24 months, depending on the length of the lease; longer fixed rent periods or reduced escalations over the term of the lease; and greater improvement allowances for tenant buildouts. With landlords willing to forego initial profits to gain an accelerated occupancy and a more stable future cash flow, tenant concessions have become a major negotiating chip and will continue to effect the market, both in bargaining for new tenants and the retention of existing occupants. In fact, rents are falling to levels of years ago as landlords are not only sacrificing their adjusted rents by offering concessions, but are also reducing base rents in an effort to entice tenants.

Hawaii's economy is now considered by local economists to be in a stable to "ready for growth" stage in its recovery. Optimistic predictions for a stable to mild recovery for this year are tentatively measured and, according to industry experts, tourism is currently in a very tenuous growth period. Due largely to the three year decline in its primary industry of tourism, the domino effect has been hard to overcome. Construction has started to wind down and the uncertainties regarding the military within Hawaii have also cast a cautious atmosphere over the growth of support industries or the formulation/expansion of businesses. Our base economy has been forced to diversify but, like our widening agricultural alternatives, the state has showed signs of growing again by capitalizing on its central Pacific (gateway) location and its need for diversification.

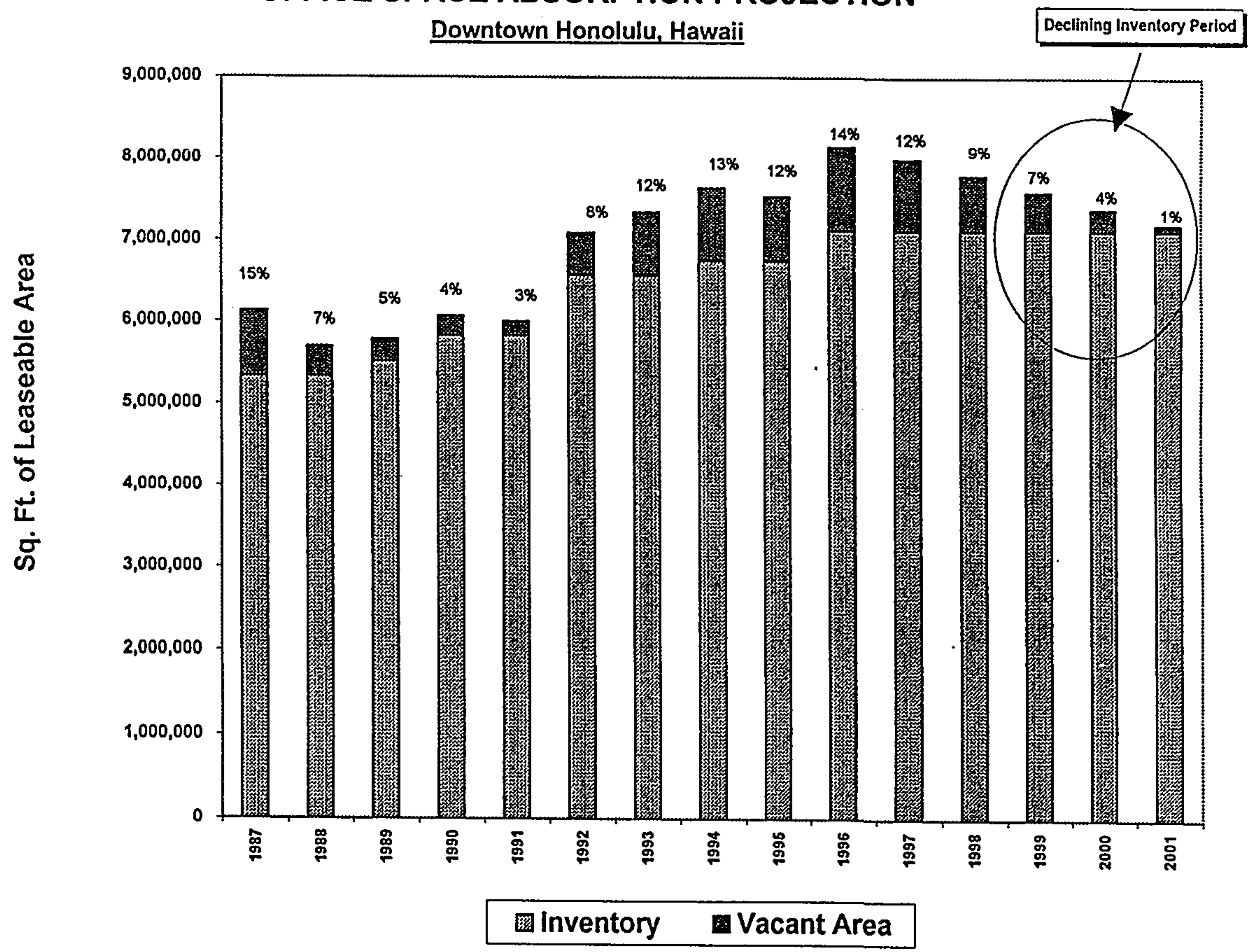
It is interesting to note that of the office space recently surveyed, almost 30 percent had/have rent reopenings in 1993 and 1994. An additional 26 percent had rent openings scheduled for the following two year period. Obviously, with the market at a prime for tenants, many buildings and firms are currently renegotiating earlier to take advantage of the liberal terms now that are dominant and secure their positions for the near future. For forecasting purposes, it appears likely that with typical fixed terms at five years, the next significant reopening period will be in 1999 and 2000. Industry professionals see the current market as a readjustment, and although beneficial in the long run, are skeptical of a rapid return to historical absorption trends. This cautious attitude mitigates any estimate of future market expectations.

III. SUMMARY OF CURRENT AND FORECAST MARKET DEMAND

During the current period of market readjustment, both economically and strategically, absorption estimates will probably not follow historic patterns as closely as in the past. Based on historical trends, the current radical impact of the recent recession and the forecast future economic outlook, we estimate that current inventory of office space will adequately supply the office market for the next five to seven years. This forecast also considers the 1996 completion of the First Hawaiian Center project currently under construction. According to developers, this project is currently 80 percent pre-leased and the opening of this project in 1996 is expected to cause a vacancy reverberation in the neighboring projects that will increase due to the approximately 150,000 square feet to be occupied by non-bank tenants. It is expected that the remaining First Hawaiian Center space will be steadily absorbed within a year or two. By this time (1998-99), the market should be near the end of its absorption of the remaining total inventory. Additionally, the current market trend for restructuring leases

OFFICE SPACE ABSORPTION PROJECTION

Downtown Honolulu, Hawaii



Source: The Hallstrom Group, Inc. March 1994 within the current beneficial rent period means that tenants who have completed lease negotiations and who are soon to enter negotiations will probably be facing the end of their fixed lease term. Alternative office locations and terms would probably be considered within this 1999-2001 period. Considering these factors and utilizing varying absorption forecasts for the remaining inventory period, we believe that the Downtown office market may not require additional Class-A office space until the beginning of the next decade. At that time, considering the projects currently under construction and those with definite time tables, space such as the proposed new Annex Tower should prove feasible and be well received.

New Class-A office space may not be well accepted until the year 2000 or shortly thereafter due to the large amount of office space available, the drop in demand attributable to tenant restructuring, and the compounding factors of a cautiously recovering economy; the speculative nature of a space absorption forecast is evident. Based on past trends and current economic forecasts for a recovering economy in general, it appears likely that the market will not soon bounce back to pre-1992 absorption levels of 250,000 to 300,000 square feet annually. Instead, our analysis indicates that, tempered by the changes both with the ample supply and the evolving market demands, near-term office space absorption will continue to go through a leveling period and will likely start to grow at a much lower rate. Therefore, considering the foregoing data and analysis, we estimate that the need for additional quality office space for the Downtown Honolulu market will mature by the turn of the century.

CERTIFICATION

The undersigned do hereby certify that, to the best of our knowledge and belief, the statements of fact contained in this report are true and correct. It is further certified that the reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions, and are our personal, unbiased professional analyses, opinions, and conclusions. We further certify that we have no present or prospective interest in the property that is the subject of this report, and have no personal interest or bias with respect to the parties involved. Our compensation is not contingent on a predetermined value or direction in value that favors the client, the amount of the value estimate, the attainment of a stipulated result, or the occurrence of a subsequent event. The appraisal analyses, opinions, and conclusions were developed, and this report has been prepared, in conformity with the requirements of the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute and the Uniform Standards of Professional Appraisal Practice. The use of this report is subject to the requirements of the Appraisal Institute relating to review by duly authorized representatives. The undersigned certify that they have made personal inspections of the property that is the subject of this report. No persons provided significant professional assistance other than the undersigned.

The Appraisal Institute conducts programs of continuing education for their designated members. As of the date of this report, the undersigned have completed the requirements of the continuing education program of the Appraisal Institute.

THE HALLSTROM GROUP, INC.

James E. Hallstrom, Jr., MAI, SRA
Hawaii State Certified
General Appraiser, CGA-178
Exp. Date December 31, 1995

Roberta O. Ishikawa, MAI, SRA
Hawaii State Certified
General Appraiser, CGA-83
Exp. Date December 31, 1995

JEH/roi/as

APPENDIX C:

BEST MANAGEMENT PRACTICES PLAN

BANK OF HAWAII ANNEX TOWER

BEST MANAGEMENT PRACTICES (BMPs) PLAN

1. **Project Summary.**

The project site at 800 Nuuanu Avenue (Tax Map Key 1-7-02:2) covers approximately 0.9 acres and is bounded by Nimitz Highway, Smith Street, Marin Street, and Nuuanu Avenue. Site elevations range from approximately 7 feet to 11 feet above mean sea level (msl). Honolulu Harbor lies directly across Nimitz Highway west of the site. Map 1 shows the project location.

The project will involve construction of an approximately 280,000 Square Foot (SF), 21-story office/commercial building with a six story underground parking garage. Construction of the underground floors will require dewatering with discharge either to groundwater by reinjection wells or to Honolulu Harbor via storm drains under Nimitz Highway. Honolulu Harbor is a Class A water and eligible to receive uncontaminated dewatering discharges from groundwater.

A Notice of Intent (NOI) to be covered under the National Pollutant Discharge Elimination System (NPDES) General Permit will be filed with and approved by the State of Hawaii Department of Health (DOH) Clean Water Branch before any dewatering discharges begin. Permission will also be obtained from the State of Hawaii Department of Transportation (DOT) for discharge to the state highway storm drain system. To mitigate potential adverse construction impacts on storm water runoff quality or Honolulu Harbor waters, BMPs will be implemented throughout the course of the project. With the approved NOI and adherence to BMPs during construction activities, there should be no significant impact on the quality of storm water runoff or Honolulu Harbor. BMPs for the project are summarized below.

2. **General.**

   a. Responsibility. The contractor's onsite project manager will have overall responsibility for the proper implementation of BMPs before and during construction activities.

   b. Worker Awareness. Workers at the job site will be trained to follow BMPs.

3. **Dewatering System Best Management Practices.**

a. Operations Plan. The dewatering system, which is designed for groundwater recharge, will be operated continuously during below grade construction work. The dewatering pumps will be operated at the rate required to maintain the excavation in a dry condition without draw down outside the project limits. Groundwater draw down will be controlled through use of the recharge system consisting of perforated pipes discharging to a gravel bed surrounding the project site.

Water not absorbed in groundwater recharge will be discharged to Honolulu Harbor via DOT storm drains under Nimitz Highway. The only type of pollutants expected to be present in construction dewatering discharges are suspended sediments. Prior to discharge, all dewatering effluent will be treated to remove suspended sediment using a combination of filtration and settling. Figure 1 shows a schematic of the dewatering extraction, treatment, and disposal system. Map 2 shows the storm drains that will convey treated effluent to Honolulu Harbor.

b. Maintenance Plan. To prevent potential contamination due to dewatering equipment, this equipment will be properly operated and maintained. All dewatering equipment will be inspected daily by the contractor's Quality Control Engineer. Any component requiring maintenance will be serviced immediately to ensure that no pollutants are introduced into the groundwater discharge. Dewatering pumps will be taken out of service for maintenance in accordance with the manufacturer's recommendations.

c. Good Housekeeping Plan. Areas around the dewatering system will be maintained in a neat and orderly condition to assure that no contaminants are conveyed in the discharge stream.

d. Sediment Handling and Disposal Plan. Sediment removed from dewatering effluent will collect in the junction boxes of the effluent treatment system. Sediment will be removed from the junction boxes as required to maintain effluent quality and when sediments reach a depth of 2 feet in the junction boxes. The boxes will be monitored every 2 hours at the start of the dewatering operation, with the schedule adjusted thereafter based on the quantity of sediments collected during the operation of the system. Sediments removed will be disposed of on-site or hauled off-site and disposed of at an approved landfill facility.

e. Monitoring Plan. The Project Quality Control Engineer will collect samples from each junction box at least once a week to assure compliance with water quality requirements. Samples will be submitted for the analyses required by the NOI permit. Results will be reported as required by the DOH.

f. Visual Inspection Plan. The groundwater discharge will be visually inspected at the junction box by the project Quality Control Engineer once each working day generally in the morning upon arrival at the site, following start up of the dewatering operation. The inspections will check for color changes or for the presence of scum or foam in the discharge. The accumulation of sediments within the junction box will also be monitored.

g. Cessation of Discharge, Revise Effluent Control and/or Mitigative Measures Plan.

Long Term: The discharge is from construction dewatering and is of a temporary duration. Upon completion of the below grade construction within the groundwater table, the dewatering and discharge thereof to the storm drain system will be discontinued. No long term effluent control or mitigative measures plan is required since the dewatering is not a long-term or continuous operation.

Short Term: Upon observation of a dewatering system malfunction, such as a turbid or colored discharge, the rate of groundwater withdrawal will be reduced. Total cessation will not be feasible, but the rate will be decreased while inspection of each dewatering well is completed. Once the source of the problem is determined, the well will be taken out of service and maintenance performed or mitigative action taken.

h. Record Keeping. Record Keeping will be continuous and thorough throughout the duration of the dewatering activity.

i. Prohibited Practices: Excavation will not occur when the groundwater level is above the working surface elevation. Excavation will proceed only when the water table is BELOW the bottom of the excavation. This requirement will be in effect so that the excavation activity does not increase the amount of suspended solids in the groundwater being pumped out of the wells at any time during the project.

4. Construction Best Management Practices.

No preexisting contamination is known or anticipated at the site. To prevent site construction activities causing onsite contamination, the contractor will follow BMPs throughout the course of the project.

a. Spillage or leaks. Spills and leaks during refueling and equipment maintenance are not anticipated. Extra care will be taken during these operations to avoid spills. However, if a spill or leak does occur, it will be contained and all contaminated soil immediately removed. Contaminated materials will be disposed in a safe and legal manner.

   Each equipment operator will make a daily inspection of their piece of equipment to uncover conditions that could cause breakdowns or possible contamination of the groundwater. The inspection will generally be performed at the start of each working day.

   No special equipment or materials will be stationed at the site to respond to spills and/or leaks. Construction equipment already on site should be adequate to address any spills or leaks.

b. Waste Disposal. All solid and all liquid wastes will be containerized at all times. Wastes will be properly transported and disposed of at an offsite, licensed disposal facility.

   No treatment is required as there will be no onsite disposal.

c. Drainage from Raw Material Storage or Stockpiling Areas. Due to the nature of the site, runoff from storage of materials to offsite will not occur. During the subsurface construction phase, all runoff will be contained within the project site within the confines of the excavation. Once the structure is above grade, material storage will be within completed portions of the building.

   Materials stored onsite will be those normally used in building construction, and generally will not be hazardous in nature. All chemical containers used at the job site will be placed in pans to catch fluid leaks or spills that might occur.

   No treatment of runoff from material storage areas is proposed.

d. Runoff from Dust Control Measures. To mitigate air quality impacts during site demolition and construction activities, clean, potable water will be used to spray stockpiles, exposed dirt, rubble, and other potential dust sources. Sufficient water will be sprayed to control dust but not enough water to cause ponding and offsite runoff. Sprayed water will either evaporate or percolate into the ground.

e. Sediment Tracking. A stabilized gravel or hardstand surface will be provided at the construction site driveways. Hosing off of vehicle tires will be undertaken to avoid depositing mud and debris in off-site areas. Water from the hosing operation will percolate into the subgrade and be discharged as part of the treated dewatering system effluent, after passing through the settlement tank.

5. Storm Water Runoff Management During Site Construction.

BMPs will be implemented to prevent contamination of storm water runoff due to site construction activities. The potential storm water contaminants due to site construction activities are sediments. As discussed above in section 4, preexisting contamination is not anticipated at the site and good housekeeping measures will be implemented to prevent chemical contamination during site construction activities. To prevent storm water runoff from carrying sediments off site during construction activities, storm water control BMPs will be implemented.

Since the area adjacent to the property line slopes away from the site, no offsite runoff will enter the project excavation or flow through the project area. The main project earthwork will be below grade and offsite transport of surface materials is anticipated during most construction. Surface water runoff will collect in the bottom of the excavation.

A plywood construction fence installed along the curbline will serve as a barrier for runoff from the site. This fence will retain water that falls within the site during construction. If sediment-bearing surface water runoff is expected from the site, an onsite retention basin will be installed. Water from the retention basin will percolate into the subgrade or be discharged to the dewatering effluent treatment system for sedimentation and filtration prior to offsite discharge.

No erosion control plan is required for the project by the City and County of Honolulu Department of Public Works since there is no grading under the project and the work site is less than one acre.

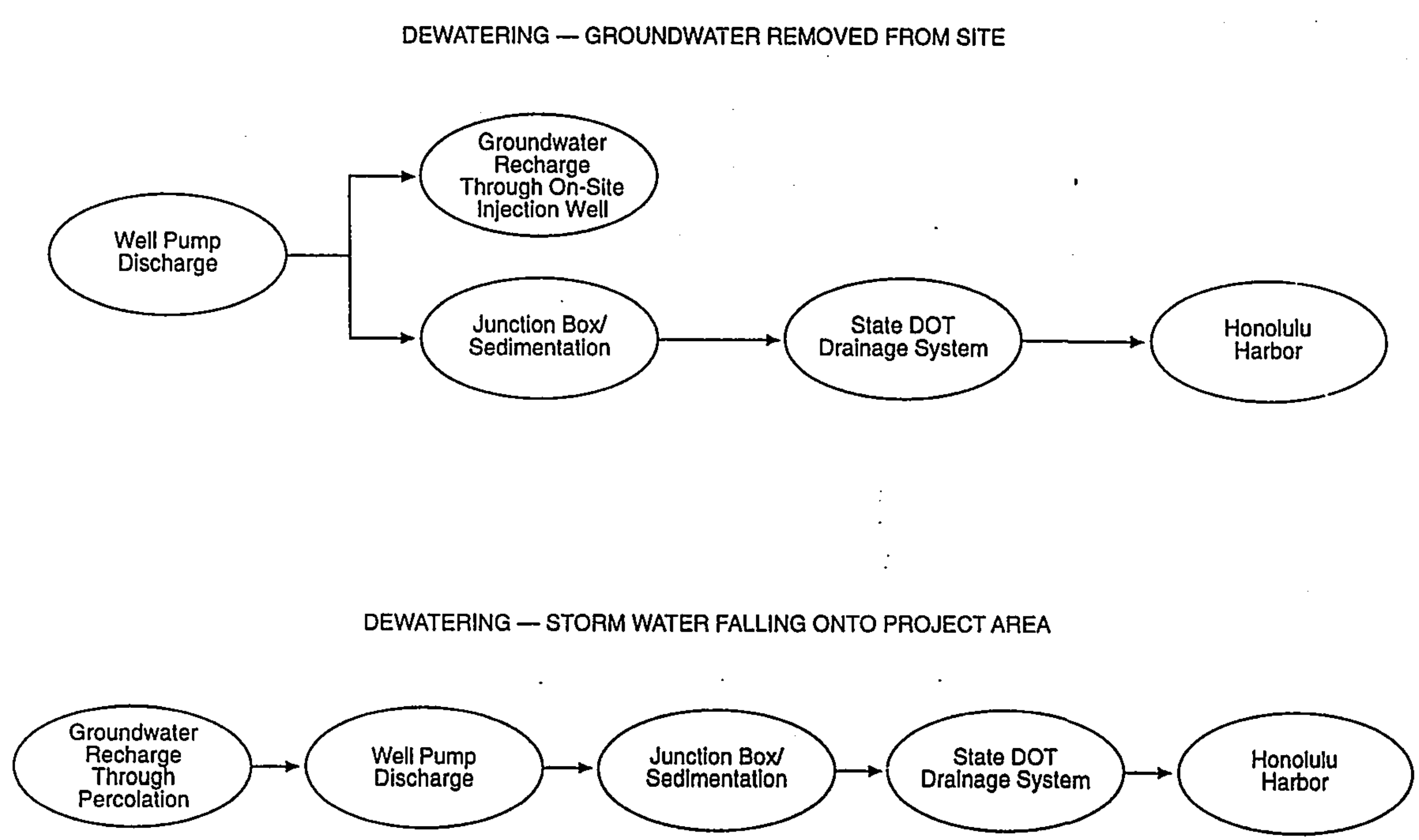
6. **Post-Construction Storm Water Runoff Management.**

During the post-construction period, storm water runoff from the site will remain separate from contact potential sediment and other pollution sources.

a. Sediment Sources. The entire site will be covered by structures, impervious paving, or landscaping. Erosion during topsoiling operations for the landscape areas will be controlled by use of filter fabric until vegetation is established.

b. Exposure of Construction-Related Materials and Wastes to Storm Water. During the post-construction period, any remaining construction-related materials will be contained inside of the building and hence be separate from storm water runoff.

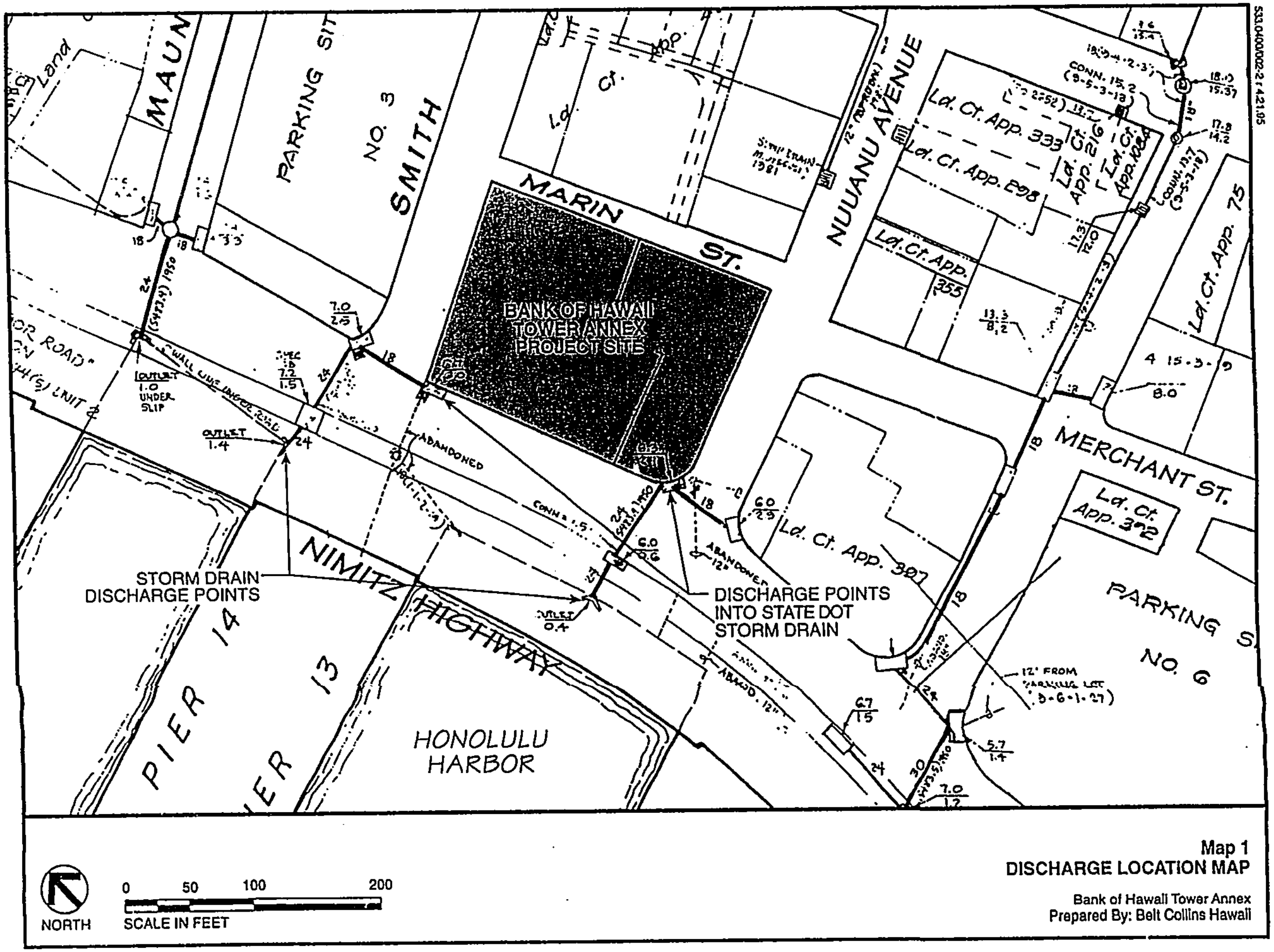
b. Removal of Storm Water Control Measures. The plywood construction fence installed along the curbline that serves as a barrier for site runoff will only be removed after exterior construction activities are substantially complete. The use of any onsite retention basins to intercept surface water runoff from the site will be discontinued only after the potential for sediment or other contamination in site runoff has ceased.



533.0400/002-1

Figure 1
DEWATERING FLOW CHART

Bank of Hawaii Tower Annex
Prepared By: Belt Collins Hawaii
April 1995



Map 1
DISCHARGE LOCATION MAP

Bank of Hawaii Tower Annex
Prepared By: Belt Collins Hawaii

APPENDIX D:

AIR QUALITY IMPACT ANALYSIS

Air Quality Impact Analysis of Vehicular Emissions of Carbon Monoxide

for

Proposed Bank of Hawii Annex Tower

Prepared by Belt Collins Hawaii
October 1995

1.0 INTRODUCTION

An air quality impact analysis was conducted for carbon monoxide (CO) emissions resulting from the proposed Bank of Hawaii Annex Tower project. CO was selected for analysis because it is the pollutant most likely to exceed ambient air quality standards, the predominant emission constituent from vehicular sources and can cause adverse health effects from short-term (acute) exposures.

Air dispersion modeling was conducted to estimate concentrations of CO from potential significant sources: 1) vehicular emissions from roadways and 2) parking ventilation emissions. Computer model input and output used to assess the potential impacts from these sources are summarized in this appendix.

2.0 VEHICULAR EMISSIONS FROM ROADWAYS

The intersection of Smith Street and Nimitz Highway was used to estimate potential CO concentrations resulting from vehicular emissions on roadways. CO concentrations near this intersection are expected to be higher than any other areas affected by the proposed project because of the high volume of vehicles and the restricted flow of traffic anticipated.

The CAL3QHC computer model, version 2.0, was used to estimate the worst-case 1-hour concentration of CO. CAL3QHC is an EPA-approved model used to estimate CO or other inert pollutant concentrations resulting from motor vehicles at roadway intersections. CAL3QHC consists of the line source dispersion algorithm developed by the State of California Department of Transportation – CALINE3 – and a traffic algorithm for estimating vehicular queue lengths at signalized intersections.

2.1 CAL3QHC Model Inputs

Model inputs required for the CAL3QHC model include: geometrics for roadway links, vehicular emission factors, receptor locations, meteorology, and selected model options. Model inputs were obtained from methodologies provided in the following documents: *Guideline for Modeling Carbon Monoxide From Roadway Intersections* (U.S. EPA, November 1992) and *User's Guide to CAL3QHC Version 2.0: A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections* (U.S. EPA, November 1992). CAL3QHC model inputs are described below. CAL3QHC input files are attached.

2.1.1 Roadway Links

Roadway links were configured to represent the vehicular movements at the intersection of Smith Street and Nimitz Highway. Each link represents a roadway segment having a specific length, width, number of vehicles, emission factor (on a per vehicle basis), and alignment. Schematics of the links used to represent the vehicular movements at the study intersection are attached.

2.1.2 Emission Factors

Carbon monoxide (CO) emission factors were determined using traffic characteristic information and the EPA-approved mobile source emission factor model, MOBILE5a (released on March 26, 1993). The *User's Guide to MOBILE5* (EPA, May 1994) was used as guidance. Traffic characteristics used as input into MOBILE5a included the following:

- Year of analysis: 1999;
- Vehicular speeds of 15 and 25 miles per hour; and
- Ambient temperature of 65 degrees Fahrenheit (lowest monthly daily minimum occurring during the period of 1970 to 1977).

The MOBILE5a model has a number of options which would reduce CO emission factors. Such provisions include vehicle maintenance and inspection programs and the reformulated fuels program. None are applicable to the area, however, and were not assumed.

An appropriate emission factor was selected based on vehicular speeds assumed for each of the roadway links (see Table 1). Emission factor assigned to each roadway link are listed in the attached CAL3QHC model output files. MOBILE5a model output are also attached.

2.1.3 Receptors

Maximum CO impacts are exhibited at close proximity to roadways since the emission releases are near ground level and dispersion increases with increasing distances from the source. For these reasons, and because pedestrian access is provided along the study intersection, receptors were assumed to be located approximately 10 feet from the roadways and just outside of the mixing zone created by the turbulent wake of moving vehicles. Receptor locations are illustrated in the schematics attached.

2.1.4 Meteorology

Meteorological conditions which will minimize atmospheric dispersion and subsequently maximize CO concentrations have been assumed, in accordance with EPA-recommended modeling methodologies. Hypothetical worst-case meteorological conditions include an atmospheric stability class of D and a wind speed of 1.0 meters per second. Such conditions are expected to be infrequent at the proposed project site. Moreover, these conditions tend to occur at night and are not expected to occur concurrently with afternoon peak-hour traffic periods. For these reasons, a more reasonable worst-case meteorological condition was evaluated. This condition assumes a neutral atmospheric stability class of C and a wind speed of 2 meters per second. In all cases, 36 wind directions in increments of 10 degrees, were used to determine the wind direction which would produce the highest CO concentrations.

2.1.5 CAL3QHC Model Options

Model options and assumptions used in the worst-case analysis are provided below.

- No vehicular inspection and maintenance (I/M) program (I/M programs serve to decrease vehicular emissions);
- No corrections for vehicular air conditioning usage, extra vehicle loads, or trailer towing (these conditions increase emissions);
- No vehicular anti-tampering program (these programs reduce the frequency of removal or disablement of catalytic convertors and consequently reduce vehicular emissions);
- Percent of vehicle miles traveled (VMT) accumulated by non-catalyst vehicles in cold-start mode (PCCN), catalyst-equipped vehicles in hot-start mode (PCHC), and catalyst-equipped vehicles in cold-start mode (PCCC) are 20.6, 27.3, and 20.6, respectively (Source: Federal Test Procedures operating mode fractions);
- Surface roughness of 321 centimeters, which is characteristic of a central business district (U.S. EPA, *Guideline For Modeling Carbon Monoxide From Roadway Intersections*, November 1992);
- Settling velocity of 0 meters per second (i.e., no settling occurs);
- Deposition velocity of 0 meters per second (i.e., no deposition occurs).

2.2 CAL3QHC Model Output

CAL3QHC model output files for both the cumulative and project-only scenarios are attached. Each file output includes a summary of the model input parameters and the maximum 1-hour CO concentrations. Scenarios modeled by model run are listed below:

Model Run #1: Cumulative Impacts

- Hypothetical Worst-Case (D stability, 1 meter per second wind speed)
- Reasonable Worst-Case (C stability, 2 meter per second wind speed)

Model Run #2: Project Only Impacts

- Hypothetical Worst-Case (D stability, 1 meter per second wind speed)
- Reasonable Worst-Case (C stability, 2 meter per second wind speed)

Model Run #3: Cumulative Impacts with Traffic Mitigation (Elimination of left turn from Smith Street to Nimitz Highway)

- Hypothetical Worst-Case (D stability, 1 meter per second wind speed)
- Reasonable Worst-Case (C stability, 2 meter per second wind speed)

Model Run #4: Project-Only Impacts with Traffic Mitigation (Elimination of left turn from Smith Street to Nimitz Highway)

- Hypothetical Worst-Case (D stability, 1 meter per second wind speed)
- Reasonable Worst-Case (C stability, 2 meter per second wind speed)

Results are summarized in Tables 2 through 5. These results indicate that all state and federal ambient air quality standards for CO are expected to be met under the reasonable worst-case conditions with the proposed project. Under the more unlikely hypothetical worst-case condition, the modeled 1-hour concentrations of CO exceed the state ambient air quality standard, but remain far below the federal standard of 35 ppm (the 35 ppm standard is a health-protective standard whereby exposures to concentrations less than 35 ppm have not been shown to cause toxic effects). In this hypothetical worst-case condition, the project's contribution to the cumulative (concentration due to natural growth in existing traffic, full development of other projects in the vicinity, and background concentrations) is less than 14 percent.

Eliminating the left-turn signal phase, as recommended in the project traffic study, would reduce the 1-hour CO concentrations. However, the maximum 1-hour CO concentration would remain above the state standard under the hypothetical worst-case condition modeled.

2.2.1 Eight-Hour Averaged Concentrations

Eight-hour averaged concentrations were estimated by applying a persistence factor of 0.3 to the maximum 1-hour modeled concentrations. The use of a persistence factor is an accepted EPA-recommended practice and is usually based upon the observed relationship between 1-hour an 8-hour averaged concentrations. Based on Department of Health (DOH) monitoring data measured in downtown Honolulu[1] during the 1988 and 1989

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[1] 1250 Punchbowl Street, Honolulu, Hawaii.

calendar years, the ratios of the maximum 8-hour concentrations to the maximum 1-hour concentrations are 0.3[2] and 0.3[3], respectively. The average of these two values provided the persistence factor of 0.3 used in this analysis. Monitoring data measured during the 1988 and 1989 calendar years were used in this analysis because they represent the most recently monitored data in which both 1-hour and 8-hour averaged summaries were available from DOH.

As summarized in Tables 2 through 5, no exceedances of the state or national 8-hour ambient air quality standards are anticipated.

3.0 PARKING VENTILATION EXHAUST EMISSIONS

A ventilation system will be used to prevent the accumulation of CO within the six-story underground parking lot. The ventilation system will consist of 6 fans per floor. These will pull supply-air from the Nuuanu Avenue side of the building, through the parking lot, and out through two air shafts on the Smith Street side of the building. While the parking ventilation system serves to mitigate the elevated levels of CO within the underground parking lot, the emissions from this system are another source of CO emissions that could impact persons on the Smith Street sidewalks and roadways, along with persons using the decks of the proposed Annex Tower. For these reasons, the potential impacts of the parking ventilation system exhaust were evaluated.

The SCREEN2 computer model was used to estimate the worst-case 1-hour concentration of CO from the proposed parking ventilation exhaust. SCREEN2 is an EPA-approved Gaussian dispersion model used to estimate pollutant concentrations from stationary point, volume, or area-type releases.

3.1 SCREEN2 Model Inputs

SCREEN2 model inputs include design parameters such as exhaust flow rate and area of release; emission rates based on an assumed steady-state concentration within the parking lot; the type of emission release (e.g., area, point, or volume); receptor heights and locations; and meteorology.

Design parameters were obtained from the architect; emissions rates were calculated based upon the concentration at which the ventilation system is programmed to operate and the air exchange rate; and a volume-type emission release was assumed because the air shafts

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[2] Highest 8-hour average (ppm)/Highest 1-hour value (ppm) = 3.03/9.1 = 0.3

[3] Highest 8-hour average (ppm)/Highest 1-hour value (ppm) = 2.39/8.4 = 0.3

will be baffled, thus restricting their otherwise vertical release. Calculations for design parameters and emission rates are attached.

Receptor locations evaluated included pedestrians on the Smith Street sidewalk and roads, along with building occupants visiting the fourth floor outdoor deck. Downwind distances of 1 to 40 meters (3.3 feet to 131.2 feet) were used to estimate potential exposure concentrations at these receptor locations.

Meteorological conditions assumed include an array of six atmospheric stability classes and various wind speeds to determine the worst-case meteorological condition that results in the highest 1-hour concentration of CO.

3.2 SCREEN2 Model Output

Table 6 summarizes the SCREEN2 model output for the two scenarios modeled. These scenarios include the emissions resulting from a parking ventilation system which is activated by concentrations of 25 ppm and 20 ppm of CO within the underground parking lot. The 25 ppm concentration is based upon a guideline level cited by the American Society of Heating Refrigerating and Air Conditioning Engineers (ASHRAE). The 20 ppm concentration will result in reduction of ventilation exhaust emissions.

SCREEN2 model results indicate that the maximum CO concentrations resulting from the parking ventilation system will not exceed state and national ambient air quality standards. The maximum 1-hour concentration resulting from the two proposed exhaust air shafts is 8.5 ppm when the ventilation system is activated at a concentration of 25 ppm of CO. When the system is activated at 20 ppm, the 1-hour maximum CO concentration is reduced to 6.8 ppm (Table 6). To minimize the cumulative impacts resulting from the exhaust air shafts of the parking ventilation system and adjacent roadway emissions, the ventilation exhaust should be operated when CO concentrations within the parking lot reach 20 ppm.

SCREEN2 model output files are attached. Each file output includes a summary of the model input parameters and the maximum 1-hour CO concentration.

4.0 SUMMARY OF FINDINGS

The results of this air quality impact analysis indicates that exceedances of the state 1-hour CO ambient air quality standard could occur, but are due primarily to the natural growth of existing vehicular traffic in the downtown area. The elimination of a separate left-turn phase from Smith Street to Nimitz Highway could reduce CO concentrations and should be considered. Reductions in traffic (and, consequently, CO emissions) should be addressed on a regional basis, but are beyond the scope of this analysis.

To minimize the cumulative effects of roadway emissions of CO and those from the parking ventilation system, the parking ventilation system should be operated when concentrations of CO reach 20 ppm rather than the original design of 25 ppm. This mitigation measure will minimize the potential for exceedances of the 1-hour state ambient air quality standard for CO.

Table 1
Carbon Monoxide Emission Factors

Speed (mph)	Emission Factor (grams/mile/vehicle)
2.5 (EPA-recommended speed used to estimate emissions during idling)[a]	168.3
15	40.6
25	26.8

a Emissions during periods of vehicular idling, in queues, were estimated by assuming a vehicular speed of 2.5 mph and then multiplying the resulting emission factor, in gram/mile/vehicle, by the assumed speed. The product yields emissions in grams/hour which can then be input into MOBILE5a. Source: U.S. EPA, MOBILE5 Information Sheet #2: Estimating Idle Emission Factors Using MOBILE5, July 30, 1993.

Table 2
Maximum 1-Hour and 8-Hour CO Concentrations
Hypothetical Worst-Case Conditions (D stability; 1 m/s wind speed)

	Project 1-Hour Averaged Concentrations (ppm)	Project 8-Hour Averaged Concentrations[d] (ppm)	Cumulative 1-Hour Averaged Concentrations (ppm)	Cumulative 8-Hour Averaged Concentrations (ppm)	Percent Contribution Due to Project (%)
Background CO Concentration (ppm)[a]	1.0	0.3	1.0	0.3	-
Maximum CO Concentration Based on CAL3QHC Model (ppm)[b]	1.9	0.6	12.8	3.8	14.8%
Total CO Concentration[c]	2.9	0.9	13.8	4.1	13.8%
Most Stringent AAQS (state)	9	4.5	9	4.5	-
Most Stringent AAQS Exceeded?	No	No	Yes	No	-
National AAQS	35	9.0	35	9.0	-
National AAQS Exceeded?	No	No	No	No	-

a Background concentration is expected to be negligible. However, a concentration of 1.0 ppm has been assumed for 1-hour periods; a concentration of 0.3 ppm has been assumed for 8-hour periods (see footnote d).

b Maximum CO concentrations obtained from CAL3QHC model runs are attached. Maximum cumulative concentration occurs at receptor 7 (10 feet from the intersection of Smith Street and Nimitz Highway, on the mauka-Ewa corner).

c Total CO Concentration = Background CO Concentration + Maximum CO Concentration Based on CAL3QHC Model

d 8-hour CO Concentration = 1-hour CO Concentration x 0.3, where 0.3 is an EPA persistence factor based upon the observed relationship between 1-hour and 8-hour averaged concentrations.

Table 3
Maximum 1-Hour and 8-Hour CO Concentrations
Reasonable Worst-Case Conditions (C stability; 2 m/s wind speed)

	Project 1-Hour Averaged Concentrations (ppm)	Project 8-Hour Averaged Concentrations[d] (ppm)	Cumulative 1-Hour Averaged Concentrations (ppm)	Cumulative 8-Hour Averaged Concentrations (ppm)	Percent Contribution Due to Project (%)
Background CO Concentration (ppm)[a]	1.0	0.3	1.0	0.3	-
Maximum CO Concentration Based on CAL3QHC Model (ppm)[b]	<0.05	0.0	5.5	1.7	0.9%
Total CO Concentration[c]	1.1	0.3	6.5	2.0	0.8%
Most Stringent AAQS (state)	9	4.5	9	4.5	-
Most Stringent AAQS Exceeded?	No	No	No	No	-
National AAQS	35	9.0	35	9.0	-
National AAQS Exceeded?	No	No	No	No	-

a Background concentration is expected to be negligible. However, a concentration of 1.0 ppm has been assumed for 1-hour periods; 0.3 ppm has been assumed for 8-hour periods (See Footnote d).

b Maximum CO concentrations obtained from CAL3QHC model runs are attached. Maximum cumulative concentration occurs at receptor 23 (approximately 180 feet southeast of the intersection of Smith Street and Nimitz Highway, and 10 feet mauka from Nimitz Highway).

c Total CO Concentration = Background CO Concentration + Maximum CO Concentration Based on CAL3QHC Model

d 8-hour CO Concentration = 1-hour CO Concentration x 0.3, where 0.3 is an EPA persistence factor based upon the observed relationship between 1-hour and 8-hour averaged concentrations.

Table 4
Maximum 1-Hour and 8-Hour CO Concentrations
Hypothetical Worst-Case Conditions (D stability; 1 m/s wind speed)
With Traffic Mitigation (Elimination of Left Turn from Smith Street to Nimitz Highway)

	Project 1-Hour Averaged Concentrations (ppm)	Project 8-Hour Averaged Concentrations[d] (ppm)	Cumulative 1-Hour Averaged Concentrations (ppm)	Cumulative 8-Hour Averaged Concentrations (ppm)	Percent Contribution Due to Project (%)
Background CO Concentration (ppm)[a]	1.0	0.3	1.0	0.3	-
Maximum CO Concentration Based on CAL3QHC Model (ppm)[b]	1.9	0.6	10.4	3.1	18.3%
Total CO Concentration[c]	2.9	0.9	11.4	3.4	16.7%
Most Stringent AAQS (state)	9	4.5	9	4.5	-
Most Stringent AAQS Exceeded?	No	No	Yes	No	-
National AAQS	35	9.0	35	9.0	-
National AAQS Exceeded?	No	No	No	No	-

a Background concentration is expected to be negligible. However, a concentration of 1.0 ppm has been assumed for 1-hour periods; a concentration of 0.3 ppm has been assumed for 8-hour periods (see footnote d).

b Maximum CO concentrations obtained from CAL3QHC model runs are attached. Maximum cumulative concentration occurs at receptor 7 (10 feet from the intersection of Smith Street and Nimitz Highway, on the mauka-ewa corner).

c Total CO Concentration = Background CO Concentration + Maximum CO Concentration Based on CAL3QHC Model

d 8-hour CO Concentration = 1-hour CO Concentration x 0.3, where 0.3 is an EPA persistence factor based upon the observed relationship between 1-hour and 8-hour averaged concentrations.

Table 5
Maximum 1-Hour and 8-Hour CO Concentrations
Reasonable Worst-Case Conditions (C stability; 2 m/s wind speed)
With Traffic Mitigation (Elimination of Left Turn from Smith Street to Nimitz Highway)

	Project 1-Hour Averaged Concentrations (ppm)	Project 8-Hour Averaged Concentrations[d] (ppm)	Cumulative 1-Hour Averaged Concentrations (ppm)	Cumulative 8-Hour Averaged Concentrations (ppm)	Percent Contribution Due to Project (%)
Background CO Concentration (ppm)[a]	1.0	0.3	1.0	0.3	-
Maximum CO Concentration Based on CAL3QHC Model (ppm)[b]	0.7	0.2	4.7	1.4	14.9%
Total CO Concentration[c]	1.7	0.5	5.7	1.7	12.3%
Most Stringent AAQS (state)	9	4.5	9	4.5	-
Most Stringent AAQS Exceeded?	No	No	Yes	No	-
National AAQS	35	9.0	35	9.0	-
National AAQS Exceeded?	No	No	No	No	-

a Background concentration is expected to be negligible. However, a concentration of 1.0 ppm has been assumed for 1-hour periods; a concentration of 0.3 ppm has been assumed for 8-hour periods (see footnote d).

b Maximum CO concentrations obtained from CAL3QHC model runs are attached. Maximum cumulative concentration occurs at receptor 7 (10 feet from the intersection of Smith Street and Nimitz Highway, on the mauka-ewa corner).

c Total CO Concentration = Background CO Concentration + Maximum CO Concentration Based on CAL3QHC Model

d 8-hour CO Concentration = 1-hour CO Concentration x 0.3, where 0.3 is an EPA persistence factor based upon the observed relationship between 1-hour and 8-hour averaged concentrations.

Table 6
Maximum 1-Hour and 8-Hour CO Concentrations
Parking Ventilation System Exhaust

Distance (meters)	25 ppm Ventilation Trigger 1-Hour Concentration (ppm)		20 ppm Ventilation Trigger 1-Hour Concentration (ppm)	
	Concentration from 1 Air Shaft Exhaust	Concentration from both Air Shaft Exhausts[a]	Concentration from 1 Air Shaft Exhaust	Concentration from both Air Shaft Exhausts[a]
1	0.0	-	0.0	-
3	6.9	-	5.5	-
5	5.8	-	4.6	-
10	4.1	-	3.3	-
15	3.1	-	2.5	-
20	2.6	-	2.0	-
25	2.1	-	1.7	-
30	1.9	-	1.5	-
35	1.6	8.5	1.3	6.8
40	1.4	-	1.2	-
State AAQS	9.0	9.0	9.0	4.5
National AAQS	35.0	35.0	35.0	9.0
AAQS Exceeded?	NO	NO	NO	NO

[a] Concentration from both air shaft exhausts = Max.concentration from 1 air shaft exhaust + Concentration at 35 meters. Concentration due to emissions from both air shafts were determined at the 35 meter distance, since the two air shafts are located approximately 120 feet (36 meter) from each other (Stringer Tusher Architects, Inc. Bank of Hawaii Annex Tower Design Drawings, August 9, 1995).

MOBILE5a Model Output

1 BANK OF HAWAII Mobile Emissions for Peak-Hour Emissions:100695:LAM
MOBILE5a (26-Mar-93)
0
-M146 Warning:
+ Diurnal emissions are zero when Tmax-Tmin<1. The minimum and maximum temperatures of the day must be used to get the proper diurnal output.

0Peak-Hour

Minimum Temp: 65. (F) Maximum Temp: 65. (F)
Period 1 RVP: 11.5 Period 2 RVP: 11.5 Period 2 Start Yr: 1995

0VOC HC emission factors include all evaporative HC emission factors, except for refueling emissions.

0

0Emission factors are as of Jan. 1st of the indicated calendar year.
0Cal. Year: 1999 I/M Program: No Ambient Temp: 65.0 / 65.0 / 65.0 (F) Region: Low
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6 Altitude: 500. Ft.
Reformulated Gas: No

0 Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
+ Veh. Speeds:	25.0	25.0	25.0		25.0	25.0	25.0	25.0	25.0	
VMT Mix:	0.619	0.189	0.085		0.031	0.002	0.001	0.066	0.006	
0Composite Emission Factors (Gm/Mile)										
VOC HC:	2.45	2.66	3.63	2.96	4.54	0.57	0.78	1.88	2.34	2.610
Exhaust HC:	1.62	2.00	2.80	2.25	2.58	0.57	0.78	1.88	1.72	1.838
Evaporat HC:	0.22	0.19	0.20	0.19	0.87				0.36	0.220
Refuel L HC:	0.21	0.28	0.28	0.28	0.47					0.221
Runing L HC:	0.56	0.43	0.59	0.48	1.02					0.512
Rsting L HC:	0.04	0.04	0.04	0.04	0.07				0.26	0.041
Exhaust CO:	25.19	29.45	39.45	32.57	50.34	1.27	1.42	9.05	17.57	26.808
Exhaust NOX:	1.64	1.89	2.58	2.10	5.27	1.32	1.48	10.46	0.99	2.457

@ 25mph

Weathered RVP: 11.5
Hot Soak Temp: 65.0 (F)
Running Loss Temp: 65.0 (F)
Resting Loss Temp: 65.0 (F)

0Evaporative Emissions by Component
(Hot Soak: g/trip, Diurnals: g, Crankcase: g/mi, Refuel: g/gal, Resting: g/hr)

	LDGV	LDGT1	LDGT2	LDGT	HDGV	MC
Hot Soak	2.04	1.74	2.06	1.84	3.73	2.69
WtDiurnal	0.00	0.00	0.00	0.00	0.00	0.00
Multiple	0.00	0.00	0.00	0.00	0.00	
Crankcase	0.01	0.01	0.01	0.01	0.02	0.00
Refuel	4.72	4.72	4.72	4.72	4.72	
Resting	0.05	0.05	0.05	0.05	0.07	0.11

1 BANK OF HAWAII Mobile Emissions for Peak-Hour Emissions:041495:LAM
MOBILE5a (26-Mar-93)
0
-M146 Warning:
+ Diurnal emissions are zero when Tmax-Tmin<1. The minimum and maximum temperatures of the day must be used to get the proper diurnal output.

Minimum Temp: 65. (F) Maximum Temp: 65. (F)
0Peak-Hour
Period 1 RVP: 11.5 Period 2 RVP: 11.5 Period 2 Start Yr: 1995
0VOC HC emission factors include all evaporative HC emission factors, except for refueling emissions.

0
0Emission factors are as of Jan. 1st of the indicated calendar year.
0Cal. Year: 1999 I/M Program: No Ambient Temp: 65.0 / 65.0 / 65.0 (F) Region: Low
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6 Altitude: 500. Ft.
Reformulated Gas: No

0 Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
Veh. Speeds:	15.0	15.0	15.0		15.0	15.0	15.0	15.0	15.0	
VMT Mix:	0.619	0.189	0.085		0.031	0.002	0.001	0.066	0.006	
0Composite Emission Factors (Gm/Mile)										
VOC HC:	3.86	3.96	5.41	4.41	7.73	0.82	1.13	2.73	3.10	4.042
Exhaust HC:	2.38	2.89	4.07	3.26	4.89	0.82	1.13	2.73	2.48	2.718
Evaporat HC:	0.22	0.19	0.20	0.19	0.87				0.36	0.220
Refuel L HC:	0.21	0.28	0.28	0.28	0.47					0.221
Runing L HC:	1.21	0.84	1.11	0.92	1.91					1.063
Rsting L HC:	0.04	0.04	0.04	0.04	0.07				0.26	0.041
Exhaust CO:	38.00	43.46	58.64	48.19	86.39	2.13	2.39	15.16	29.32	40.621
Exhaust NOX:	1.63	1.88	2.56	2.09	4.73	1.61	1.80	12.72	0.82	2.582

@ 15mph

Weathered RVP: 11.5 Hot Soak Temp: 65.0 (F)
Running Loss Temp: 65.0 (F)
Resting Loss Temp: 65.0 (F)

0Evaporative Emissions by Component
(Hot Soak: g/trip, Diurnals: g, Crankcase: g/mi, Refuel: g/gal, Resting: g/hr)

	LDGV	LDGT1	LDGT2	LDGT	HDGV	MC
Hot Soak	2.04	1.74	2.06	1.84	3.73	2.69
WtDiurnal	0.00	0.00	0.00	0.00	0.00	0.00
Multiple	0.00	0.00	0.00	0.00	0.00	
Crankcase	0.01	0.01	0.01	0.01	0.02	0.00
Refuel	4.72	4.72	4.72	4.72	4.72	
Resting	0.05	0.05	0.05	0.05	0.07	0.11

1 BANK OF HAWAII Idle Emissions for Peak-Hour Emissions:041495:LAM
MOBILE5a (26-Mar-93)
0
-M146 Warning:
+ Diurnal emissions are zero when Tmax-Tmin<1. The minimum and maximum temperatures of the day must be used to get the proper diurnal output.

0Peak-Hour Minimum Temp: 65. (F) Maximum Temp: 65. (F)
Period 1 RVP: 11.5 Period 2 RVP: 11.5 Period 2 Start Yr: 1995
0VOC HC emission factors include all evaporative HC emission factors, except for refueling emissions.
0

0Emission factors are as of Jan. 1st of the indicated calendar year.
0Cal. Year: 1999 I/M Program: No Ambient Temp: 65.0 / 65.0 / 65.0 (F) Region: Low
Anti-tam. Program: No Operating Mode: 20.6 / 27.3 / 20.6 Altitude: 500. Ft.
Reformulated Gas: No

0 Veh. Type:	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC	All Veh
+										
Veh. Speeds:	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	
VMT Mix:	0.619	0.189	0.085		0.031	0.002	0.001	0.066	0.006	
0Composite Emission Factors (Gm/Mile)										
VOC HC:	24.33	25.20	35.58	28.43	42.06	1.49	2.04	4.93	10.96	24.565
Exhaust HC:	10.18	12.63	18.40	14.43	13.71	1.49	2.04	4.93	10.34	11.087
Evaporat HC:	0.22	0.19	0.20	0.19	0.87				0.36	0.220
Refuel L HC:	0.21	0.28	0.28	0.28	0.47					0.221
Runing L HC:	13.88	12.33	16.94	13.77	27.42					13.217
Rsting L HC:	0.04	0.04	0.04	0.04	0.07				0.26	0.04[illegible]
Exhaust CO:	159.69	188.20	271.04	214.02	231.18	5.24	5.87	37.33	163.09	168.270
Exhaust NOX:	2.38	2.73	3.67	3.03	4.19	2.51	2.81	19.85	0.99	3.766

0Evaporative Emissions by Component Weathered RVP: 11.5 Hot Soak Temp: 65.0 (F)
(Hot Soak: g/trip, Diurnals: g, Crankcase: g/mi, Refuel: g/gal, Resting: g/hr) Running Loss Temp: 65.0 (F)
Resting Loss Temp: 65.0 (F)

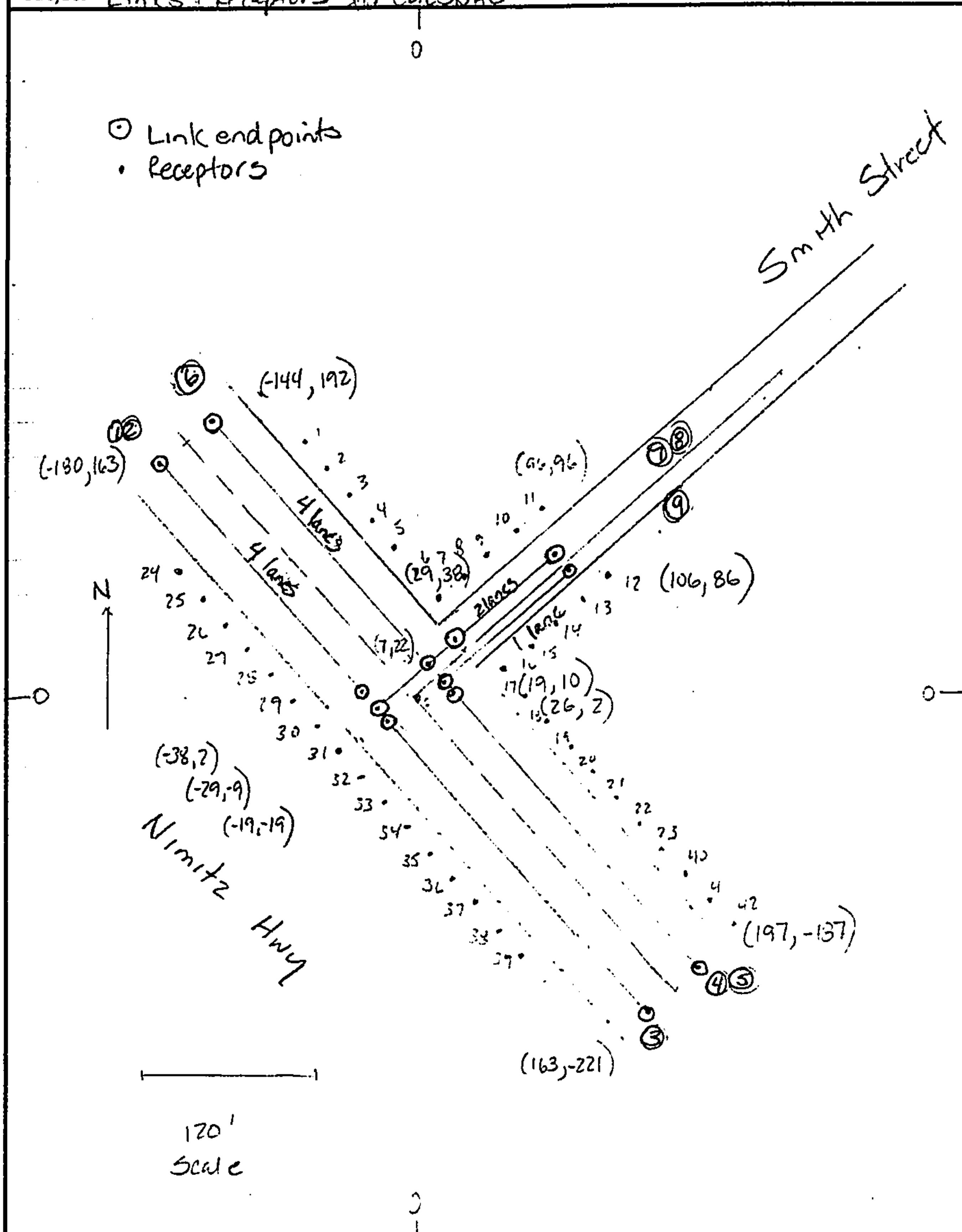
	LDGV	LDGT1	LDGT2	LDGT	HDGV	LDDV	LDDT	HDDV	MC
Hot Soak	2.04	1.74	2.06	1.84	3.73				2.69
WtDiurnal	0.00	0.00	0.00	0.00	0.00				0.00
Multiple	0.00	0.00	0.00	0.00	0.00				
Crankcase	0.01	0.01	0.01	0.01	0.02				0.00
Refuel	4.72	4.72	4.72	4.72	4.72				
Resting	0.05	0.05	0.05	0.05	0.07				0.11

Idle emission rate = 168.3 g/mile * 2.5 mile/hr = 420.8 g/hr

Source: U.S.EPA, MOBILE5 Information Sheet #2: Estimating Idle Emission Factors Using MOBILE5, July 30, 1993.

Schematic of Roadway Links and Receptors

Project BOH Annex Tower EA	Sheet No. 1 of 1	BELT COLLINS & ASSOCIATES Engineering • Planning Landscape Architecture
Job No. 533.0401, E02	Date 10/95	
Client	By Lam	
Subject Links & Receptors for CAL3QHC		



CAL3QHC Model Output

Model Run #1: Cumulative Impacts

- Hypothetical Worst-Case (D stability, 1 meter per second wind speed)
- Reasonable Worst-Case (C stability, 2 meter per second wind speed)

Model Run #2: Project Only Impacts

- Hypothetical Worst-Case (D stability, 1 meter per second wind speed)
- Reasonable Worst-Case (C stability, 2 meter per second wind speed)

Model Run #3: Cumulative Impacts with Traffic Mitigation (Elimination of left turn from Smith Street to Nimitz Highway)

- Hypothetical Worst-Case (D stability, 1 meter per second wind speed)
- Reasonable Worst-Case (C stability, 2 meter per second wind speed)

Model Run #4: Project-Only Impacts with Traffic Mitigation (Elimination of left turn from Smith Street to Nimitz Highway)

- Hypothetical Worst-Case (D stability, 1 meter per second wind speed)
- Reasonable Worst-Case (C stability, 2 meter per second wind speed)

1 CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0, JANUARY 1992 PAGE 1

JOB: BOH CO:CUMULATIVE IMPACTS:100695:LAM RUN: NUUANU & SMITH INTERSECTION
DATE: 10/08/95 TIME: 14:44

SITE & METEOROLOGICAL VARIABLES

VS = 0.0 CM/S VD = 0.0 CM/S Z0 = 321. CM
U = 1.0 M/S CLAS = 4 (D) ATIM = 60. MINUTES MIXH = 1000. M AMB = 0.0 PPM

LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	LENGTH (FT)	BRG (DEG)	TYPE	VPH	EF (G/MI)	H (FT)	W (FT)	V/C	QUEUE (VEH)
1. SB Nimitz-Appr.	-29.0	-9.0	-180.0	163.0	229.	319.	AG	3911.	27.0	0.0	68.0		
2. SB Nimitz-Queus	-38.0	2.0	-108.7	82.1	107.	319.	AG	602.	100.0	0.0	48.0	0.73	5.4
3. SB Nimitz-Depart.	-29.0	-9.0	163.0	-221.0	286.	138.	AG	3689.	27.0	0.0	68.0		
4. NB Nimitz-Appr.	7.0	22.0	197.0	-187.0	282.	138.	AG	4671.	27.0	0.0	68.0		
5. NB Nimitz-Queue	26.0	2.0	634.8	-670.9	907.	138.	AG	1204.	100.0	0.0	48.0	1.03	46.1
6. NB Nimitz-Depart.	7.0	22.0	-144.0	192.0	227.	318.	AG	4337.	27.0	0.0	68.0		
7. SW-B Smith -Appr.	-29.0	-9.0	96.0	96.0	163.	50.	AG	94.	41.0	0.0	44.0		
8. SW-B Smith -Queue	29.0	38.0	62.5	67.0	44.	49.	AG	1956.	100.0	0.0	24.0	0.28	2.3
9. NE-B Smith	19.0	10.0	106.0	86.0	116.	49.	AG	554.	41.0	0.0	32.0		

1 PAGE 2

JOB: BOH CO:CUMULATIVE IMPACTS:100695:LAM RUN: NUUANU & SMITH INTERSECTION
DATE: 10/08/95 TIME: 14:44

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
2. SB Nimitz-Queue	150	20	2.0	3911	1600	420.80	3	1
5. NB Nimitz-Queue	150	40	2.0	4671	1600	420.80	3	1
8. SW-B Smith -Queue	150	130	2.0	94	1600	420.80	3	1

RECEPTOR LOCATIONS

RECEPTOR	X	Y	Z
1. REC 1	-31.0	178.0	6.0
2. REC 2	-62.0	158.0	6.0
3. REC 3	-48.0	142.0	6.0
4. REC 4	-31.0	122.0	6.0
5. REC 5	-17.0	103.0	6.0
6. REC 6	0.0	86.0	6.0
7. REC 7	14.0	67.0	6.0
8. REC 8	34.0	82.0	6.0
9. REC 9	48.0	98.0	6.0
10. REC 10	67.0	113.0	6.0
11. REC 11	86.0	130.0	6.0
12. REC 12	134.0	82.0	6.0
13. REC 13	115.0	67.0	6.0
14. REC 14	96.0	48.0	6.0
15. REC 15	82.0	34.0	6.0
16. REC 16	62.0	19.0	6.0
17. REC 17	72.0	0.0	6.0
18. REC 18	91.0	-19.0	6.0
19. REC 19	108.0	-36.0	6.0
20. REC 20	122.0	-53.0	6.0
21. REC 21	139.0	-72.0	6.0
22. REC 21	154.0	-91.0	6.0
23. REC 23	170.0	-108.0	6.0
24. REC 24	-168.0	89.0	6.0
25. REC 25	-149.0	67.0	6.0
26. REC 26	-134.0	50.0	6.0
27. REC 27	-120.0	34.0	6.0
28. REC 28	-101.0	14.0	6.0
29. REC 29	-86.0	0.0	6.0
30. REC 30	-72.0	-19.0	6.0
31. REC 31	-53.0	-38.0	6.0
32. REC 32	-38.0	-55.0	6.0
33. REC 33	-24.0	-72.0	6.0
34. REC 34	-7.0	-89.0	6.0
35. REC 35	10.0	-110.0	6.0
36. REC 36	24.0	-125.0	6.0
37. REC 37	41.0	-144.0	6.0
38. REC 38	57.0	-163.0	6.0
39. REC 39	72.0	-182.0	6.0
40. REC 40	187.0	-125.0	6.0
41. REC 41	204.0	-144.0	6.0
42. REC 42	221.0	-161.0	6.0

1 PAGE 3

JOB: BOH CO:CUMULATIVE IMPACTS:100695:LAM RUN: NUUANU & SMITH INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR) * CONCENTRATION (PPM)

WIND ANGLE (DEGR)	REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
10.	0.0	0.2	0.2	0.2	0.3	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.9	2.5	1.4	0.6	0.4	0.3
20.	0.0	0.1	0.1	0.1	0.2	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.7	1.8	0.7	0.3	0.2	0.2
30.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.5	1.1	0.3	0.1	0.0	0.1
40.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.7	0.1	0.0	0.0	0.0
50.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.0	0.0	0.0	0.0
60.	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0
70.	0.0	0.0	0.0	0.0	0.1	0.1	1.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.1
80.	0.0	0.1	0.1	0.1	0.2	0.4	2.2	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.3	0.2	0.3
90.	0.0	0.2	0.2	0.4	0.6	1.1	3.3	0.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	0.4	0.3	0.4
100.	0.0	0.4	0.4	0.6	1.0	1.8	4.2	1.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.6	0.5	0.5	0.5
110.	0.0	0.8	0.9	1.3	2.0	2.8	5.0	2.3	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.5	1.0	0.8	0.7	0.8
120.	0.6	1.9	2.1	2.5	3.5	4.4	6.4	3.5	0.7	0.4	0.0	0.0	0.1	0.1	0.3	1.4	2.2	1.9	1.7	1.8
130.	1.7	4.4	4.6	5.2	6.2	7.0	9.0	5.8	1.7	0.9	0.2	0.2	0.3	0.7	1.3	3.8	5.0	4.5	4.0	4.0
140.	3.8	7.3	7.4	8.1	9.1	9.8	11.9	8.6	4.0	2.1	1.1	0.8	1.2	2.0	3.1	7.2	8.6	7.9	7.2	7.2
150.	5.6	8.6	8.8	9.4	10.0	10.9	12.8	11.0	6.6	3.5	2.2	1.6	2.2	3.5	5.1	9.6	10.9	10.1	9.5	9.3
160.	6.0	8.2	8.4	8.7	9.2	9.9	11.7	12.0	8.8	5.1	3.5	2.5	3.3	4.8	6.6	10.4	11.3	10.7	10.1	10.0
170.	5.5	7.6	7.6	7.6	7.9	8.5	9.7	11.5	9.7	6.2	4.6	3.3	4.2	5.6	7.1	10.2	11.0	10.6	10.2	10.2
180.	5.0	6.8	6.9	6.9	6.7	7.2	8.0	10.0	9.4	6.9	5.2	3.9	4.7	5.8	7.2	9.7	10.2	10.1	9.8	9.9
190.	4.7	6.4	6.5	6.5	6.2	6.2	6.7	8.3	8.4	7.2	5.5	4.1	4.7	5.6	6.8	9.0	9.6	9.3	9.3	9.3
200.	4.4	5.8	6.1	6.1	6.0	5.8	6.0	6.7	7.2	6.7	5.3	4.0	4.7	5.6	6.7	8.5	9.0	8.8	8.6	8.7
210.	4.1	5.4	5.6	5.9	6.0	5.7	5.9	5.6	6.0	6.1	5.2	4.1	4.6	5.6	6.5	8.2	8.7	8.5	8.4	8.5
220.	4.1	5.3	5.6	6.0	6.1	6.0	6.0	5.0	5.0	5.2	4.7	4.4	4.9	5.4	6.1	8.1	8.9	8.7	8.7	8.7
230.	3.8	5.4	5.7	6.0	6.3	6.1	6.1	5.0	4.1	4.2	4.0	4.9	5.5	5.5	6.2	8.0	9.0	9.0	8.9	9.0
240.	3.7	4.9	5.1	5.6	5.9	6.0	6.0	4.8	4.1	3.8	3.3	5.2	6.0	6.0	6.2	7.6	8.7	8.5	8.4	8.5
250.	3.3	4.7	4.9	5.3	5.7	5.9	6.1	4.9	4.2	3.5	3.1	5.3	6.5	6.6	6.4	7.5	8.6	8.4	8.4	8.4
260.	3.0	4.7	5.0	5.4	5.8	6.0	6.4	4.9	4.1	3.3	2.7	5.1	6.4	7.6	7.0	7.6	8.6	9.0	9.0	9.0
270.	2.3	4.4	5.0	5.4	5.9	6.0	6.4	4.9	3.8	3.1	2.3	4.3	6.2	7.9	7.9	8.1	9.3	9.6	9.8	9.8
280.	1.6	4.0	4.6	5.2	5.8	6.0	6.5	4.6	3.3	2.5	1.7	3.3	5.1	7.8	8.5	8.6	9.5	10.2	10.4	10.6
290.	0.9	3.3	4.0	4.7	5.3	5.5	6.2	3.9	2.5	1.6	1.0	2.0	3.6	6.8	8.5	8.9	9.7	10.3	10.5	11.1
300.	0.4	2.5	3.2	3.9	4.5	4.8	5.5	2.8	1.5	0.9	0.4	0.9	2.2	5.2	7.7	8.9	9.4	10.1	10.2	10.8
310.	0.1	1.9	2.4	3.0	3.6	3.8	4.4	1.6	0.7	0.3	0.1	0.2	1.2	3.2	6.1	8.5	8.5	8.4	8.5	9.1
320.	0.0	1.3	1.5	1.9	2.5	2.4	3.0	0.7	0.2	0.1	0.0	0.0	0.8	1.7	4.5	7.2	7.0	6.4	6.0	6.4
330.	0.0	0.6	0.8	0.9	1.3	1.2	1.5	0.2	0.0	0.0	0.0	0.0	0.4	1.1	3.0	5.8	5.1	4.2	3.6	3.5
340.	0.0	0.3	0.4	0.5	0.7	0.6	0.8	0.0	0.0	0.0	0.0	0.0	0.3	0.7	2.0	4.9	3.9	2.8	2.0	1.9
350.	0.0	0.3	0.3	0.3	0.4	0.4	0.5	0.0	0.0	0.0	0.0	0.0	0.2	0.7	1.4	4.2	2.9	1.7	1.0	1.1
360.	0.0	0.2	0.2	0.3	0.3	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.2	0.7	1.0	3.4	2.1	1.2	0.7	0.7
MAX	6.0	8.6	8.8	9.4	10.0	10.9	12.8	12.0	9.7	7.2	5.5	5.3	6.5	7.9	8.5	10.4	11.3	10.7	10.5	11.1
DEGR.	160	150	150	150	150	150	150	160	170	190	190	250	250	270	280	160	160	160	290	290

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JOB: BOH CO:CUMULATIVE IMPACTS:100695:LAM RUN: NUUANU & SMITH INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR) * CONCENTRATION (PPM)

WIND ANGLE (DEGR)	REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
10.	0.3	0.4	0.4	3.7	4.6	5.1	5.9	6.7	6.9	6.9	6.3	6.0	6.3	6.8	7.3	7.6	7.6	7.4	7.3	0.3
20.	0.2	0.3	0.2	4.1	4.6	5.1	5.9	6.5	6.7	6.5	6.1	6.3	6.5	6.9	7.3	7.3	7.0	6.9	6.8	0.2
30.	0.1	0.1	0.1	4.4	4.7	5.2	5.9	6.2	6.4	6.4	6.1	6.7	6.9	7.0	7.0	7.0	6.8	6.7	6.6	0.1
40.	0.0	0.0	0.0	4.8	5.0	5.7	6.3	6.4	6.8	6.6	6.5	6.9	7.1	7.2	7.0	6.9	6.9	6.8	6.7	0.0
50.	0.0	0.0	0.0	5.0	5.2	6.1	6.5	6.8	7.3	7.2	6.9	7.2	7.2	7.2	6.9	7.0	7.0	6.9	6.8	0.0
60.	0.0	0.0	0.0	4.8	5.3	6.2	6.5	7.0	7.7	7.3	6.8	6.9	6.9	6.8	6.8	6.8	6.8	6.7	6.6	0.0
70.	0.1	0.2	0.2	5.0	5.6	6.6	6.7	7.4	7.8	7.2	6.7	6.9	6.8	6.8	6.7	6.7	6.7	6.7	6.4	0.1
80.	0.3	0.3	0.3	5.6	6.7	7.4	7.7	7.9	8.0	7.2	6.9	7.1	7.1	7.1	6.9	6.9	6.9	6.8	6.4	0.2
90.	0.4	0.5	0.5	6.5	7.7	8.3	8.6	8.5	8.3	7.2	7.5	7.6	7.5	7.5	7.3	7.4	7.2	6.8	6.2	0.3
100.	0.5	0.6	0.6	7.6	8.6	8.8	8.8	8.6	8.6	7.8	8.1	8.0	7.8	7.8	7.5	7.4	7.1	6.6	5.7	0.4
110.	0.7	0.9	0.9	8.6	9.3	9.3	9.3	8.9	8.9	8.1	8.2	8.0	7.8	7.8	7.3	7.0	6.6	6.0	5.1	0.6
120.	1.7	1.9	1.7	9.1	9.3	9.2	8.8	8.8	8.6	7.9	8.0	7.5	7.3	7.1	6.6	6.2	5.7	5.0	4.4	1.4
130.	3.9	4.1	3.7	7.8	7.7	7.5	7.2	7.0	6.9	6.2	6.2	5.9	5.6	5.5	4.9	4.6	4.3	3.8	3.1	3.2
140.	6.9	6.9	6.4	4.9	4.7	4.5	4.2	4.2	4.3	3.5	3.8	3.6	3.3	3.3	2.8	2.7	2.4	2.2	1.7	5.6
150.	8.9	8.8	8.0	2.1	1.8	1.8	1.8	1.7	1.7	1.4	1.6	1.6	1.3	1.4	1.2	1.1	1.1	0.8	0.6	7.0
160.	9.6	9.4	8.5	0.6	0.6	0.6	0.6	0.7	0.6	0.3	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.3	0.2	7.3
170.	9.8	9.6	8.7	0.2	0.2	0.2	0.2	0.3	0.2	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	7.5
180.	9.7	9.5	8.8	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	7.7

190.	9.3	9.2	8.7	0.2	0.1	0.1	0.1	0.2	0.1	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	7.8
200.	8.7	8.8	8.5	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	8.1
210.	8.5	8.6	8.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.3
220.	8.7	8.9	8.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.7
230.	9.0	9.1	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0
240.	8.5	8.6	8.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.6
250.	8.4	8.6	8.6	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	8.6
260.	9.0	9.2	9.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	9.1
270.	9.9	9.9	9.9	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.1	9.7
280.	10.7	10.8	10.9	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	10.8
290.	11.3	11.6	11.7	0.2	0.2	0.2	0.2	0.3	0.4	0.3	0.3	0.1	0.2	0.4	0.3	0.4	0.4	0.3	0.2	11.7
300.	11.0	12.0	12.0	0.3	0.3	0.4	0.4	0.5	0.7	0.6	0.8	0.6	0.7	0.9	0.8	0.9	0.8	0.8	0.6	11.8
310.	9.5	10.2	10.4	0.5	0.7	0.8	0.9	1.1	1.5	1.6	1.9	1.9	1.9	2.3	2.0	2.1	2.2	2.1	1.8	10.4
320.	6.5	7.2	7.3	1.0	1.4	1.6	1.9	2.4	3.0	3.1	3.6	3.7	3.9	4.2	4.0	4.2	4.1	4.3	4.1	7.1
330.	3.5	3.9	3.7	1.5	2.1	2.5	3.0	3.9	4.6	4.8	5.5	5.5	5.5	5.7	5.6	5.8	6.1	6.1	6.2	3.5
340.	1.8	1.9	1.7	1.9	2.7	3.3	4.0	5.1	5.9	6.2	6.7	6.7	6.4	6.5	6.6	6.7	7.2	7.3	7.4	1.6
350.	0.9	0.9	0.9	2.5	3.5	4.1	4.9	6.0	6.7	6.9	7.1	6.7	6.5	6.6	7.0	7.3	7.6	7.7	7.9	0.7
360.	0.6	0.6	0.6	3.1	4.2	4.8	5.6	6.6	7.2	7.1	7.0	6.5	6.1	6.8	7.2	7.5	7.9	7.7	7.6	0.5
MAX	11.3	12.0	12.0	9.1	9.3	9.3	9.3	8.9	8.9	8.1	8.2	8.0	7.8	7.8	7.5	7.6	7.9	7.7	7.9	11.8
DEGR.	290	300	300	120	110	110	110	110	110	110	110	100	110	110	100	10	360	360	350	300

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JOB: BOH CO:CUMULATIVE IMPACTS:100695:LAM RUN: NUUANU & SMITH INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC41	REC42
10.	0.3	0.3
20.	0.2	0.2
30.	0.1	0.1
40.	0.0	0.0
50.	0.0	0.0
60.	0.0	0.0
70.	0.0	0.0
80.	0.0	0.0
90.	0.0	0.0
100.	0.1	0.1
110.	0.2	0.2
120.	1.0	0.7
130.	2.7	1.9
140.	4.9	3.6
150.	6.2	4.8
160.	6.3	4.9
170.	6.1	4.7
180.	6.1	4.4
190.	6.2	4.2
200.	6.7	4.1
210.	7.5	4.6
220.	8.3	5.7
230.	8.8	6.8
240.	8.7	7.5
250.	8.7	7.9
260.	9.2	8.6
270.	9.8	9.4
280.	10.7	10.3
290.	11.6	11.4
300.	12.0	12.1
310.	10.7	10.5
320.	7.3	7.1
330.	3.8	3.4
340.	1.5	1.5
350.	0.6	0.6
360.	0.5	0.4
MAX	12.0	12.1
DEGR.	300	300

* THE HIGHEST CONCENTRATION IS 12.80 PPM AT 150 DEGREES FROM REC7 .

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JOB: BOH CO:CUMULATIVE IMPACTS:100695:LAM RUN: NUUANU & SMITH INTERSECTION
DATE: 10/08/95 TIME: 14:44

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

LINK #	REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
ANGLE (DEGREES)	160	150	150	150	150	150	150	160	170	190	190	250	250	270	280	160	160	160	290	290
1	0.2	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.8	1.3	1.5	0.0	0.0	0.0	1.2	1.0
2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.5	0.5	0.0	0.0	0.0	0.4	0.3
3	1.0	1.0	1.1	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.0	0.3	0.4	0.1	0.1	1.4	1.4	1.2	0.7	1.0
4	1.4	1.6	1.8	2.2	2.6	3.1	3.9	2.9	2.4	1.7	1.6	0.6	0.8	0.5	0.7	4.5	4.9	4.7	4.0	4.3
5	1.4	1.8	2.0	2.3	2.6	3.1	3.6	2.8	2.1	1.3	1.2	0.2	0.3	0.0	0.0	4.5	5.0	4.8	3.0	3.5
6	1.2	3.2	2.9	2.6	2.3	1.6	1.1	0.1	0.1	0.2	0.1	0.9	1.0	1.7	2.1	0.0	0.0	0.0	1.0	0.8
7	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
8	0.6	0.5	0.6	0.7	1.0	1.5	2.5	4.4	3.3	2.3	1.0	1.4	1.9	2.9	2.8	0.0	0.0	0.0	0.1	0.1
9	0.1	0.1	0.1	0.2	0.2	0.3	0.4	0.5	0.5	0.5	0.5	0.7	0.9	0.8	0.7	0.0	0.0	0.0	0.1	0.1

CO/LINK (PPM)

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JOB: BOH CO:CUMULATIVE IMPACTS:100695:LAM RUN: NUUANU & SMITH INTERSECTION
DATE: 10/08/95 TIME: 14:44

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

CO/LINK (PPM)

LINK #	REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
ANGLE (DEGREES)	290	300	300	120	110	110	110	110	110	110	110	100	110	110	100	10	360	360	350	300
1	0.8	0.9	0.8	3.3	3.3	3.1	2.7	2.2	1.8	0.8	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.3	0.7
2	0.3	0.3	0.2	1.0	1.4	1.4	1.2	0.8	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2
3	1.2	0.9	1.1	0.9	0.7	0.9	1.2	1.6	2.2	2.9	3.7	3.4	3.5	3.6	3.3	2.9	3.2	3.1	3.2	1.2
4	4.5	4.8	4.9	1.3	1.3	1.5	1.8	2.1	2.2	2.2	2.2	2.4	2.0	1.9	2.0	2.1	2.0	2.1	1.8	4.9
5	3.8	3.9	4.0	1.5	1.1	1.3	1.5	1.8	2.1	2.2	2.3	2.2	2.3	2.3	2.2	1.5	1.4	1.6	1.4	4.1
6	0.6	0.9	0.7	0.8	1.1	0.8	0.6	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.3	0.6	0.6
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.1	0.2	0.2	0.2	0.3	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.5	0.4	0.4	0.1
9	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.0

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JOB: BOH CO:CUMULATIVE IMPACTS:100695:LAM RUN: NUUANU & SMITH INTERSECTION
DATE: 10/08/95 TIME: 14:44

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

CO/LINK (PPM)

LINK #	REC41	REC42
ANGLE (DEGREES)	300	300
1	0.6	0.6
2	0.2	0.2
3	1.3	1.4
4	5.1	5.1
5	4.2	4.2
6	0.5	0.5
7	0.0	0.0
8	0.1	0.1
9	0.0	0.0

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JOB: BOH CO:CUMULATIVE IMPACTS:100695:LAM RUN: NUUANU & SMITH INTERSECTION

METEOROLOGICAL VARIABLES

U = 2.0 M/S CLAS = 3 (C) ATIM = 60. MINUTES MIXH = 1000. M AMB = 0.0 PPM

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JOB: BOH CO:CUMULATIVE IMPACTS:100695:LAM RUN: NUUANU & SMITH INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
10.	0.0	0.1	0.1	0.1	0.2	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	1.3	0.8	0.5	0.4	0.3
20.	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	1.0	0.6	0.3	0.1	0.1
30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.7	0.2	0.0	0.0	0.0
40.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.5	0.1	0.0	0.0	0.0
50.	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.1	0.0	0.0	0.0
60.	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.0
70.	0.0	0.0	0.0	0.0	0.0	0.1	0.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
80.	0.0	0.1	0.1	0.1	0.2	0.5	1.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.1	0.1
90.	0.0	0.2	0.3	0.3	0.5	0.7	1.6	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.4	0.3	0.3
100.	0.0	0.5	0.5	0.7	0.8	1.0	2.1	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.7	0.6	0.6	0.6
110.	0.3	0.9	1.0	1.1	1.4	1.7	2.7	1.6	0.4	0.2	0.0	0.0	0.0	0.1	0.2	0.9	1.2	1.2	1.1	1.1
120.	0.5	1.6	1.7	1.8	2.2	2.6	3.7	2.3	0.8	0.4	0.1	0.1	0.1	0.3	0.5	1.6	2.1	2.0	1.7	1.8
130.	1.2	2.5	2.5	2.7	3.1	3.5	4.5	3.3	1.7	0.6	0.3	0.2	0.4	0.6	1.1	2.7	3.1	2.9	2.7	2.7
140.	1.7	3.3	3.2	3.4	3.8	4.2	5.2	4.1	2.5	1.2	0.8	0.5	0.8	1.2	1.8	3.6	4.1	3.9	3.6	3.6
150.	2.2	3.5	3.7	4.0	4.0	4.5	5.5	4.8	3.2	1.8	1.2	0.9	1.2	1.8	2.5	4.3	4.8	4.6	4.3	4.3
160.	2.5	3.8	3.8	4.0	4.3	4.5	5.3	4.9	3.6	2.5	1.6	1.3	1.6	2.2	3.1	4.7	5.1	4.8	4.7	4.6
170.	2.6	3.9	3.8	4.0	4.1	4.4	4.9	4.9	3.9	2.9	2.0	1.6	1.9	2.7	3.3	4.9	5.3	5.1	4.9	4.9
180.	2.5	3.6	3.6	3.8	3.7	3.9	4.6	5.0	4.1	3.1	2.3	1.8	2.2	2.9	3.5	4.9	5.2	5.1	4.9	4.9
190.	2.5	3.4	3.4	3.3	3.5	3.5	4.1	4.4	3.9	3.3	2.4	1.9	2.2	2.8	3.4	4.6	5.0	4.9	4.8	4.9
200.	2.4	3.2	3.2	3.5	3.4	3.2	3.8	4.0	3.7	3.2	2.4	2.2	2.4	2.9	3.5	4.5	5.0	4.8	4.8	4.7
210.	2.3	3.0	3.2	3.4	3.4	3.4	3.6	3.6	3.5	2.9	2.3	2.1	2.3	2.7	3.4	4.5	5.0	4.9	4.9	4.9
220.	2.3	3.1	3.2	3.3	3.4	3.5	3.5	3.1	3.1	2.7	2.4	2.3	2.7	3.0	3.5	4.5	5.0	5.0	5.0	5.0
230.	2.0	3.0	3.1	3.3	3.4	3.4	3.3	2.7	2.6	2.5	2.2	2.5	3.0	3.2	3.6	4.6	5.0	5.1	5.0	5.1
240.	2.0	2.8	3.0	3.2	3.4	3.3	3.3	2.5	2.3	2.0	1.7	2.4	2.9	3.5	3.5	4.4	5.0	4.8	4.8	4.9
250.	1.7	2.6	2.8	3.0	3.1	3.3	3.3	2.6	2.1	1.9	1.6	2.2	3.1	3.4	3.7	4.3	4.8	4.9	4.8	4.9
260.	1.5	2.3	2.5	2.8	3.1	3.2	3.4	2.5	1.9	1.5	1.3	2.1	2.8	3.5	3.8	4.4	4.6	4.9	4.9	4.9
270.	1.2	2.2	2.4	2.7	3.0	3.1	3.3	2.3	1.9	1.4	1.1	1.9	2.7	3.6	4.0	4.3	4.7	4.8	4.9	5.1
280.	0.9	2.0	2.3	2.5	2.8	2.9	3.2	2.3	1.6	1.2	0.8	1.5	2.4	3.4	3.9	4.4	4.8	5.1	5.1	5.3
290.	0.6	1.8	2.1	2.3	2.7	2.7	3.0	1.9	1.4	0.9	0.6	1.2	1.8	2.9	3.6	4.4	4.8	4.9	5.0	5.2
300.	0.5	1.4	1.7	2.0	2.3	2.4	2.6	1.6	1.0	0.6	0.4	0.8	1.3	2.6	3.5	4.5	4.5	4.5	4.6	4.9
310.	0.2	1.2	1.5	1.6	1.9	2.0	2.3	1.1	0.6	0.4	0.1	0.4	0.8	2.0	3.1	4.1	4.1	4.0	4.2	4.4
320.	0.1	0.9	1.1	1.3	1.6	1.6	1.7	0.7	0.4	0.1	0.1	0.1	0.6	1.5	2.5	3.7	3.7	3.6	3.4	3.7
330.	0.0	0.6	0.7	0.8	1.1	1.1	1.2	0.3	0.1	0.0	0.0	0.0	0.3	0.9	1.9	3.1	2.8	2.5	2.3	2.4
340.	0.0	0.4	0.4	0.5	0.6	0.6	0.7	0.2	0.0	0.0	0.0	0.0	0.2	0.5	1.4	2.7	2.1	1.8	1.6	1.6
350.	0.0	0.2	0.3	0.3	0.4	0.4	0.5	0.1	0.0	0.0	0.0	0.0	0.1	0.3	0.9	2.1	1.4	1.2	0.9	1.0
360.	0.0	0.2	0.2	0.2	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.6	1.7	1.1	0.9	0.7	0.6
MAX	2.6	3.9	3.8	4.0	4.3	4.5	5.5	5.0	4.1	3.3	2.4	2.5	3.1	3.6	4.0	4.9	5.3	5.1	5.1	5.3
DEGR.	170	170	160	160	160	150	150	180	180	190	190	230	250	270	270	170	170	170	280	280

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JOB: BOH CO:CUMULATIVE IMPACTS:100695:LAM RUN: NUUANU & SMITH INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
10.	0.2	0.3	0.2	1.9	2.2	2.7	2.9	3.3	3.6	3.5	3.4	3.5	3.5	3.7	3.9	3.9	3.8	3.8	3.7	0.2
20.	0.1	0.1	0.1	2.1	2.4	2.8	3.1	3.4	3.6	3.5	3.3	3.5	3.6	3.7	3.8	3.9	3.7	3.8	3.6	0.1
30.	0.0	0.0	0.0	2.4	2.7	3.1	3.3	3.5	3.8	3.6	3.6	3.5	3.6	3.7	3.7	3.8	3.7	3.6	3.6	0.0
40.	0.0	0.0	0.0	2.7	2.9	3.3	3.5	3.7	3.8	3.6	3.7	3.7	3.8	3.9	3.8	3.8	3.8	3.8	3.8	0.0
50.	0.0	0.0	0.0	2.8	3.0	3.3	3.7	3.8	4.1	3.8	3.6	3.7	3.8	3.9	3.9	3.9	3.8	3.8	3.8	0.0
60.	0.0	0.0	0.0	2.9	3.2	3.6	3.8	4.0	4.2	3.8	3.6	3.7	3.8	3.8	3.8	3.8	3.8	3.8	3.5	0.0
70.	0.0	0.1	0.0	2.9	3.3	3.7	4.0	4.0	4.1	3.9	3.7	3.8	3.8	3.8	3.7	3.7	3.7	3.6	3.4	0.0
80.	0.1	0.2	0.2	3.2	3.6	3.7	4.1	4.2	4.2	3.8	3.7	3.8	3.8	3.8	3.6	3.6	3.6	3.5	3.3	0.1
90.	0.3	0.4	0.4	3.5	3.7	4.1	4.3	4.2	4.4	4.0	3.9	3.9	3.8	3.7	3.7	3.6	3.6	3.4	3.1	0.2
100.	0.5	0.7	0.5	3.8	4.0	4.2	4.2	4.1	4.3	3.9	3.9	3.8	3.8	3.7	3.6	3.5	3.3	3.2	2.9	0.4
110.	1.0	1.0	0.9	3.9	4.0	4.2	4.1	4.2	4.1	3.6	3.7	3.7	3.5	3.6	3.4	3.3	3.2	2.9	2.6	0.8
120.	1.7	1.7	1.6	3.7	3.8	4.1	4.0	3.8	3.7	3.3	3.5	3.4	3.2	3.2	3.0	2.9	2.8	2.5	2.1	1.3

130.	*	2.6	2.6	2.4	3.4	3.4	3.4	3.3	3.3	3.2	2.8	3.0	2.9	2.8	2.8	2.4	2.3	2.2	2.0	1.7	2.0
140.	*	3.4	3.5	3.2	2.6	2.6	2.7	2.5	2.5	2.5	2.2	2.3	2.2	2.0	2.1	1.8	1.8	1.6	1.5	1.2	2.8
150.	*	4.1	4.0	3.6	1.9	1.7	1.7	1.5	1.5	1.5	1.3	1.4	1.4	1.2	1.3	1.2	1.1	1.0	0.9	0.7	3.3
160.	*	4.5	4.4	4.1	1.0	0.9	0.9	1.0	1.0	0.9	0.8	0.9	0.8	0.6	0.7	0.6	0.6	0.5	0.5	0.4	3.4
170.	*	4.7	4.6	4.2	0.4	0.4	0.3	0.3	0.4	0.3	0.2	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2	3.7
180.	*	4.8	4.8	4.4	0.2	0.2	0.2	0.1	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	4.0
190.	*	4.7	4.7	4.4	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	4.0
200.	*	4.7	4.8	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2
210.	*	4.9	4.9	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.5
220.	*	5.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.8
230.	*	5.1	5.1	5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
240.	*	5.0	5.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
250.	*	4.8	4.9	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9
260.	*	4.8	5.0	4.9	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	4.9
270.	*	5.2	5.2	5.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	5.1
280.	*	5.2	5.4	5.5	0.1	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.1	0.2	0.3	0.3	0.3	0.2	0.2	0.2	5.2
290.	*	5.2	5.4	5.5	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.4	0.4	0.5	0.5	0.4	0.4	0.4	0.4	5.4
300.	*	5.0	5.2	5.4	0.3	0.4	0.4	0.5	0.6	0.8	0.8	0.9	0.8	0.9	1.0	0.9	1.0	0.9	0.9	0.8	5.2
310.	*	4.5	4.8	4.8	0.5	0.6	0.7	0.9	1.1	1.3	1.4	1.6	1.4	1.5	1.7	1.4	1.6	1.5	1.6	1.5	4.7
320.	*	3.8	4.0	3.8	0.7	1.0	1.1	1.2	1.6	2.0	2.0	2.2	2.1	2.1	2.1	2.1	2.2	2.2	2.3	2.4	3.9
330.	*	2.6	2.9	2.6	0.9	1.3	1.4	1.7	2.1	2.6	2.5	2.6	2.6	2.5	2.6	2.7	2.7	2.9	2.9	3.0	2.6
340.	*	1.7	1.8	1.8	1.2	1.5	1.7	2.1	2.5	2.9	2.9	3.0	2.9	2.8	3.1	3.1	3.3	3.3	3.4	3.4	1.6
350.	*	2.0	1.1	1.1	1.4	1.9	2.2	2.6	2.9	3.2	3.3	3.2	3.2	3.0	3.3	3.4	3.6	3.7	3.6	3.7	1.0
360.	*	0.5	0.6	0.5	1.6	2.1	2.4	2.7	3.2	3.5	3.4	3.3	3.3	3.3	3.7	3.6	3.8	3.8	3.7	3.8	0.4
MAX	*	5.2	5.4	5.5	3.9	4.0	4.2	4.3	4.2	4.4	4.0	3.9	3.9	3.8	3.9	3.9	3.9	3.8	3.8	3.8	5.4
DEGR.	*	270	280	280	110	100	100	90	80	90	90	90	90	40	50	10	50	10	20	40	290

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR)	*	CONCENTRATION (PPM) REC41	REC42
10.	*	0.2	0.2
20.	*	0.1	0.1
30.	*	0.0	0.0
40.	*	0.0	0.0
50.	*	0.0	0.0
60.	*	0.0	0.0
70.	*	0.0	0.0
80.	*	0.0	0.0
90.	*	0.1	0.1
100.	*	0.2	0.2
110.	*	0.5	0.4
120.	*	1.0	0.8
130.	*	1.5	1.2
140.	*	2.3	1.7
150.	*	2.7	2.0
160.	*	2.8	2.2
170.	*	3.1	2.2
180.	*	3.2	2.3
190.	*	3.4	2.3
200.	*	3.5	2.5
210.	*	4.1	2.9
220.	*	4.5	3.3
230.	*	4.7	3.7
240.	*	4.8	4.1
250.	*	4.8	4.2
260.	*	4.9	4.5
270.	*	5.2	4.9
280.	*	5.3	5.1
290.	*	5.4	5.1
300.	*	5.3	5.3
310.	*	4.8	4.8
320.	*	3.9	3.8
330.	*	2.6	2.7
340.	*	1.8	1.8
350.	*	1.0	0.8
360.	*	0.5	0.4
MAX	*	5.4	5.3
DEGR.	*	290	300

* THE HIGHEST CONCENTRATION IS 5.50 PPM AT 280 DEGREES FROM REC23.

DATE: 10/08/95 TIME: 14:44

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

* CO/LINK (PPM)
* ANGLE (DEGREES)

LINK #	REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
	170	170	160	160	160	150	150	180	180	190	190	230	250	270	270	170	170	170	280	280
1	0.3	0.7	0.4	0.3	0.3	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.4	0.5	0.6	0.0	0.0	0.0	0.4	0.3
2	0.1	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.0	0.0	0.0	0.1	0.1
3	0.3	0.3	0.4	0.5	0.6	0.6	0.6	0.7	0.6	0.5	0.4	0.4	0.2	0.1	0.2	0.8	0.8	0.8	0.6	0.7
4	0.4	0.4	0.5	0.7	0.8	1.2	1.6	1.2	1.0	0.8	0.7	0.6	0.5	0.4	0.7	2.1	2.3	2.2	2.0	2.1
5	0.4	0.3	0.5	0.6	0.7	1.0	1.2	0.8	0.7	0.6	0.5	0.4	0.2	0.1	0.2	2.0	2.2	2.1	1.5	1.7
6	0.9	1.8	1.6	1.5	1.4	0.9	0.6	0.4	0.2	0.2	0.1	0.2	0.5	0.8	0.8	0.0	0.0	0.0	0.4	0.3
7	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
8	0.2	0.1	0.2	0.2	0.3	0.7	1.2	1.5	1.2	0.8	0.4	0.4	0.7	1.0	1.0	0.0	0.0	0.0	0.1	0.1
9	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.4	0.3	0.0	0.0	0.0	0.0	0.0

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JOB: BOH CO:CUMULATIVE IMPACTS:100695:LAM RUN: NUUANU & SMITH INTERSECTION
DATE: 10/08/95 TIME: 14:44

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

* CO/LINK (PPM)
* ANGLE (DEGREES)

LINK #	REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
	270	280	280	110	100	100	90	80	90	90	90	90	40	50	10	50	10	20	40	290
1	0.2	0.2	0.2	1.6	1.6	1.5	1.5	1.4	1.2	0.7	0.1	0.0	0.1	0.0	0.2	0.0	0.1	0.0	0.0	0.2
2	0.1	0.1	0.1	0.4	0.6	0.7	0.7	0.7	0.5	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1
3	0.9	0.8	0.9	0.3	0.2	0.3	0.3	0.3	0.7	1.1	1.6	1.7	1.6	1.7	1.5	1.7	1.6	1.5	1.6	0.8
4	2.1	2.2	2.3	0.4	0.4	0.5	0.5	0.5	0.8	1.0	1.2	1.2	1.0	1.2	0.9	1.2	1.0	1.2	1.2	2.2
5	1.8	1.9	1.9	0.4	0.3	0.4	0.3	0.3	0.5	0.7	0.9	1.0	0.6	0.9	0.6	1.0	0.8	0.9	1.0	1.9
6	0.1	0.2	0.1	0.7	0.8	0.7	0.7	0.7	0.4	0.2	0.0	0.0	0.2	0.0	0.3	0.0	0.2	0.1	0.0	0.2
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.0	0.2	0.1	0.2	0.0	0.1	0.1	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0

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JOB: BOH CO:CUMULATIVE IMPACTS:100695:LAM RUN: NUUANU & SMITH INTERSECTION
DATE: 10/08/95 TIME: 14:44

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

* CO/LINK (PPM)
* ANGLE (DEGREES)

LINK #	REC41	REC42
	290	300
1	0.2	0.3
2	0.0	0.1
3	0.8	0.7
4	2.3	2.2
5	1.9	1.8
6	0.2	0.2
7	0.0	0.0
8	0.0	0.1
9	0.0	0.0

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JOB: BOH CO:PROJECT ONLY IMPACTS:100595:LAM RUN: NUUANU & SMITH INTERSECTION
DATE: 10/06/95 TIME: 10:53

SITE & METEOROLOGICAL VARIABLES

VS = 0.0 CM/S VD = 0.0 CM/S Z0 = 321. CM
U = 1.0 M/S CLAS = 4 (D) ATIM = 60. MINUTES MIXH = 1000. M AMB = 0.0 PPM

LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	LENGTH (FT)	BRG (DEG)	TYPE	VPH	EF (G/MI)	H (FT)	W (FT)	V/C	QUEUE (VEH)
	LINK COORDINATES (FT)												
1. SB Nimitz-Appr.	-29.0	-9.0	-180.0	163.0	229.	319.	AG	11.	27.0	0.0	68.0		
2. SB Nimitz-Queue	-38.0	2.0	-38.8	2.9	1.	319.	AG	150.	100.0	0.0	12.0	0.01	0.1
3. SB Nimitz-Depart.	-29.0	-9.0	163.0	-221.0	286.	138.	AG	0.	27.0	0.0	68.0		
4. NB Nimitz-Appr.	7.0	22.0	197.0	-187.0	282.	138.	AG	16.	27.0	0.0	68.0		
5. NB Nimitz-Queue	26.0	2.0	28.3	-0.6	3.	138.	AG	301.	100.0	0.0	12.0	0.01	0.2
6. NB Nimitz-Depart.	7.0	22.0	-144.0	192.0	227.	318.	AG	26.	27.0	0.0	68.0		
7. SW-B Smith -Appr.	-29.0	-9.0	96.0	96.0	163.	50.	AG	30.	41.0	0.0	44.0		
8. SW-B Smith -Queue	29.0	38.0	39.5	47.1	14.	49.	AG	1956.	100.0	0.0	24.0	0.09	0.7
9. NE-B Smith	19.0	10.0	106.0	86.0	116.	49.	AG	27.	41.0	0.0	32.0		

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JOB: BOH CO:PROJECT ONLY IMPACTS:100595:LAM RUN: NUUANU & SMITH INTERSECTION
DATE: 10/06/95 TIME: 10:53

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
2. SB Nimitz-Queue	150	20	2.0	11	1600	420.80	3	1
5. NB Nimitz-Queue	150	40	2.0	16	1600	420.80	3	1
8. SW-B Smith -Queue	150	130	2.0	30	1600	420.80	3	1

RECEPTOR LOCATIONS

RECEPTOR	X	Y	Z
	COORDINATES (FT)		
1. REC 1	-31.0	178.0	6.0
2. REC 2	-62.0	158.0	6.0
3. REC 3	-48.0	142.0	6.0
4. REC 4	-31.0	122.0	6.0
5. REC 5	-17.0	103.0	6.0
6. REC 6	0.0	86.0	6.0
7. REC 7	14.0	67.0	6.0
8. REC 8	34.0	82.0	6.0
9. REC 9	48.0	98.0	6.0
10. REC 10	67.0	113.0	6.0
11. REC 11	86.0	130.0	6.0
12. REC 12	134.0	82.0	6.0
13. REC 13	115.0	67.0	6.0
14. REC 14	96.0	48.0	6.0
15. REC 15	82.0	34.0	6.0
16. REC 16	62.0	19.0	6.0
17. REC 17	72.0	0.0	6.0
18. REC 18	91.0	-19.0	6.0
19. REC 19	108.0	-36.0	6.0
20. REC 20	122.0	-53.0	6.0
21. REC 21	139.0	-72.0	6.0
22. REC 21	154.0	-91.0	6.0
23. REC 23	170.0	-108.0	6.0
24. REC 24	-168.0	89.0	6.0
25. REC 25	-149.0	67.0	6.0
26. REC 26	-134.0	50.0	6.0
27. REC 27	-120.0	34.0	6.0
28. REC 28	-101.0	14.0	6.0
29. REC 29	-86.0	0.0	6.0
30. REC 30	-72.0	-19.0	6.0
31. REC 31	-53.0	-38.0	6.0
32. REC 32	-38.0	-55.0	6.0
33. REC 33	-24.0	-72.0	6.0
34. REC 34	-7.0	-89.0	6.0
35. REC 35	10.0	-110.0	6.0
36. REC 36	24.0	-125.0	6.0
37. REC 37	41.0	-144.0	6.0
38. REC 38	57.0	-163.0	6.0
39. REC 39	72.0	-182.0	6.0
40. REC 40	187.0	-125.0	6.0
41. REC 41	204.0	-144.0	6.0
42. REC 42	221.0	-161.0	6.0

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JOB: BOH CO:PROJECT ONLY IMPACTS:100595:LAM RUN: NUUANU & SMITH INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR) • CONCENTRATION (PPM)

WIND ANGLE (DEGR)	REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
10.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100.	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
110.	0.0	0.0	0.0	0.1	0.1	0.2	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120.	0.0	0.1	0.1	0.2	0.3	0.5	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
130.	0.1	0.2	0.2	0.3	0.5	0.8	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
140.	0.2	0.2	0.3	0.4	0.6	1.0	2.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
150.	0.2	0.2	0.2	0.3	0.5	0.9	1.9	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
160.	0.2	0.1	0.1	0.2	0.3	0.6	1.4	1.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
170.	0.1	0.0	0.1	0.1	0.1	0.3	0.9	1.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
180.	0.1	0.0	0.0	0.0	0.0	0.1	0.4	1.5	0.7	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
190.	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.4	0.9	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
200.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.9	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
210.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.7	0.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
220.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.4	0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
230.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.4	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
240.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.4	0.4	0.2	0.0	0.0	0.0	0.0	0.0
250.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.5	0.6	0.4	0.0	0.0	0.0	0.0	0.0
260.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.8	0.7	0.1	0.0	0.0	0.0	0.0
270.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.8	1.0	0.3	0.0	0.0	0.0	0.0
280.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.6	1.2	0.7	0.1	0.0	0.0	0.0
290.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.0	1.1	0.3	0.2	0.1	0.1
300.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	1.6	0.6	0.3	0.2	0.2
310.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.8	0.9	0.5	0.3	0.3
320.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.6	0.9	0.5	0.4	0.3
330.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.8	0.4	0.3	0.2
340.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.5	0.2	0.1	0.1
350.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.1	0.0	0.0
360.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
MAX	0.2	0.2	0.3	0.4	0.6	1.0	2.1	1.5	0.9	0.6	0.4	0.4	0.5	0.8	1.2	1.8	0.9	0.5	0.4	0.3
DEGR.	140	130	140	140	140	140	140	180	190	200	210	250	250	260	280	310	310	310	320	310

Conc @ max, cumulative impact location & wind directions

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JOB: BOH CO:PROJECT ONLY IMPACTS:100595:LAM

RUN: NUUANU & SMITH INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to
the maximum concentration, only the first
angle, of the angles with same maximum
concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR) • CONCENTRATION (PPM)

WIND ANGLE (DEGR)	REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
10.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.0
20.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.2	0.1	0.1	0.0	0.0	0.0
30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0
40.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
50.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70.	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80.	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90.	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100.	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
110.	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120.	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
130.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
140.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
150.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
160.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
170.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
180.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

190.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
200.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
210.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
220.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
230.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
240.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
250.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
260.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
270.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
280.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
290.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
300.	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
310.	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
320.	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
330.	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
340.	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0
350.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0
360.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.0
MAX	0.2	0.2	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1
DEGR.	310	310	300	90	90	90	80	80	70	50	40	30	20	20	10	10	360	10	10	300

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JOB: BOH CO:PROJECT ONLY IMPACTS:100595:LAM

RUN: NUUANU & SMITH INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC41	REC42
10.	0.0	0.0
20.	0.0	0.0
30.	0.0	0.0
40.	0.0	0.0
50.	0.0	0.0
60.	0.0	0.0
70.	0.0	0.0
80.	0.0	0.0
90.	0.0	0.0
100.	0.0	0.0
110.	0.0	0.0
120.	0.0	0.0
130.	0.0	0.0
140.	0.0	0.0
150.	0.0	0.0
160.	0.0	0.0
170.	0.0	0.0
180.	0.0	0.0
190.	0.0	0.0
200.	0.0	0.0
210.	0.0	0.0
220.	0.0	0.0
230.	0.0	0.0
240.	0.0	0.0
250.	0.0	0.0
260.	0.0	0.0
270.	0.0	0.0
280.	0.0	0.0
290.	0.0	0.0
300.	0.1	0.0
310.	0.1	0.1
320.	0.1	0.1
330.	0.1	0.1
340.	0.0	0.0
350.	0.0	0.0
360.	0.0	0.0
MAX	0.1	0.1
DEGR.	300	310

THE HIGHEST CONCENTRATION IS 2.10 PPM AT 140 DEGREES FROM REC7 .

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JOB: BOH CO:PROJECT ONLY IMPACTS:100595:LAM
DATE: 10/06/95 TIME: 10:53

RUN: NUUANU & SMITH INTERSECTION

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

CO/LINK (PPM)
ANGLE (DEGREES)

LINK #	REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
	140	130	140	140	140	140	140	180	190	200	210	250	250	260	280	310	310	310	320	310
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.2	0.2	0.3	0.4	0.6	1.0	2.1	1.5	0.9	0.6	0.4	0.4	0.5	0.8	1.2	1.8	0.9	0.5	0.4	0.3
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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JOB: BOH CO:PROJECT ONLY IMPACTS:100595:LAM RUN: NUUANU & SMITH INTERSECTION
DATE: 10/06/95 TIME: 10:53

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

CO/LINK (PPM)
ANGLE (DEGREES)

LINK #	REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
	310	310	300	90	90	90	80	80	70	50	40	30	20	20	10	10	360	10	10	300
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.2	0.2	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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JOB: BOH CO:PROJECT ONLY IMPACTS:100595:LAM RUN: NUUANU & SMITH INTERSECTION
DATE: 10/06/95 TIME: 10:53

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

CO/LINK (PPM)
ANGLE (DEGREES)

LINK #	REC41	REC42
	300	310
1	0.0	0.0
2	0.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.1	0.1
9	0.0	0.0

1

JOB: BOH CO:PROJECT ONLY IMPACTS:100595:LAM RUN: NUUANU & SMITH INTERSECTION

METEOROLOGICAL VARIABLES

U = 2.0 M/S   CLAS = 3 (C)   ATIM = 60. MINUTES   MIXH = 1000. M   AMB = 0.0 PPM

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JOB: BOH CO:PROJECT ONLY IMPACTS:100595:LAM   RUN: NUUANU & SMITH INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
10.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
20.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90.	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100.	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
110.	0.0	0.0	0.0	0.1	0.1	0.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120.	0.0	0.1	0.1	0.1	0.1	0.3	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
130.	0.0	0.1	0.1	0.1	0.2	0.3	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
140.	0.1	0.1	0.1	0.1	0.2	0.3	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
150.	0.1	0.1	0.1	0.1	0.2	0.3	0.7	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
160.	0.1	0.1	0.1	0.1	0.1	0.3	0.6	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
170.	0.1	0.0	0.0	0.1	0.1	0.2	0.5	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
180.	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.5	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
190.	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.5	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
200.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
210.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.2	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
220.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
230.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
240.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.0
250.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.2	0.3	0.1	0.0	0.0	0.0	0.0
260.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.3	0.2	0.0	0.0	0.0	0.0
270.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.4	0.3	0.1	0.0	0.0	0.0
280.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.4	0.1	0.2	0.0	0.0
290.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.5	0.2	0.1	0.1	0.1
300.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.5	0.3	0.1	0.1	0.1
310.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.6	0.3	0.2	0.1	0.1
320.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6	0.3	0.2	0.1	0.1
330.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.3	0.2	0.1	0.1
340.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.1	0.1	0.1
350.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.1	0.1	0.0
360.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.0	0.0
MAX	0.1	0.1	0.1	0.1	0.2	0.3	0.7	0.5	0.3	0.2	0.1	0.1	0.2	0.3	0.4	0.6	0.3	0.2	0.1	0.1
DEGR.	140	120	120	110	130	120	130	160	180	190	180	220	250	270	270	310	300	310	290	290

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JOB: BOH CO:PROJECT ONLY IMPACTS:100595:LAM   RUN: NUUANU & SMITH INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
10.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
20.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
40.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
50.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90.	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100.	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
110.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

WIND ANGLE (DEGR)																				
130.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
140.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
150.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
160.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
170.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
180.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
190.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
200.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
210.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
220.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
230.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
240.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
250.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
260.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
270.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
280.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
290.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
300.	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
310.	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
320.	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
330.	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
340.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
350.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
360.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
MAX	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
DEGR.	300	10	10	10	10	90	70	60	50	30	20	10	10	10	10	10	10	10	10	10

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MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC41	REC42
10.	0.0	0.0
20.	0.0	0.0
30.	0.0	0.0
40.	0.0	0.0
50.	0.0	0.0
60.	0.0	0.0
70.	0.0	0.0
80.	0.0	0.0
90.	0.0	0.0
100.	0.0	0.0
110.	0.0	0.0
120.	0.0	0.0
130.	0.0	0.0
140.	0.0	0.0
150.	0.0	0.0
160.	0.0	0.0
170.	0.0	0.0
180.	0.0	0.0
190.	0.0	0.0
200.	0.0	0.0
210.	0.0	0.0
220.	0.0	0.0
230.	0.0	0.0
240.	0.0	0.0
250.	0.0	0.0
260.	0.0	0.0
270.	0.0	0.0
280.	0.0	0.0
290.	0.0	0.0
300.	0.0	0.0
310.	0.0	0.0
320.	0.0	0.0
330.	0.0	0.0
340.	0.0	0.0
350.	0.0	0.0
360.	0.0	0.0
MAX	0.0	0.0
DEGR.	10	10

THE HIGHEST CONCENTRATION IS 0.70 PPM AT 130 DEGREES FROM REC7 .

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DATE: 10/06/95 TIME: 10:53

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

* CO/LINK (PPM)
* ANGLE (DEGREES)

LINK #	REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
	140	120	120	110	130	120	130	160	180	190	180	220	250	270	270	310	300	310	290	290
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.1	0.1	0.1	0.1	0.2	0.3	0.7	0.5	0.3	0.2	0.1	0.1	0.2	0.3	0.4	0.6	0.3	0.2	0.1	0.1
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

* CO/LINK (PPM)
* ANGLE (DEGREES)

LINK #	REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
	300	10	10	10	10	90	70	60	50	30	20	10	10	10	10	10	10	10	10	10
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

* CO/LINK (PPM)
* ANGLE (DEGREES)

LINK #	REC41	REC42
	10	10
1	0.0	0.0
2	0.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
9	0.0	0.0

W/ Mitigation (elimination of left turn phase from Smith St. to Nimitz)

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CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0, JANUARY 1992 PAGE 1

JOB: BOH CO:CUMULATIVE:LOS D :100695:LAM
DATE: 10/08/95 TIME: 14:45 RUN: NUUANU & SMITH INTERSECTION

SITE & METEOROLOGICAL VARIABLES

VS = 0.0 CM/S VD = 0.0 CM/S Z0 = 321. CM
U = 1.0 M/S CLAS = 4 (D) ATIM = 60. MINUTES MIXH = 1000. M AMB = 0.0 PPM

LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	LENGTH (FT)	BRG (DEG)	TYPE	VPH	EF (G/MI)	H (FT)	W (FT)	V/C	QUEUE (VEH)
1. SB Nimitz-Appr.	-29.0	-9.0	-180.0	163.0	229.	319.	AG	3911.	27.0	0.0	68.0		
2. SB Nimitz-Queue	-38.0	2.0	-108.7	82.1	107.	319.	AG	602.	100.0	0.0	48.0	0.73	5.4
3. SB Nimitz-Depart.	-29.0	-9.0	163.0	-221.0	286.	138.	AG	3689.	27.0	0.0	68.0		
4. NB Nimitz-Appr.	7.0	22.0	197.0	-187.0	282.	138.	AG	4671.	27.0	0.0	68.0		
5. NB Nimitz-Queue	26.0	2.0	136.0	-119.5	164.	138.	AG	602.	100.0	0.0	48.0	0.87	8.3
6. NB Nimitz-Depart.	7.0	22.0	-144.0	192.0	227.	318.	AG	4337.	27.0	0.0	68.0		
7. SW-B Smith -Appr.	-29.0	-9.0	96.0	96.0	163.	50.	AG	94.	41.0	0.0	44.0		
8. SW-B Smith -Queue	29.0	38.0	62.5	67.0	44.	49.	AG	1956.	100.0	0.0	24.0	0.28	2.3
9. NE-B Smith	19.0	10.0	106.0	86.0	116.	49.	AG	554.	41.0	0.0	32.0		

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JOB: BOH CO:CUMULATIVE:LOS D :100695:LAM PAGE 2
DATE: 10/08/95 TIME: 14:45 RUN: NUUANU & SMITH INTERSECTION

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
2. SB Nimitz-Queue	150	20	2.0	3911	1600	420.80	3	1
5. NB Nimitz-Queue	150	20	2.0	4671	1600	420.80	3	1
8. SW-B Smith -Queue	150	130	2.0	94	1600	420.80	3	1

RECEPTOR LOCATIONS

RECEPTOR	X	Y	Z
1. REC 1	-31.0	178.0	6.0
2. REC 2	-62.0	158.0	6.0
3. REC 3	-48.0	142.0	6.0
4. REC 4	-31.0	122.0	6.0
5. REC 5	-17.0	103.0	6.0
6. REC 6	0.0	86.0	6.0
7. REC 7	14.0	67.0	6.0
8. REC 8	34.0	82.0	6.0
9. REC 9	48.0	98.0	6.0
10. REC 10	67.0	113.0	6.0
11. REC 11	86.0	130.0	6.0
12. REC 12	134.0	82.0	6.0
13. REC 13	115.0	67.0	6.0
14. REC 14	96.0	48.0	6.0
15. REC 15	82.0	34.0	6.0
16. REC 16	62.0	19.0	6.0
17. REC 17	72.0	0.0	6.0
18. REC 18	91.0	-19.0	6.0
19. REC 19	108.0	-36.0	6.0
20. REC 20	122.0	-53.0	6.0
21. REC 21	139.0	-72.0	6.0
22. REC 21	154.0	-91.0	6.0
23. REC 23	170.0	-108.0	6.0
24. REC 24	-168.0	89.0	6.0
25. REC 25	-149.0	67.0	6.0
26. REC 26	-134.0	50.0	6.0
27. REC 27	-120.0	34.0	6.0
28. REC 28	-101.0	14.0	6.0
29. REC 29	-86.0	0.0	6.0
30. REC 30	-72.0	-19.0	6.0
31. REC 31	-53.0	-38.0	6.0
32. REC 32	-38.0	-55.0	6.0
33. REC 33	-24.0	-72.0	6.0
34. REC 34	-7.0	-89.0	6.0
35. REC 35	10.0	-110.0	6.0
36. REC 36	24.0	-125.0	6.0
37. REC 37	41.0	-144.0	6.0
38. REC 38	57.0	-163.0	6.0
39. REC 39	72.0	-182.0	6.0
40. REC 40	187.0	-125.0	6.0
41. REC 41	204.0	-144.0	6.0
42. REC 42	221.0	-161.0	6.0

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JOB: BOH CO:CUMULATIVE:LOS D :100695:LAM RUN: NUUANU & SMITH INTERSECTION PAGE 3

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR) • CONCENTRATION (PPM)

WIND ANGLE (DEGR)	REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
10.	0.0	0.2	0.2	0.2	0.3	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.9	2.5	1.4	0.6	0.4	0.3
20.	0.0	0.1	0.1	0.1	0.2	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.7	1.8	0.7	0.3	0.2	0.2
30.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.5	1.1	0.3	0.1	0.0	0.1
40.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.7	0.1	0.0	0.0	0.0
50.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.0	0.0	0.0	0.0
60.	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0
70.	0.0	0.0	0.0	0.0	0.1	0.1	1.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.1	0.1
80.	0.0	0.1	0.1	0.1	0.2	0.4	2.2	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.3	0.2	0.3
90.	0.0	0.2	0.2	0.4	0.6	1.1	3.3	0.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.4	0.3	0.4
100.	0.0	0.4	0.4	0.6	1.0	1.8	4.2	1.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.4	0.4	0.4
110.	0.0	0.7	0.8	1.2	1.9	2.7	4.9	2.3	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.4	0.8	0.6	0.5	0.6
120.	0.4	1.6	1.8	2.1	3.1	3.9	5.9	3.3	0.6	0.3	0.0	0.0	0.0	0.0	0.1	0.9	1.5	1.2	1.1	1.1
130.	1.1	3.4	3.6	4.1	5.0	5.7	7.6	4.9	1.1	0.5	0.0	0.0	0.0	0.1	0.4	2.2	3.1	2.6	2.1	2.0
140.	2.6	5.8	5.9	6.3	7.1	7.7	9.5	6.9	2.7	1.1	0.3	0.1	0.2	0.7	1.3	4.5	5.4	4.7	3.9	3.7
150.	4.2	7.3	7.3	7.7	8.2	8.7	10.4	8.8	4.7	1.9	0.9	0.3	0.7	1.5	2.7	6.4	7.2	6.4	5.5	5.0
160.	5.0	7.5	7.6	7.8	8.1	8.4	9.9	10.2	7.1	3.5	2.1	1.0	1.6	2.8	4.4	7.6	8.2	7.5	6.7	6.3
170.	5.1	7.3	7.3	7.2	7.4	7.7	8.6	10.3	8.4	4.9	3.4	1.9	2.7	4.0	5.4	7.9	8.5	8.0	7.5	7.1
180.	4.8	6.7	6.9	6.8	6.6	6.8	7.4	9.2	8.5	6.0	4.3	2.7	3.5	4.5	5.7	7.8	8.1	8.0	7.6	7.4
190.	4.6	6.4	6.5	6.4	6.1	6.1	6.5	7.8	7.8	6.5	4.9	3.2	3.7	4.5	5.5	7.3	7.7	7.5	7.4	7.3
200.	4.4	5.8	6.1	6.1	6.0	5.7	5.9	6.5	6.8	6.3	4.8	3.2	3.9	4.6	5.5	6.9	7.2	7.1	6.9	6.9
210.	4.1	5.4	5.6	5.9	6.0	5.7	5.8	5.5	5.9	5.9	5.0	3.4	3.8	4.6	5.3	6.7	7.0	6.8	6.8	6.8
220.	4.1	5.3	5.6	6.0	6.1	6.0	6.0	4.9	5.0	5.1	4.6	3.9	4.2	4.5	5.1	6.7	7.2	7.1	7.0	7.0
230.	3.8	5.4	5.7	6.0	6.3	6.1	6.1	5.0	4.1	4.2	3.9	4.5	5.0	4.8	5.3	6.7	7.3	7.3	7.3	7.3
240.	3.7	4.9	5.1	5.6	5.9	6.0	6.0	4.8	4.1	3.8	3.3	4.9	5.7	5.6	5.6	6.7	7.0	6.9	6.8	6.9
250.	3.3	4.7	4.9	5.3	5.7	5.9	6.1	4.9	4.2	3.5	3.1	5.2	6.3	6.4	6.0	6.8	7.1	6.8	6.8	6.8
260.	3.0	4.7	5.0	5.4	5.8	6.0	6.4	4.9	4.1	3.3	2.7	5.0	6.3	7.5	6.9	7.2	7.3	7.4	7.3	7.3
270.	2.3	4.4	5.0	5.4	5.9	6.0	6.4	4.9	3.8	3.1	2.3	4.3	6.2	7.9	7.9	7.9	8.1	8.0	8.0	8.0
280.	1.6	4.0	4.6	5.2	5.8	6.0	6.5	4.6	3.3	2.5	1.7	3.3	5.1	7.8	8.5	8.5	8.6	8.8	8.7	8.7
290.	0.9	3.3	4.0	4.7	5.3	5.5	6.2	3.9	2.5	1.6	1.0	2.0	3.6	6.8	8.5	8.9	9.0	9.0	9.0	9.3
300.	0.4	2.5	3.2	3.9	4.5	4.8	5.5	2.8	1.5	0.9	0.4	0.9	2.2	5.2	7.7	8.9	8.9	9.1	9.0	9.3
310.	0.1	1.9	2.4	3.0	3.6	3.8	4.4	1.6	0.7	0.3	0.1	0.2	1.2	3.2	6.1	8.5	8.2	7.8	7.7	8.0
320.	0.0	1.3	1.5	1.9	2.5	2.4	3.0	0.7	0.2	0.1	0.0	0.0	0.8	1.7	4.5	7.2	6.9	6.2	5.7	5.8
330.	0.0	0.6	0.8	0.9	1.3	1.2	1.5	0.2	0.0	0.0	0.0	0.0	0.4	1.1	3.0	5.8	5.1	4.1	3.4	3.3
340.	0.0	0.3	0.4	0.5	0.7	0.6	0.8	0.0	0.0	0.0	0.0	0.0	0.3	0.7	2.0	4.9	3.9	2.7	1.9	1.8
350.	0.0	0.3	0.3	0.3	0.4	0.4	0.5	0.0	0.0	0.0	0.0	0.0	0.2	0.7	1.4	4.2	2.9	1.6	1.0	1.0
360.	0.0	0.2	0.2	0.3	0.3	0.3	0.4	0.0	0.0	0.0	0.0	0.0	0.2	0.7	1.0	3.4	2.1	1.1	0.7	0.6
MAX	5.1	7.5	7.6	7.8	8.2	8.7	10.4	10.3	8.5	6.5	5.0	5.2	6.3	7.9	8.5	8.9	9.0	9.1	9.0	9.3
DEGR.	170	160	160	160	150	150	150	170	180	190	210	250	260	270	280	290	290	300	290	290

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR) • CONCENTRATION (PPM)

WIND ANGLE (DEGR)	REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
10.	0.3	0.4	0.4	3.7	4.6	5.1	5.9	6.7	6.9	6.9	6.3	6.0	6.2	6.5	6.8	6.8	6.7	6.5	6.4	0.3
20.	0.2	0.3	0.2	4.1	4.6	5.1	5.9	6.5	6.7	6.5	6.1	6.2	6.3	6.4	6.6	6.5	6.1	6.0	5.9	0.2
30.	0.1	0.1	0.1	4.4	4.7	5.2	5.9	6.2	6.4	6.4	6.1	6.5	6.5	6.3	6.1	6.0	5.8	5.7	5.5	0.1
40.	0.0	0.0	0.0	4.8	5.0	5.7	6.3	6.4	6.8	6.6	6.5	6.6	6.5	6.4	6.1	5.9	5.9	5.7	5.4	0.0
50.	0.0	0.0	0.0	5.0	5.2	6.1	6.5	6.8	7.3	7.1	6.7	6.7	6.4	6.2	5.9	6.0	6.0	5.7	5.3	0.0
60.	0.0	0.0	0.0	4.8	5.3	6.2	6.5	7.0	7.6	7.1	6.4	6.1	6.0	5.9	5.8	5.8	5.7	5.3	4.9	0.0
70.	0.1	0.2	0.2	5.0	5.6	6.6	6.7	7.4	7.7	6.9	6.1	6.1	5.8	5.9	5.7	5.6	5.4	5.1	4.6	0.1
80.	0.3	0.3	0.3	5.6	6.6	7.3	7.6	7.7	7.7	6.7	6.1	6.1	6.1	6.1	5.8	5.7	5.4	5.0	4.5	0.2
90.	0.4	0.4	0.4	6.4	7.6	8.1	8.4	8.1	7.7	6.4	6.5	6.4	6.3	6.2	5.9	5.8	5.3	4.8	4.2	0.3
100.	0.4	0.5	0.5	7.4	8.2	8.4	8.3	7.9	7.7	6.7	6.8	6.6	6.3	6.2	5.7	5.5	5.0	4.5	3.6	0.3
110.	0.5	0.6	0.6	8.0	8.6	8.5	8.3	7.7	7.5	6.6	6.6	6.3	6.0	5.9	5.2	4.8	4.3	3.7	2.9	0.4
120.	0.9	1.0	0.9	8.0	8.0	7.8	7.3	7.2	6.9	6.1	6.0	5.5	5.3	5.0	4.4	3.9	3.5	2.8	2.2	0.6
130.	1.8	1.8	1.5	6.5	6.3	6.0	5.7	5.4	5.3	4.5	4.5	4.2	3.9	3.7	3.1	2.9	2.6	2.1	1.5	1.1
140.	3.1	2.8	2.4	4.0	3.8	3.6	3.3	3.3	3.3	2.6	2.8	2.6	2.3	2.3	1.9	1.8	1.5	1.3	0.9	1.8
150.	4.2	3.6	2.9	1.8	1.5	1.5	1.5	1.4	1.4	1.1	1.3	1.3	1.0	1.1	0.9	0.8	0.8	0.6	0.4	2.1
160.	5.3	4.5	3.6	0.5	0.5	0.5	0.5	0.6	0.5	0.3	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.3	0.2	2.5
170.	6.1	5.3	4.2	0.2	0.2	0.2	0.2	0.3	0.2	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	3.1
180.	6.7	5.7	4.8	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	3.7

190.	6.9	5.9	5.0	0.2	0.1	0.1	0.1	0.2	0.1	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	4.2
200.	6.7	5.9	5.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	4.7
210.	6.7	6.1	5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0
220.	7.0	6.6	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4
230.	7.3	7.0	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.6
240.	6.9	6.8	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3
250.	6.8	6.9	6.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	5.5
260.	7.3	7.5	6.8	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	6.0
270.	8.0	8.0	7.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.1	6.7
280.	8.8	8.8	8.4	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	7.8
290.	9.4	9.6	9.3	0.2	0.2	0.2	0.2	0.3	0.4	0.3	0.3	0.1	0.2	0.4	0.3	0.4	0.4	0.3	0.2	8.8
300.	9.3	10.0	9.8	0.3	0.3	0.4	0.4	0.5	0.7	0.6	0.8	0.6	0.7	0.9	0.8	0.9	0.8	0.8	0.6	9.1
310.	8.2	8.7	8.7	0.5	0.7	0.8	0.9	1.1	1.5	1.6	1.9	1.9	1.9	2.3	2.0	2.1	2.2	2.1	1.8	8.4
320.	5.9	6.3	6.3	1.0	1.4	1.6	1.9	2.4	3.0	3.1	3.6	3.7	3.9	4.2	4.0	4.2	4.1	4.2	4.1	6.1
330.	3.2	3.5	3.3	1.5	2.1	2.5	3.0	3.9	4.6	4.8	5.5	5.5	5.5	5.7	5.6	5.7	6.0	5.9	6.0	3.0
340.	1.7	1.8	1.5	1.9	2.7	3.3	4.0	5.1	5.9	6.2	6.7	6.7	6.4	6.5	6.5	6.6	6.9	7.0	6.9	1.4
350.	0.8	0.9	0.8	2.5	3.5	4.1	4.9	6.0	6.7	6.9	7.1	6.7	6.5	6.5	6.9	7.0	7.2	7.1	7.2	0.6
360.	0.5	0.5	0.5	3.1	4.2	4.8	5.6	6.6	7.2	7.1	7.0	6.5	6.1	6.6	6.8	7.0	7.2	6.9	6.8	0.4
MAX	9.4	10.0	9.8	8.0	8.6	8.5	8.4	8.1	7.7	7.1	7.1	6.7	6.5	6.6	6.9	7.0	7.2	7.1	7.2	9.1
DEGR.	290	300	300	110	110	110	90	90	70	360	350	50	30	360	350	350	350	350	350	300

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JOB: BOH CO:CUMULATIVE:LOS D :100695:LAM

RUN: NUUANU & SMITH INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC41	REC42
10.	0.3	0.3
20.	0.2	0.2
30.	0.1	0.1
40.	0.0	0.0
50.	0.0	0.0
60.	0.0	0.0
70.	0.0	0.0
80.	0.0	0.0
90.	0.0	0.0
100.	0.0	0.0
110.	0.0	0.0
120.	0.2	0.0
130.	0.6	0.0
140.	1.1	0.0
150.	1.3	0.1
160.	1.5	0.2
170.	1.7	0.4
180.	2.1	0.5
190.	2.6	0.6
200.	3.3	0.8
210.	4.2	1.4
220.	5.0	2.4
230.	5.4	3.5
240.	5.4	4.3
25C.	5.4	4.7
260.	5.8	5.2
270.	6.3	5.8
280.	7.2	6.6
290.	8.3	7.8
300.	8.9	8.7
310.	8.3	8.0
320.	6.0	5.7
330.	3.2	2.9
340.	1.3	1.3
350.	0.5	0.5
360.	0.4	0.4
MAX	8.9	8.7
DEGR.	300	300

* THE HIGHEST CONCENTRATION IS 10.40 PPM AT 150 DEGREES FROM REC7 .

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JOB: BOH CO:CUMULATIVE:LOS D :100695:LAM
DATE: 10/08/95 TIME: 14:45

RUN: NUUANU & SMITH INTERSECTION

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING THE MAXIMUN CONCENTRATION FOR EACH RECEPTOR

LINK #	REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
ANGLE (DEGREES)	170	160	160	160	150	150	150	170	180	190	210	250	260	270	280	290	290	300	290	290
1	0.5	0.8	0.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.8	1.0	1.3	1.5	1.7	1.7	1.4	1.2	1.0
2	0.2	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.4	0.5	0.5	0.6	0.6	0.4	0.4	0.3
3	1.0	1.1	1.2	1.4	1.2	1.2	1.2	1.5	1.3	1.1	0.7	0.3	0.1	0.1	0.1	0.0	0.2	0.2	0.7	1.0
4	1.0	1.1	1.4	1.8	2.6	3.1	3.9	2.9	2.2	1.7	1.1	0.6	0.4	0.5	0.7	1.7	3.0	3.2	4.0	4.3
5	0.3	0.3	0.4	0.5	0.8	0.9	1.2	1.0	0.8	0.6	0.3	0.1	0.0	0.0	0.0	0.1	0.7	0.9	1.5	1.7
6	1.7	3.6	3.4	3.1	2.3	1.6	1.1	0.2	0.2	0.2	0.5	0.9	1.3	1.7	2.1	2.7	1.9	2.0	1.0	0.8
7	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
8	0.3	0.2	0.3	0.4	1.0	1.5	2.5	4.1	3.5	2.3	1.6	1.4	2.1	2.9	2.8	1.3	0.4	0.6	0.1	0.1
9	0.1	0.1	0.1	0.1	0.2	0.3	0.4	0.5	0.4	0.5	0.3	0.7	0.9	0.8	0.7	0.7	0.4	0.3	0.1	0.1

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RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

* CO/LINK (PPM)
* ANGLE (DEGREES)

LINK #	REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
ANGLE (DEGREES)	290	300	300	110	110	110	90	90	70	360	350	50	30	360	350	350	350	350	350	300
1	0.8	0.9	0.8	3.4	3.3	3.1	3.0	2.7	2.8	3.4	3.4	0.0	0.1	0.7	0.9	0.6	0.5	0.3	0.3	0.7
2	0.3	0.3	0.2	1.0	1.4	1.4	1.6	1.3	1.3	1.6	1.4	0.0	0.0	0.2	0.3	0.2	0.1	0.1	0.1	0.2
3	1.2	0.9	1.1	0.5	0.7	0.9	0.3	0.6	0.2	0.0	0.3	2.9	2.6	2.7	2.9	3.1	3.2	3.2	3.2	1.2
4	4.5	4.8	4.9	1.0	1.3	1.5	0.9	1.3	0.8	0.0	0.0	2.0	1.7	1.0	0.9	1.2	1.5	1.7	1.8	4.9
5	1.9	1.9	1.8	0.3	0.4	0.5	0.2	0.4	0.1	0.0	0.0	0.5	0.4	0.1	0.2	0.3	0.5	0.6	0.7	1.4
6	0.6	0.9	0.7	1.4	1.1	0.8	1.5	1.0	1.4	2.1	2.0	0.2	0.5	1.4	1.4	1.2	0.9	0.7	0.6	0.6
7	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
8	0.1	0.2	0.2	0.3	0.3	0.2	0.6	0.5	0.8	0.0	0.0	0.7	0.8	0.3	0.2	0.3	0.4	0.4	0.4	0.1
9	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.0	0.0	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.0

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RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

* CO/LINK (PPM)
* ANGLE (DEGREES)

LINK #	REC41	REC42
ANGLE (DEGREES)	300	300
1	0.6	0.6
2	0.2	0.2
3	1.3	1.4
4	5.1	5.1
5	1.1	0.8
6	0.5	0.5
7	0.0	0.0
8	0.1	0.1
9	0.0	0.0

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METEOROLOGICAL VARIABLES

U = 2.0 M/S   CLAS = 3 (C)   ATIM = 60. MINUTES   MIXH = 1000. M   AMB = 0.0 PPM

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JOB: BOH CO:CUMULATIVE:LOS D :100695:LAH   RUN: NUUANU & SMITH INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
10.	0.0	0.1	0.1	0.1	0.2	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	1.3	0.8	0.5	0.4	0.3
20.	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	1.0	0.6	0.3	0.1	0.1
30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.7	0.2	0.0	0.0	0.0
40.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.5	0.1	0.0	0.0	0.0
50.	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.1	0.0	0.0	0.0
60.	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.0
70.	0.0	0.0	0.0	0.0	0.0	0.1	0.9	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
80.	0.0	0.1	0.1	0.1	0.2	0.5	1.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.1	0.1
90.	0.0	0.2	0.3	0.3	0.5	0.7	1.6	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.3	0.2	0.2
100.	0.0	0.4	0.4	0.6	0.7	0.9	2.0	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.5	0.4	0.4
110.	0.2	0.7	0.8	1.0	1.2	1.5	2.4	1.4	0.3	0.1	0.0	0.0	0.0	0.0	0.1	0.6	0.9	0.7	0.7	0.7
120.	0.3	1.4	1.4	1.5	1.8	2.2	3.2	2.0	0.6	0.2	0.0	0.0	0.0	0.1	0.2	1.1	1.5	1.3	1.0	1.0
130.	0.9	2.1	2.1	2.3	2.6	2.9	3.8	2.8	1.3	0.3	0.1	0.0	0.1	0.2	0.6	1.8	2.1	1.8	1.7	1.6
140.	1.3	2.8	2.8	2.9	3.2	3.5	4.4	3.4	2.0	0.8	0.4	0.1	0.3	0.6	1.1	2.5	2.8	2.6	2.3	2.1
150.	1.8	3.1	3.3	3.5	3.4	3.8	4.7	4.0	2.5	1.2	0.7	0.4	0.6	1.1	1.7	3.1	3.4	3.2	2.8	2.7
160.	2.1	3.5	3.4	3.6	3.8	3.9	4.6	4.2	3.0	1.9	1.0	0.7	0.9	1.5	2.2	3.5	3.7	3.4	3.2	3.0
170.	2.3	3.7	3.5	3.7	3.8	4.0	4.4	4.3	3.4	2.3	1.5	1.0	1.2	1.9	2.5	3.7	4.0	3.8	3.5	3.4
180.	2.4	3.5	3.5	3.6	3.5	3.6	4.2	4.5	3.7	2.6	1.9	1.3	1.6	2.2	2.7	3.8	4.0	4.0	3.7	3.6
190.	2.4	3.3	3.3	3.3	3.4	3.3	3.9	4.0	3.5	2.9	2.1	1.4	1.7	2.2	2.8	3.7	4.0	3.9	3.8	3.7
200.	2.3	3.2	3.2	3.4	3.3	3.2	3.6	3.8	3.5	3.0	2.2	1.8	1.9	2.3	2.9	3.7	4.0	3.9	3.9	3.7
210.	2.3	3.0	3.2	3.4	3.4	3.3	3.5	3.5	3.3	2.7	2.1	1.8	1.9	2.3	2.8	3.8	4.0	3.9	3.9	3.9
220.	2.3	3.1	3.2	3.3	3.4	3.5	3.4	3.1	3.0	2.6	2.3	2.0	2.4	2.7	3.0	3.8	4.0	4.0	4.0	4.0
230.	2.0	3.0	3.1	3.3	3.4	3.4	3.3	2.7	2.5	2.4	2.2	2.3	2.7	2.9	3.2	4.0	4.1	4.1	4.1	4.1
240.	2.0	2.8	3.0	3.2	3.4	3.3	3.3	2.5	2.3	2.0	1.7	2.2	2.8	3.2	3.2	3.9	4.1	3.9	3.9	3.9
250.	1.7	2.6	2.8	3.0	3.1	3.3	3.3	2.6	2.1	1.9	1.6	2.1	3.0	3.3	3.4	3.9	4.0	4.0	3.9	4.0
260.	1.5	2.3	2.5	2.8	3.1	3.2	3.4	2.5	1.9	1.5	1.3	2.1	2.8	3.4	3.7	4.1	3.9	4.1	4.0	4.0
270.	1.2	2.2	2.4	2.7	3.0	3.1	3.3	2.3	1.9	1.4	1.1	1.9	2.6	3.6	3.9	4.1	4.2	4.0	4.1	4.3
280.	0.9	2.0	2.3	2.5	2.8	2.9	3.2	2.3	1.6	1.2	0.8	1.5	2.4	3.4	3.8	4.2	4.3	4.4	4.4	4.4
290.	0.6	1.8	2.1	2.3	2.7	2.7	3.0	1.9	1.4	0.9	0.6	1.2	1.8	2.9	3.6	4.3	4.4	4.3	4.3	4.4
300.	0.5	1.4	1.7	2.0	2.3	2.4	2.6	1.6	1.0	0.6	0.4	0.8	1.3	2.6	3.5	4.4	4.2	4.0	4.0	4.2
310.	0.2	1.2	1.5	1.6	1.9	2.0	2.3	1.1	0.6	0.4	0.1	0.4	0.8	2.0	3.1	4.1	3.8	3.6	3.7	3.8
320.	0.1	0.9	1.1	1.3	1.6	1.6	1.7	0.7	0.4	0.1	0.1	0.1	0.6	1.5	2.5	3.7	3.5	3.3	3.0	3.2
330.	0.0	0.6	0.7	0.8	1.1	1.1	1.2	0.3	0.1	0.0	0.0	0.0	0.3	0.9	1.9	3.1	2.8	2.4	2.1	2.2
340.	0.0	0.4	0.4	0.5	0.6	0.6	0.7	0.2	0.0	0.0	0.0	0.0	0.2	0.5	1.4	2.7	2.1	1.7	1.5	1.5
350.	0.0	0.2	0.3	0.3	0.4	0.4	0.5	0.1	0.0	0.0	0.0	0.0	0.1	0.3	0.9	2.1	1.4	1.1	0.8	0.9
360.	0.0	0.2	0.2	0.2	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.6	1.7	1.1	0.8	0.6	0.5
MAX	2.4	3.7	3.5	3.7	3.8	4.0	4.7	4.5	3.7	3.0	2.3	2.3	3.0	3.6	3.9	4.4	4.4	4.4	4.4	4.4
DEGR.	180	170	170	170	160	170	150	180	180	200	220	230	250	270	270	300	290	280	280	280

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JOB: BOH CO:CUMULATIVE:LOS D :100695:LAH   RUN: NUUANU & SMITH INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
10.	0.2	0.2	0.2	1.9	2.2	2.7	2.9	3.3	3.6	3.5	3.4	3.4	3.4	3.5	3.6	3.5	3.4	3.4	3.3	0.2
20.	0.1	0.1	0.1	2.1	2.4	2.8	3.1	3.4	3.6	3.5	3.3	3.5	3.5	3.5	3.4	3.5	3.2	3.3	3.1	0.1
30.	0.0	0.0	0.0	2.4	2.7	3.1	3.3	3.5	3.8	3.6	3.5	3.4	3.4	3.4	3.3	3.3	3.3	3.1	3.0	0.0
40.	0.0	0.0	0.0	2.7	2.9	3.3	3.5	3.7	3.8	3.6	3.6	3.5	3.5	3.5	3.3	3.4	3.3	3.2	3.1	0.0
50.	0.0	0.0	0.0	2.8	3.0	3.3	3.7	3.8	4.0	3.8	3.5	3.5	3.5	3.4	3.4	3.4	3.2	3.1	3.0	0.0
60.	0.0	0.0	0.0	2.9	3.2	3.6	3.8	3.9	4.2	3.7	3.4	3.4	3.4	3.4	3.3	3.2	3.2	3.1	2.7	0.0
70.	0.0	0.1	0.0	2.9	3.3	3.6	3.9	3.9	4.0	3.7	3.4	3.4	3.3	3.3	3.1	3.1	3.0	2.8	2.5	0.0
80.	0.1	0.2	0.2	3.1	3.5	3.7	4.0	4.0	4.0	3.5	3.3	3.3	3.2	3.2	3.0	2.9	2.8	2.6	2.3	0.1
90.	0.2	0.3	0.3	3.5	3.6	4.0	4.1	4.0	4.1	3.6	3.4	3.3	3.2	3.1	3.0	2.8	2.8	2.5	2.1	0.1
100.	0.3	0.4	0.3	3.6	3.8	3.9	4.0	3.7	3.8	3.4	3.3	3.2	3.1	3.0	2.8	2.7	2.4	2.2	1.9	0.2
110.	0.5	0.5	0.4	3.6	3.7	3.8	3.7	3.7	3.5	3.0	3.0	3.0	2.8	2.8	2.6	2.4	2.3	1.9	1.6	0.3
120.	0.8	0.8	0.7	3.3	3.4	3.7	3.5	3.3	3.1	2.6	2.7	2.7	2.5	2.4	2.2	2.1	1.9	1.6	1.2	0.4

130. *	1.4	1.2	1.0	3.0	3.0	2.9	2.8	2.8	2.7	2.2	2.4	2.2	2.1	2.1	1.7	1.6	1.5	1.3	1.0	0.7
140. *	1.8	1.6	1.3	2.3	2.3	2.3	2.1	2.1	2.0	1.7	1.8	1.7	1.6	1.5	1.3	1.3	1.1	1.0	0.7	1.0
150. *	2.3	1.8	1.5	1.7	1.5	1.5	1.3	1.3	1.3	1.0	1.1	1.1	0.9	1.0	0.9	0.8	0.7	0.6	0.4	1.2
160. *	2.7	2.3	1.9	0.9	0.8	0.8	0.8	0.8	0.7	0.6	0.7	0.7	0.5	0.6	0.5	0.5	0.4	0.4	0.3	1.3
170. *	3.0	2.5	2.1	0.4	0.4	0.3	0.3	0.4	0.3	0.2	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2	1.6
180. *	3.3	2.9	2.3	0.2	0.2	0.2	0.1	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	2.0
190. *	3.4	3.0	2.5	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	2.1
200. *	3.6	3.2	2.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4
210. *	3.8	3.5	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6
220. *	4.0	3.7	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9
230. *	4.1	3.9	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.1
240. -*	4.0	3.9	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2
250. *	3.9	3.8	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3
260. *	3.9	4.1	3.7	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	3.4
270. *	4.3	4.2	4.0	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	3.6
280. *	4.3	4.4	4.3	0.1	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.1	0.2	0.3	0.3	0.3	0.2	0.2	0.2	3.7
290. *	4.3	4.5	4.3	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.4	0.4	0.5	0.5	0.4	0.4	0.4	0.4	4.0
300. *	4.2	4.4	4.3	0.3	0.4	0.4	0.5	0.6	0.8	0.8	0.9	0.8	0.9	1.0	0.9	1.0	0.9	0.9	0.8	3.9
310. *	3.9	4.1	3.9	0.5	0.6	0.7	0.9	1.1	1.3	1.4	1.6	1.4	1.5	1.7	1.4	1.6	1.5	1.5	1.4	3.6
320. *	3.3	3.4	3.1	0.7	1.0	1.1	1.2	1.6	2.0	2.0	2.2	2.1	2.1	2.1	2.1	2.1	2.1	2.3	2.3	3.1
330. *	2.3	2.5	2.2	0.9	1.3	1.4	1.7	2.1	2.6	2.5	2.6	2.6	2.5	2.6	2.6	2.7	2.8	2.7	2.9	2.1
340. *	1.5	1.5	1.5	1.2	1.5	1.7	2.1	2.5	2.9	2.9	3.0	2.9	2.8	3.0	3.0	3.1	3.1	3.2	3.1	1.3
350. *	0.9	0.9	0.9	1.4	1.9	2.2	2.6	2.9	3.2	3.3	3.2	3.2	3.0	3.2	3.2	3.4	3.5	3.3	3.4	0.8
360. *	0.4	0.6	0.4	1.6	2.1	2.4	2.7	3.2	3.5	3.4	3.3	3.3	3.2	3.5	3.4	3.6	3.5	3.4	3.4	0.3
MAX *	4.3	4.5	4.3	3.6	3.8	4.0	4.1	4.0	4.2	3.8	3.6	3.5	3.5	3.5	3.6	3.6	3.5	3.4	3.4	4.0
DEGR. *	270	290	300	100	100	90	90	80	60	50	40	20	20	10	10	360	350	360	360	290

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MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR) *	CONCENTRATION (PPM) REC41	REC42
10. *	0.2	0.2
20. *	0.1	0.1
30. *	0.0	0.0
40. *	0.0	0.0
50. *	0.0	0.0
60. *	0.0	0.0
70. *	0.0	0.0
80. *	0.0	0.0
90. *	0.0	0.0
100. *	0.0	0.0
110. *	0.0	0.0
120. *	0.1	0.0
130. *	0.2	0.0
140. *	0.5	0.0
150. *	0.6	0.0
160. *	0.7	0.1
170. *	1.0	0.2
180. *	1.2	0.3
190. *	1.5	0.5
200. *	1.7	0.7
210. *	2.2	1.0
220. *	2.6	1.4
230. *	2.8	1.9
240. *	2.9	2.2
250. *	3.1	2.4
260. *	3.2	2.8
270. *	3.5	3.1
280. *	3.7	3.4
290. *	3.8	3.4
300. *	3.9	3.8
310. *	3.6	3.5
320. *	2.9	2.8
330. *	2.0	2.1
340. *	1.5	1.4
350. *	0.8	0.7
360. *	0.4	0.3
MAX *	3.9	3.8
DEGR. *	300	300

* THE HIGHEST CONCENTRATION IS 4.70 PPM AT 150 DEGREES FROM REC7 .

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DATE: 10/08/95 TIME: 14:45

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

* CO/LINK (PPM)
* ANGLE (DEGREES)

LINK #	REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
	180	170	170	170	160	170	150	180	180	200	220	230	250	270	270	300	290	280	280	280
1	0.4	0.7	0.6	0.5	0.3	0.2	0.0	0.1	0.1	0.2	0.3	0.2	0.4	0.5	0.6	0.6	0.6	0.5	0.4	0.3
2	0.2	0.3	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.1
3	0.3	0.3	0.4	0.5	0.6	0.7	0.6	0.7	0.6	0.4	0.3	0.4	0.2	0.1	0.2	0.0	0.3	0.5	0.6	0.7
4	0.3	0.4	0.4	0.6	0.8	1.0	1.6	1.2	1.0	0.7	0.4	0.6	0.5	0.4	0.7	0.8	1.5	1.8	2.0	2.1
5	0.1	0.1	0.1	0.1	0.2	0.3	0.4	0.3	0.3	0.2	0.1	0.2	0.1	0.1	0.1	0.0	0.4	0.7	0.8	0.8
6	1.0	1.8	1.7	1.6	1.4	1.2	0.6	0.4	0.2	0.3	0.5	0.2	0.5	0.8	0.8	1.2	0.8	0.5	0.4	0.3
7	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0
8	0.1	0.1	0.1	0.2	0.3	0.4	1.2	1.5	1.2	0.8	0.5	0.4	0.7	1.0	1.0	1.1	0.4	0.1	0.1	0.1
9	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.2	0.4	0.4	0.3	0.4	0.2	0.1	0.0	0.0

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JOB: BOH CO:CUMULATIVE:LOS D :100695:LAM RUN: NUUANU & SMITH INTERSECTION
DATE: 10/08/95 TIME: 14:45

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

* CO/LINK (PPM)
* ANGLE (DEGREES)

LINK #	REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
	270	290	300	100	100	90	90	80	60	50	40	20	20	10	10	360	350	360	360	290
1	0.2	0.3	0.3	1.7	1.6	1.6	1.5	1.4	1.6	1.4	0.9	0.7	0.4	0.3	0.2	0.2	0.3	0.1	0.1	0.2
2	0.1	0.1	0.1	0.3	0.6	0.7	0.7	0.7	0.8	0.5	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1
3	0.9	0.7	0.6	0.2	0.2	0.2	0.3	0.3	0.2	0.3	0.9	1.0	1.3	1.4	1.5	1.5	1.5	1.6	1.6	0.8
4	2.1	2.2	2.2	0.3	0.4	0.4	0.5	0.5	0.3	0.4	0.5	0.5	0.7	0.7	0.9	0.8	0.8	1.0	1.0	2.2
5	0.9	0.9	0.7	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5
6	0.1	0.2	0.3	0.9	0.8	0.8	0.7	0.7	0.9	0.8	0.7	0.7	0.5	0.5	0.3	0.4	0.4	0.2	0.2	0.2
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0

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JOB: BOH CO:CUMULATIVE:LOS D :100695:LAM RUN: NUUANU & SMITH INTERSECTION
DATE: 10/08/95 TIME: 14:45

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

* CO/LINK (PPM)
* ANGLE (DEGREES)

LINK #	REC41	REC42
	300	300
1	0.2	0.2
2	0.1	0.1
3	0.7	0.7
4	2.2	2.2
5	0.4	0.3
6	0.2	0.2
7	0.0	0.0
8	0.1	0.1
9	0.0	0.0

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CAL3QHC: LINE SOURCE DISPERSION MODEL - VERSION 2.0, JANUARY 1992 PAGE 1

JOB: BOH CO:PROJECT ONLY:LOS D :100695:LAM RUN: NUUANU & SMITH INTERSECTION
DATE: 10/08/95 TIME: 14:53

SITE & METEOROLOGICAL VARIABLES

VS = 0.0 CM/S VD = 0.0 CM/S Z0 = 321. CM
U = 1.0 M/S CLAS = 4 (D) ATIM = 60. MINUTES MIXH = 1000. M AMB = 0.0 PPM

LINK VARIABLES

LINK DESCRIPTION	X1	Y1	X2	Y2	LENGTH (FT)	BRG (DEG)	TYPE	VPH	EF (G/MI)	H (FT)	W (FT)	V/C	QUEUE (VEH)
	LINK COORDINATES (FT)												
1. SB Nimitz-Appr.	-29.0	-9.0	-180.0	163.0	229.	319.	AG	11.	27.0	0.0	68.0		
2. SB Nimitz-Queue	-38.0	2.0	-38.8	2.9	1.	319.	AG	150.	100.0	0.0	12.0	0.01	0.1
3. SB Nimitz-Depart.	-29.0	-9.0	163.0	-221.0	286.	138.	AG	0.	27.0	0.0	68.0		
4. NB Nimitz-Appr.	7.0	22.0	197.0	-187.0	282.	138.	AG	16.	27.0	0.0	68.0		
5. NB Nimitz-Queue	26.0	2.0	27.2	0.7	2.	138.	AG	150.	100.0	0.0	12.0	0.01	0.1
6. NB Nimitz-Depart.	7.0	22.0	-144.0	192.0	227.	318.	AG	26.	27.0	0.0	68.0		
7. SW-B Smith -Appr.	-29.0	-9.0	96.0	96.0	163.	50.	AG	30.	41.0	0.0	44.0		
8. SW-B Smith -Queue	29.0	38.0	39.5	47.1	14.	49.	AG	1956.	100.0	0.0	24.0	0.09	0.7
9. NE-B Smith	19.0	10.0	106.0	86.0	116.	49.	AG	27.	41.0	0.0	32.0		

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JOB: BOH CO:PROJECT ONLY:LOS D :100695:LAM RUN: NUUANU & SMITH INTERSECTION
DATE: 10/08/95 TIME: 14:53

ADDITIONAL QUEUE LINK PARAMETERS

LINK DESCRIPTION	CYCLE LENGTH (SEC)	RED TIME (SEC)	CLEARANCE LOST TIME (SEC)	APPROACH VOL (VPH)	SATURATION FLOW RATE (VPH)	IDLE EM FAC (gm/hr)	SIGNAL TYPE	ARRIVAL RATE
2. SB Nimitz-Queue	150	20	2.0	11	1600	420.80	3	1
5. NB Nimitz-Queue	150	20	2.0	16	1600	420.80	3	1
8. SW-B Smith -Queue	150	130	2.0	30	1600	420.80	3	1

RECEPTOR LOCATIONS

RECEPTOR	X	Y	Z
	COORDINATES (FT)		
1. REC 1	-31.0	178.0	6.0
2. REC 2	-62.0	158.0	6.0
3. REC 3	-48.0	142.0	6.0
4. REC 4	-31.0	122.0	6.0
5. REC 5	-17.0	103.0	6.0
6. REC 6	0.0	86.0	6.0
7. REC 7	14.0	67.0	6.0
8. REC 8	34.0	82.0	6.0
9. REC 9	48.0	98.0	6.0
10. REC 10	67.0	113.0	6.0
11. REC 11	86.0	130.0	6.0
12. REC 12	134.0	82.0	6.0
13. REC 13	115.0	67.0	6.0
14. REC 14	96.0	48.0	6.0
15. REC 15	82.0	34.0	6.0
16. REC 16	62.0	19.0	6.0
17. REC 17	72.0	0.0	6.0
18. REC 18	91.0	-19.0	6.0
19. REC 19	108.0	-36.0	6.0
20. REC 20	122.0	-53.0	6.0
21. REC 21	139.0	-72.0	6.0
22. REC 21	154.0	-91.0	6.0
23. REC 23	170.0	-108.0	6.0
24. REC 24	-168.0	89.0	6.0
25. REC 25	-149.0	67.0	6.0
26. REC 26	-134.0	50.0	6.0
27. REC 27	-120.0	34.0	6.0
28. REC 28	-101.0	14.0	6.0
29. REC 29	-86.0	0.0	6.0
30. REC 30	-72.0	-19.0	6.0
31. REC 31	-53.0	-38.0	6.0
32. REC 32	-38.C	-55.0	6.0
33. REC 33	-24.0	-72.0	6.0
34. REC 34	-7.0	-89.0	6.0
35. REC 35	10.0	-110.0	6.0
36. REC 36	24.0	-125.0	6.0
37. REC 37	41.0	-144.0	6.0
38. REC 38	57.0	-163.0	6.0
39. REC 39	72.0	-182.0	6.0
40. REC 40	187.0	-125.0	6.0
41. REC 41	204.0	-144.0	6.0
42. REC 42	221.0	-161.0	6.0

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JOB: BOH CO:PROJECT ONLY:LOS D :100695:LAM RUN: NUUANU & SMITH INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
10.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100.	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
110.	0.0	0.0	0.0	0.1	0.1	0.2	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120.	0.0	0.1	0.1	0.2	0.3	0.5	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
130.	0.1	0.2	0.2	0.3	0.5	0.8	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
140.	0.2	0.2	0.3	0.4	0.6	1.0	2.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
150.	0.2	0.2	0.2	0.3	0.5	0.9	1.9	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
160.	0.2	0.1	0.1	0.2	0.3	0.6	1.4	1.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
170.	0.1	0.0	0.1	0.1	0.1	0.3	0.9	1.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
180.	0.1	0.0	0.0	0.0	0.0	0.1	0.4	1.5	0.7	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
190.	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.4	0.9	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
200.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.9	0.6	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
210.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.7	0.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
220.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.4	0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
230.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
240.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.4	0.4	0.2	0.0	0.0	0.0	0.0	0.0
250.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.5	0.6	0.4	0.0	0.0	0.0	0.0	0.0
260.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.8	0.7	0.1	0.0	0.0	0.0	0.0
270.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.8	1.0	0.3	0.0	0.0	0.0	0.0
280.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.6	1.2	0.7	0.1	0.0	0.0	0.0
290.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.0	1.1	0.3	0.2	0.1	0.1
300.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.7	1.6	0.6	0.3	0.2	0.2
310.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.8	0.9	0.5	0.3	0.3
320.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.6	0.9	0.5	0.4	0.3
330.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	0.8	0.4	0.3	0.2
340.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.5	0.2	0.1	0.1
350.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.1	0.0	0.0
360.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
MAX	0.2	0.2	0.3	0.4	0.6	1.0	2.1	1.5	0.9	0.6	0.4	0.4	0.5	0.8	1.2	1.8	0.9	0.5	0.4	0.3
DEGR.	140	130	140	140	140	140	140	180	190	200	210	250	250	260	280	310	310	310	320	310

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
10.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.0
20.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.2	0.1	0.1	0.0	0.0	0.0
30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0
40.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
50.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70.	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80.	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90.	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100.	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
110.	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120.	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
130.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
140.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
150.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
160.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
170.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
180.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

190.	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
200.	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
210.	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
220.	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
230.	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
240.	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
250.	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
260.	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
270.	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
280.	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
290.	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
300.	*	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
310.	*	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
320.	*	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
330.	*	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
340.	*	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0
350.	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0
360.	*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.0
MAX	*	0.2	0.2	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1
DEGR.	*	310	310	300	90	90	90	80	80	70	50	40	30	20	20	10	10	360	10	10	300

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MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR)	*	CONCENTRATION (PPM) REC41	REC42
10.	*	0.0	0.0
20.	*	0.0	0.0
30.	*	0.0	0.0
40.	*	0.0	0.0
50.	*	0.0	0.0
60.	*	0.0	0.0
70.	*	0.0	0.0
80.	*	0.0	0.0
90.	*	0.0	0.0
100.	*	0.0	0.0
110.	*	0.0	0.0
120.	*	0.0	0.0
130.	*	0.0	0.0
140.	*	0.0	0.0
150.	*	0.0	0.0
160.	*	0.0	0.0
170.	*	0.0	0.0
180.	*	0.0	0.0
190.	*	0.0	0.0
200.	*	0.0	0.0
210.	*	0.0	0.0
220.	*	0.0	0.0
230.	*	0.0	0.0
240.	*	0.0	0.0
250.	*	0.0	0.0
260.	*	0.0	0.0
270.	*	0.0	0.0
280.	*	0.0	0.0
290.	*	0.0	0.0
300.	*	0.1	0.0
310.	*	0.1	0.1
320.	*	0.1	0.1
330.	*	0.1	0.1
340.	*	0.0	0.0
350.	*	0.0	0.0
360.	*	0.0	0.0
MAX	*	0.1	0.1
DEGR.	*	300	310

THE HIGHEST CONCENTRATION IS 2.10 PPM AT 140 DEGREES FROM REC7 .

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RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

CO/LINK (PPM)
ANGLE (DEGREES)

LINK #	REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
	140	130	140	140	140	140	140	180	190	200	210	250	250	260	280	310	310	310	320	310
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.2	0.2	0.3	0.4	0.6	1.0	2.1	1.5	0.9	0.6	0.4	0.4	0.5	0.8	1.2	1.8	0.9	0.5	0.4	0.3
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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JOB: BOH CO:PROJECT ONLY:LOS D :100695:LAM RUN: NUUANU & SMITH INTERSECTION PAGE 7
DATE: 10/08/95 TIME: 14:53

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

CO/LINK (PPM)
ANGLE (DEGREES)

LINK #	REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
	310	310	300	90	90	90	80	80	70	50	40	30	20	20	10	10	360	10	10	300
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.2	0.2	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

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JOB: BOH CO:PROJECT ONLY:LOS D :100695:LAM RUN: NUUANU & SMITH INTERSECTION PAGE 8
DATE: 10/08/95 TIME: 14:53

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

CO/LINK (PPM)
ANGLE (DEGREES)

LINK #	REC41	REC42
	300	310
1	0.0	0.0
2	0.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.1	0.1
9	0.0	0.0

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JOB: BOH CO:PROJECT ONLY:LOS D :100695:LAM RUN: NUUANU & SMITH INTERSECTION PAGE 9

METEOROLOGICAL VARIABLES

U = 2.0 M/S   CLAS = 3 (C)   ATIM = 60. MINUTES   MIXH = 1000. M   AMB = 0.0 PPM

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JOB: BOH CO:PROJECT ONLY:LOS D :100695:LAM   RUN: NUUANU & SMITH INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
10.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
20.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
40.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
50.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90.	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100.	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
110.	0.0	0.0	0.0	0.1	0.1	0.2	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120.	0.0	0.1	0.1	0.1	0.1	0.3	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
130.	0.0	0.1	0.1	0.1	0.2	0.3	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
140.	0.1	0.1	0.1	0.1	0.2	0.3	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
150.	0.1	0.1	0.1	0.1	0.2	0.3	0.7	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
160.	0.1	0.1	0.1	0.1	0.1	0.2	0.6	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
170.	0.1	0.0	0.0	0.1	0.1	0.2	0.5	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
180.	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.5	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
190.	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
200.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.4	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
210.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.2	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
220.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
230.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
240.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.0
250.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.2	0.2	0.3	0.1	0.0	0.0	0.0	0.0
260.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.3	0.2	0.0	0.0	0.0	0.0
270.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.4	0.3	0.1	0.0	0.0	0.0
280.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.4	0.1	0.1	0.0	0.0
290.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.5	0.2	0.1	0.1	0.1
300.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.5	0.3	0.1	0.1	0.1
310.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.6	0.3	0.2	0.1	0.1
320.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.6	0.3	0.2	0.1	0.1
330.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.3	0.2	0.1	0.1
340.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.2	0.1	0.1	0.1
350.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.2	0.1	0.1	0.0
360.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.1	0.0	0.0
MAX	0.1	0.1	0.1	0.1	0.2	0.3	0.7	0.5	0.3	0.2	0.1	0.1	0.2	0.3	0.4	0.6	0.3	0.2	0.1	0.1
DEGR.	140	120	120	110	130	120	130	160	180	190	180	220	250	270	270	310	300	310	290	290

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JOB: BOH CO:PROJECT ONLY:LOS D :100695:LAM   RUN: NUUANU & SMITH INTERSECTION

MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
10.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
20.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
30.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
40.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
50.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
60.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
70.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
80.	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
90.	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
100.	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
110.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
120.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

130.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
140.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
150.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
160.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
170.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
180.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
190.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
200.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
210.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
220.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
230.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
240.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
250.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
260.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
270.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
280.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
290.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
300.	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
310.	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
320.	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
330.	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
340.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
350.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
360.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
MAX	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
DEGR.	300	10	10	10	10	90	70	60	50	30	20	10	10	10	10	10	10	10	10	10

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MODEL RESULTS

REMARKS : In search of the angle corresponding to the maximum concentration, only the first angle, of the angles with same maximum concentrations, is indicated as maximum.

WIND ANGLE RANGE: 10.-360.

WIND ANGLE (DEGR)	CONCENTRATION (PPM) REC41	REC42
10.	0.0	0.0
20.	0.0	0.0
30.	0.0	0.0
40.	0.0	0.0
50.	0.0	0.0
60.	0.0	0.0
70.	0.0	0.0
80.	0.0	0.0
90.	0.0	0.0
100.	0.0	0.0
110.	0.0	0.0
120.	0.0	0.0
130.	0.0	0.0
140.	0.0	0.0
150.	0.0	0.0
160.	0.0	0.0
170.	0.0	0.0
180.	0.0	0.0
190.	0.0	0.0
200.	0.0	0.0
210.	0.0	0.0
220.	0.0	0.0
230.	0.0	0.0
240.	0.0	0.0
250.	0.0	0.0
260.	0.0	0.0
270.	0.0	0.0
280.	0.0	0.0
290.	0.0	0.0
300.	0.0	0.0
310.	0.0	0.0
320.	0.0	0.0
330.	0.0	0.0
340.	0.0	0.0
350.	0.0	0.0
360.	0.0	0.0
MAX	0.0	0.0
DEGR.	10	10

THE HIGHEST CONCENTRATION IS 0.70 PPM AT 130 DEGREES FROM REC7 .

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DATE: 10/08/95 TIME: 14:53

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

* CO/LINK (PPM)
* ANGLE (DEGREES)

LINK #	REC1	REC2	REC3	REC4	REC5	REC6	REC7	REC8	REC9	REC10	REC11	REC12	REC13	REC14	REC15	REC16	REC17	REC18	REC19	REC20
	140	120	120	110	130	120	130	160	180	190	180	220	250	270	270	310	300	310	290	290
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.1	0.1	0.1	0.1	0.2	0.3	0.7	0.5	0.3	0.2	0.1	0.1	0.2	0.3	0.4	0.6	0.3	0.2	0.1	0.1
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DATE: 10/08/95 TIME: 14:53

RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

* CO/LINK (PPM)
* ANGLE (DEGREES)

LINK #	REC21	REC22	REC23	REC24	REC25	REC26	REC27	REC28	REC29	REC30	REC31	REC32	REC33	REC34	REC35	REC36	REC37	REC38	REC39	REC40
	300	10	10	10	10	90	70	60	50	30	20	10	10	10	10	10	10	10	10	10
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	0.1	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DATE: 10/08/95 TIME: 14:53

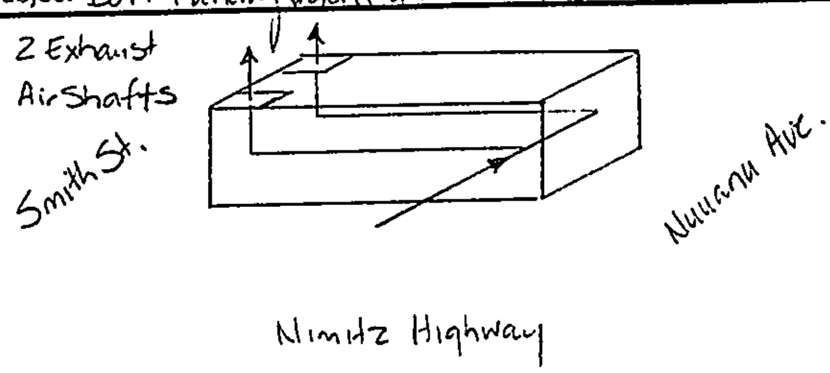
RECEPTOR - LINK MATRIX FOR THE ANGLE PRODUCING
THE MAXIMUM CONCENTRATION FOR EACH RECEPTOR

* CO/LINK (PPM)
* ANGLE (DEGREES)

LINK #	REC41	REC42
	10	10
1	0.0	0.0
2	0.0	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
9	0.0	0.0

SCREEN2 Model Input Calculations

Project BOH Annex Tower EA	Sheet No. 1 of 4	BELT COLLINS & ASSOCIATES Engineering • Planning Landscape Architecture
Job No. 533.0401, E02	Date 10-17-95	
Client	By Kam	
Subject BOH Parking Ventilation - Exhaust Characteristics		



Exhaust Air Shaft Release Height = 12 ft = 3.7 m
Exhaust Flow = 72,600 cfm/shaft = 34.3 m^3/s/shaft
Area of release = 120 ft^2/shaft = 11.2 m^2/shaft → 3.3 m x 3.3 m
Exit velocity = 600 ft/min/shaft = 3.0 m/s/shaft

For SCREEN2 Modeling Purposes

Initial lateral dimension (σ_{y_0}) = length of side of release / 4.3
= 3.3 m / 4.3
= 0.8 m

Initial vertical dimension (σ_{z_0}) = building height / 2.15
= 76.2 m / 2.15
= 35.4 m

Project	BOH Annex Tower EA	Sheet No. 2 of 4	BELT COLLINS & ASSOCIATES Engineering • Planning Landscape Architecture
Job No.	533.0401, E02	Date 10-17-95	
Client		By sam	
Subject	BOH Parking Ventilation - Air Exchange		

Air Exchange Rate = (Volume of Air w/in Parking Structure)/(Max. Flow Rate of Ventilation System)

Volume of Air w/in Parking Structure (approx.)
= (area of base parking level) * (height of 6-story parking lot)
= (38,500 ft^2) * (56.5 ft)
= 2,175,250 ft^3, estimated dimensions obtained from design drawings (StringerTusherArchitects Inc., Aug. 9, 1995)

Max. Flow Rate of Ventilation System
= (72,600 cfm / exhaust shaft) * (2 exhaust shafts)
= 145,200 cfm

Air Exchange Rate = (2,175,250 ft^3) / (145,200 ft^3/min)

= 15.0 min ∴ Supply air replaces parking lot air once every 15 minutes. Concentration of CO w/in parking structure is probably less than 25 ppm (or the level at which the ventilation system kicks in).

Project BOH Annex Tower EA	Sheet No. 3 of 4	BELT COLLINS & ASSOCIATES Engineering • Planning Landscape Architecture
Job No. 533.0401.E02	Date 10-17-95	
Client	By jam	
Subject BOH Parking Ventilation - Emission Rate		

Parking ventilation operates when CO concentration ≥ 25ppm (28,571 μg/m³)

Assume steady-state condition: Amount of CO concentration within parking structure maintains a maximum concentration of 25ppm while parking ventilation system is operating. Because max. CO concentration in supply air is 13.8ppm (based on max. 1-hr modeled concentration from CAL3QHC), actual parking lot concentration of CO, X, is more likely to be:

$$13.8\,ppm \le X \le 25\,ppm$$

Note: Conversion from ppm to μg/m³

$$\mu g/m^3 = ppm \times \text{Molecular Wt.} \times 1000 \div 24.5$$

Emission Rate of CO = CO Concentration w/in Parking Lot × Exhaust Flow
= 28,571 μg/m³ × 34.3 m³/s/shaft
= 979,985 μg/s/shaft
= 1.0 g/s/shaft

Project	BOH Annex Tower EA	Sheet No. 4 of 4		BELT COLLINS & ASSOCIATES Engineering • Planning Landscape Architecture
Job No.	533.0401.E02	Date	10-17-95	
Client		By	Lam	
Subject	BOH Parking Ventilation - Mitigation			

Mitigation: Reduce concentration level of CO used to 'kick in' operation of parking lot ventilation system → 25 ppm to 20 ppm.

20 ppm = 22,857 μg/m³

Emission Rate of CO = CO Concentration w/in Parking Lot * Exhaust Flow
= 22,857 μg/m³ * 34.3 m³/s/shaft
= 783,995 μg/s/shaft
= 0.8 g/s/shaft

SCREEN2 Model Output

10/19/95
11:35:39

*** SCREEN2 MODEL RUN ***
*** VERSION DATED 92245 ***

BOH Parking Ventilation Exhaust:CO Concentration

SIMPLE TERRAIN INPUTS:

SOURCE TYPE	=	VOLUME
EMISSION RATE (G/S)	=	1.00000
SOURCE HEIGHT (M)	=	3.7000
INIT. LATERAL DIMEN (M)	=	.8000
INIT. VERTICAL DIMEN (M)	=	35.4000
RECEPTOR HEIGHT (M)	=	1.8000
URBAN/RURAL OPTION	=	URBAN

BUOY. FLUX = .000 M**4/S**3; MOM. FLUX = .000 M**4/S**2.

*** FULL METEOROLOGY ***

****
*** SCREEN DISCRETE DISTANCES ***
****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
1.	.0000	0	.0	.0	.0	.00	.00	.00	
2.	.0000	0	.0	.0	.0	.00	.00	.00	
3.	7883.	5	1.0	1.0	10000.0	3.70	1.13	35.53	NO
4.	7177.	5	1.0	1.0	10000.0	3.70	1.24	35.58	NO
5.	6586. (5.8ppm)	5	1.0	1.0	10000.0	3.70	1.35	35.62	NO
6.	6084.	5	1.0	1.0	10000.0	3.70	1.46	35.66	NO
7.	5652.	5	1.0	1.0	10000.0	3.70	1.57	35.71	NO
8.	5277.	5	1.0	1.0	10000.0	3.70	1.68	35.75	NO
9.	4948.	5	1.0	1.0	10000.0	3.70	1.79	35.79	NO
10.	4657. (4.1ppm)	5	1.0	1.0	10000.0	3.70	1.89	35.84	NO
15.	3594. (3.1ppm)	5	1.0	1.0	10000.0	3.70	2.44	36.06	NO
20.	2921. (2.6ppm)	5	1.0	1.0	10000.0	3.70	2.98	36.27	NO
25.	2457. (2.1ppm)	5	1.0	1.0	10000.0	3.70	3.53	36.49	NO
30.	2117. (1.9ppm)	5	1.0	1.0	10000.0	3.70	4.07	36.70	NO
35.	1858. (1.6ppm)	5	1.0	1.0	10000.0	3.70	4.61	36.92	NO
40.	1653. (1.4ppm)	5	1.0	1.0	10000.0	3.70	5.15	37.13	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

Exhaust air shafts are separated by ~ 120' (36m) ∴ cumulative impact from both exhausts is: max conc (@3m) + conc. (@~36m)
6.9 ppm + 1.6 ppm
8.5 ppm

****
*** SUMMARY OF SCREEN MODEL RESULTS ***
****

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	7883.	3.	0.

→ 6.9 ppm

****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
****

10/19/95
11:41:22

*** SCREEN2 MODEL RUN ***
*** VERSION DATED 92245 ***

BOH Parking Ventilation:CO Conc.w/Mitigation:20 ppm Trigger

SIMPLE TERRAIN INPUTS:

SOURCE TYPE	=	VOLUME
EMISSION RATE (G/S)	=	.800000
SOURCE HEIGHT (M)	=	3.7000
INIT. LATERAL DIMEN (M)	=	.8000
INIT. VERTICAL DIMEN (M)	=	35.4000
RECEPTOR HEIGHT (M)	=	1.8000
URBAN/RURAL OPTION	=	URBAN

BUOY. FLUX = .000 M**4/S**3; MOM. FLUX = .000 M**4/S**2.

*** FULL METEOROLOGY ***

****
*** SCREEN DISCRETE DISTANCES ***
****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
1.	.0000	0	.0	.0	.0	.00	.00	.00	
2.	.0000	0	.0	.0	.0	.00	.00	.00	
3.	6306.	5	1.0	1.0	10000.0	3.70	1.13	35.53	NO
4.	5742.	5	1.0	1.0	10000.0	3.70	1.24	35.58	NO
5.	5269. (4.6ppm)	5	1.0	1.0	10000.0	3.70	1.35	35.62	NO
6.	4867.	5	1.0	1.0	10000.0	3.70	1.46	35.66	NO
7.	4522.	5	1.0	1.0	10000.0	3.70	1.57	35.71	NO
8.	4222.	5	1.0	1.0	10000.0	3.70	1.68	35.75	NO
9.	3959.	5	1.0	1.0	10000.0	3.70	1.79	35.79	NO
10.	3726. (3.3ppm)	5	1.0	1.0	10000.0	3.70	1.89	35.84	NO
15.	2875. (2.5ppm)	5	1.0	1.0	10000.0	3.70	2.44	36.06	NO
20.	2337. (2.0ppm)	5	1.0	1.0	10000.0	3.70	2.98	36.27	NO
25.	1965. (1.7ppm)	5	1.0	1.0	10000.0	3.70	3.53	36.49	NO
30.	1694. (1.6ppm)	5	1.0	1.0	10000.0	3.70	4.07	36.70	NO
35.	1486. (1.3ppm)	5	1.0	1.0	10000.0	3.70	4.61	36.92	NO
40.	1323. (1.2ppm)	5	1.0	1.0	10000.0	3.70	5.15	37.13	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

Exhaust air shafts are separated by ~120' (36 meters)
∴ cumulative impact is:
max. conc (@ 3m) + conc. (@ ~36m) —
5.5 ppm + 1.3 ppm
6.8 ppm

****
*** SUMMARY OF SCREEN MODEL RESULTS ***
****

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)	
SIMPLE TERRAIN	6306.	3.	0.	→ 5.5 ppm

****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
****

10/19/95
16:05:52

*** SCREEN2 MODEL RUN ***
*** VERSION DATED 92245 ***

BOH Parking Ventilation:CO Concentrations:Fourth Floor

SIMPLE TERRAIN INPUTS:

SOURCE TYPE	=	VOLUME
EMISSION RATE (G/S)	=	1.00000
SOURCE HEIGHT (M)	=	3.7000
INIT. LATERAL DIMEN (M)	=	.8000
INIT. VERTICAL DIMEN (M)	=	35.4000
RECEPTOR HEIGHT (M)	=	12.2000
URBAN/RURAL OPTION	=	URBAN

BUOY. FLUX = .000 M**4/S**3; MOM. FLUX = .000 M**4/S**2.

*** FULL METEOROLOGY ***

****
*** SCREEN DISCRETE DISTANCES ***
****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
1.	.0000	0	.0	.0	.0	.00	.00	.00	
2.	.0000	0	.0	.0	.0	.00	.00	.00	
3.	7446.	5	1.0	1.0	10000.0	3.70	1.13	35.53	NO
4.	6780.	5	1.0	1.0	10000.0	3.70	1.24	35.58	NO
5.	6223.	5	1.0	1.0	10000.0	3.70	1.35	35.62	NO
6.	5749.	5	1.0	1.0	10000.0	3.70	1.46	35.66	NO
7.	5342.	5	1.0	1.0	10000.0	3.70	1.57	35.71	NO
8.	4988.	5	1.0	1.0	10000.0	3.70	1.68	35.75	NO
9.	4678.	5	1.0	1.0	10000.0	3.70	1.79	35.79	NO
10.	4403.	5	1.0	1.0	10000.0	3.70	1.89	35.84	NO
15.	3401.	5	1.0	1.0	10000.0	3.70	2.44	36.06	NO
20.	2765.	5	1.0	1.0	10000.0	3.70	2.98	36.27	NO
25.	2327.	5	1.0	1.0	10000.0	3.70	3.53	36.49	NO
30.	2007.	5	1.0	1.0	10000.0	3.70	4.07	36.70	NO
35.	1762.	5	1.0	1.0	10000.0	3.70	4.61	36.92	NO
40.	1569.	5	1.0	1.0	10000.0	3.70	5.15	37.13	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SUMMARY OF SCREEN MODEL RESULTS ***
****

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	7446.	3.	0.

****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
****

APPENDIX E:

NOISE IMPACT ANALYSIS

D.L. ADAMS ASSOCIATES, LTD.
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DARBY
& ASSOCIATES
ACOUSTICAL CONSULTANTS

#95-35

ENVIRONMENTAL NOISE IMPACT ASSESSMENT
BANK OF HAWAII ANNEX TOWER

September, 1995

Prepared For:

GRAHAM, MURATA, RUSSELL
345 Queen Street, Suite 400
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CONTENTS

1.0 Summary

1. The project site is located in Downtown Honolulu and there are no noise sensitive areas in the immediate vicinity of the project site.

2. The project site is currently exposed to relatively high traffic noise levels along Nimitz Highway. The noise levels generally decrease as the distance from Nimitz Highway is increased.

3. The maximum increase from existing peak hour traffic noise levels in the year 1999 along Nimitz Highway should be 1.2 dB. This increase is projected to occur whether or not the office tower is constructed.

4. Traffic along Smith Street, Marin Street and Nuuanu Avenue do not and will not significantly contribute to the noise levels at the project site.

5. Noise sources located within the project site are mechanical equipment, such as an emergency generator, chillers, exhaust fans, cooling towers, etc., electrical equipment, and service area activities related to deliveries and trash pickup. Noise from these on site sources can be reduced to acceptable levels by incorporating appropriate noise control measures in the design.

6. Construction noise could cause some short-term annoyance to occupants of nearby buildings, particularly if pile driving is used. In cases where construction noise exceeds or is expected to exceed the Department of Health's (DOH) property line limits, a construction noise permit must be obtained from the DOH. Required permit conditions include restrictions on the maximum allowable noise levels and permissible operating hours. If pile driving is used, vibration monitoring is recommended to ensure that ground-borne vibrations transmitted into adjacent buildings is well below the limits at which structural damage can occur.

2.0 Project Description

The future Bank of Hawaii Annex Tower is a 250-ft. tall office tower with a six-level, 570-stall underground parking garage. The project site, which is presently occupied by a 5-story level office building, is located on the mauka side of Nimitz Highway between Smith Street and Nuuanu Avenue. The site is bordered on the mauka side by Marin Street (Figure 1).

Surrounding the project site are offices and retail air-conditioned low-rise buildings. There is also a naturally ventilated 250-ft. tall residential tower between Smith Street and Maunakea Street with a line-of-sight to the project site.

3.0 Existing Acoustical Environment

Noise measurements were made at and in the vicinity of the project site on the morning of September 6, 1995. Background noise levels were sampled for 5-minute and 15-minute time periods using Larson-Davis Laboratories, Model 700 and 800 Sound Level Meters. The specific measurement locations, depicted in Figure 2, are described below:

1. The makai-side sidewalk, along Nimitz Highway across from the project site, approximately 10 ft. from the curb.

2. At the corner of Smith Street and Marin Street, across from the project site, approximately 5 ft. from the Smith Street curb.

3. Along Marin Street, midway between Smith Street and Nuuanu Avenue, across from the project site.

4. At the entrance to the existing office building parking lot along Nuuanu Avenue.

The weather conditions during the measurements were sunny skies, with a temperature of about 90 degrees and tradewinds at 0-5 mph.

The dominant noise source at all locations was traffic on Nimitz Highway although at times departing aircraft from Honolulu International Airport and construction equipment along King Street were audible. The results of the measurements are presented in Table 1.

4.0 Noise Standards and Guidelines

Standards and guidelines promulgated by the various local, state and federal agencies use different noise descriptors to express noise levels. To better understand the various noise descriptors used, a list of some common acoustical terminology is presented as Appendix 1.

4.1 State Department of Health

The Hawaii Department of Health (DOH) regulations [Reference 1] specify allowable noise levels in terms of the A-weighted sound levels that may not be exceeded for more than 10% of any 20-minute period. The DOH regulations for Oahu are presented in Figure 3.

4.2 City and County of Honolulu Land Use Ordinance

The City and County of Honolulu Land Use Ordinance (LUO) [Reference 2] noise regulations differ from the DOH noise regulations in that the maximum permissible octave band sound pressure levels are specified instead of A-weighted sound pressure levels. Also, there is no specified period of time associated with the exceedance of these levels. Figure 4 presents the LUO allowable noise levels.

4.3 State Department of Transportation, Airports Division

The Hawaii Department of Transportation (DOT) Airports Division local land use compatibility guidelines [Reference 3] are expressed in terms of yearly day-night average sound levels, L_{dn}, due to aircraft operations. These guidelines permit an L_{dn} of up to 65 dBA for offices without incorporating additional Noise Level Reduction (NLR) measures into the building construction. The DOT guidelines further state that offices can be constructed in areas exposed to L_{dn} levels of up to 75 dBA, if proper NLR measures are included in the construction.

4.4 U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) recommended allowable noise levels is expressed in terms of equivalent sound level, L_{eq}. For office buildings, the EPA recommends an L_{eq} not exceeding 70 dBA.

5.0 Potential Noise Impacts and Recommended Noise Impact Mitigation

5.1 Traffic Noise

Traffic counts were taken during the noise measurements at Location 1 to allow calibration of the Federal Highway (FHWA) Traffic Noise Prediction Model [Reference 4]. Once calibrated, the FHWA noise model was used to project future traffic noise using data provided by the traffic engineer [References 5 and 6]. This data consisted of estimated traffic volumes with and without the project for the year 1999. Calculated existing and future traffic noise levels along Nimitz Highway are presented in Table 2.

The results summarized in Table 2 indicate that the increase in 1999 peak hour traffic noise levels over existing levels will range from 0.7 dB to 1.2 dB. It can also be seen that there are no differences between the 1999 traffic noise levels from Nimitz Highway "with" and "without" the project.

Traffic parameters, such as flow conditions and low vehicle speeds, prevent the FHWA noise model from being used for the other affected city streets. However, it is possible to predict the relative changes in morning and afternoon peak hour traffic noise levels due to changes in traffic volume. The results are summarized in Table 3.

The results summarized in Table 3 indicate that construction of the office tower will only influence the 1999 morning peak hour traffic noise. There will be slight increases in traffic noise levels along Smith Street and Nuuanu Avenue of 0.3 dB and 0.1 dB, respectively; and a decrease of 0.7 dB along Marin Street. It should be noted that the changes given in Table 3 correspond to differences between 1999 peak hour traffic noise with and without the project. However, as with the existing condition, the much higher traffic volumes and proximity of Nimitz Highway result in the noise levels in the vicinity of the project site to be dominated by traffic on Nimitz Highway.

5.2 Aircraft Noise

As mentioned in Section 4, the DOT guidelines state that office buildings are compatible for areas with an L_{dn} of 65 dBA or less without additional noise level reduction measures. Figures 5 and 6, taken from the *Honolulu International Airport Master Plan* [Reference 3], are maps with L_{dn} contours due to aircraft operations. These maps indicate that the project site is exposed to an L_{dn} of less than 60 dBA and, in fact, is expected to decrease to at about 55 dBA in the year 2007. This decrease is expected to come from the increasingly widespread use of more fuel-efficient and quieter aircraft engines.

5.3 Project Operational Noise

Noise from mechanical and electrical equipment may exceed the maximum allowable noise levels set forth in the DOH and LUO regulations, if proper mitigative measures are not employed. The required noise control measures may include the following:

1. Installation of intake and discharge silencers on cooling towers.
2. Installation of acoustical louvers or silencers at mechanical and electrical equipment room intake and exhaust air openings.
3. Installation of effective exhaust silencers and air inlet and outlet silencers for the emergency generator.
4. Installation of sound absorbing materials on the wall and ceiling surfaces of hard rooms housing noisy equipment.
5. Acoustically treat service areas utilized for deliveries and trash pickup and/or restrict use of such areas during nighttime and early morning hours.

5.4 Construction Noise

Development of the project site will involve demolition excavation and construction activities. The various construction phases of the project may generate significant amounts of noise. The actual noise levels produced are dependent on the methods and construction equipment employed during each stage of the process. Typical construction equipment noise level ranges are shown in Figure 7.

In cases where construction noise is expected to exceed the DOH's "allowable" property line limits, a permit must be obtained from the DOH to allow the operation of vehicles, construction equipment, power tools, etc., which radiate noise in excess of the "allowable" limits. Required permit conditions for construction activities are:

> "No permit shall allow construction activities creating excessive noise...before 7:00 am and after 6:00 pm of the same day."
>
> "No permit shall allow construction activities which emit noise in excess of ninety-five dBA...except between 9:00 am and 5:30 pm of the same day."
>
> "No permit shall allow construction activities which exceed the allowable noise levels on Sundays and on...[certain] holidays. Activities exceeding ninety-five dBA shall [also] be prohibited on Saturdays."

If the pile driving is required, pile drivers will most likely be the loudest equipment used during construction and will probably cause some transitory annoyance to occupants of the neighboring commercial and nearly residential buildings. It would be advisable to monitor ground vibration caused by any pile driving activities to ensure that the vibration transmitted to neighboring buildings is well below the levels at which structural damage may occur.

REFERENCES:

1. *Chapter 43 - Community Noise Control for Oahu*, Department of Health, State of Hawaii, Administrative Rules, Title 11, 1981.

2. *Section 3.11, Noise Regulations*, Land Use Ordinance, City and County of Honolulu, October 22, 1986.

3. *Honolulu International Airport Master Plan Update and Noise Compatibility Program Inventory of Existing Noise Mitigation Programs and Noise Map Information*, Prepared for State of Hawaii Department of Transportation, Airports Division, December 1989.

4. *FHWA Highway Traffic Noise Prediction Model*, FHWA - RD - 77 - 108; U.S. Department of Transportation, December 1978.

5. *Traffic Impact Analysis Report, Bank of Hawaii Annex Tower*, Barton-Aschman Associates, Inc., October 28, 1994.

6. *Traffic Impact Analysis Report Addendum, Bank of Hawaii Annex Tower*, Parson Engineering Science, Inc., September 27, 1995.

7. *Toward a National Strategy for Noise Control*, U.S. Environmental Protection Agency, April 1977.

8. *Chapter 42 - Vehicular Noise Control for Oahu*, Department of Health, State of Hawaii, Administrative Rules, Title 11, November 6, 1981.

TABLE 1

NOISE LEVEL MEASUREMENTS FOR
BANK OF HAWAII ANNEX TOWER

Location	Leq, dBA	Comments
1 - Nimitz Highway	74.0	Traffic noise dominant with occasional departing aircraft audible.
2 - Smith Street	67.1	Traffic on Nimitz Highway dominant noise source with construction equipment on King Street audible.
3 - Marin Street	61.8	Traffic on Nimitz Highway dominant noise source.
4 - Nuuanu	66.5	Traffic on Nimitz Highway dominant noise source.

TABLE 2

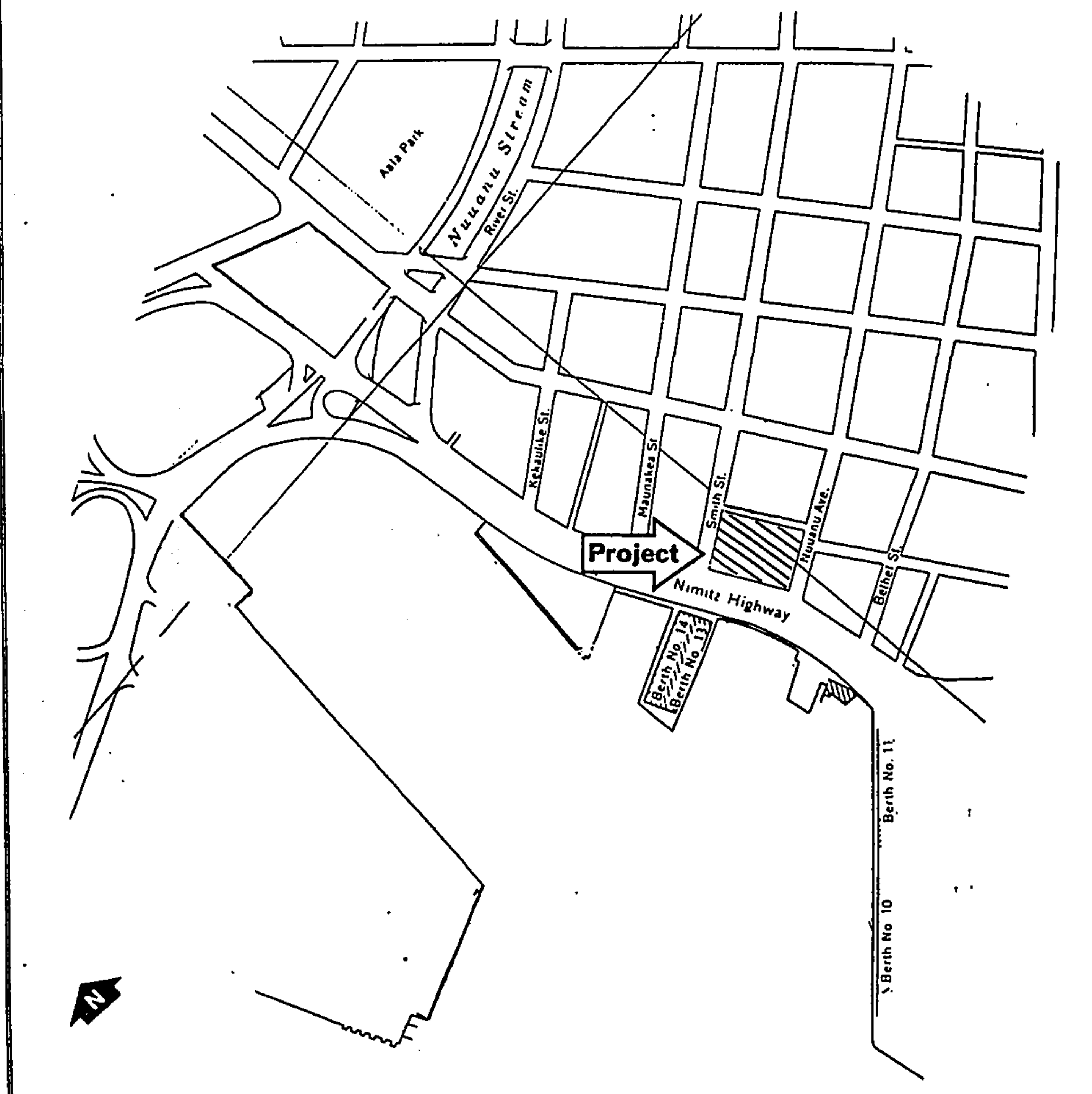
PEAK HOUR TRAFFIC NOISE LEVELS ALONG
NIMITZ HIGHWAY AT PROJECT SITE

Condition	Leq, dBA	Comments
Existing		
AM	71.7	30 ft. Mauka of Highway
PM	72.6	30 ft. Mauka of Highway
1999 Without Project		
AM	72.4	30 ft. Mauka of Highway
PM	73.8	30 ft. Mauka of Highway
1999 With Project		
AM	72.4	30 ft. Mauka of Highway
PM	73.8	30 ft. Mauka of Highway

TABLE 3

RELATIVE DIFFERENCE IN FUTURE PEAK HOUR TRAFFIC NOISE LEVELS WITH AND WITHOUT THE PROJECT FOR CITY STREETS BORDERING THE PROJECT SITE

Location	Difference in Leq, dBA	Comments
Smith Street		
AM	0.3	Slight increase with project.
PM	0.0	No difference.
Marin Street		
AM	- 0.7	Slight decrease with project.
PM	0.0	No difference.
Nuuanu Avenue		
AM	0.1	Slight increase with project.
PM	0.0	No difference.



D.L. ADAMS ASSOCIATES, LTD.
dba
DARBY & ASSOCIATES
ACOUSTICAL CONSULTANTS

Figure 1 Project Site Location

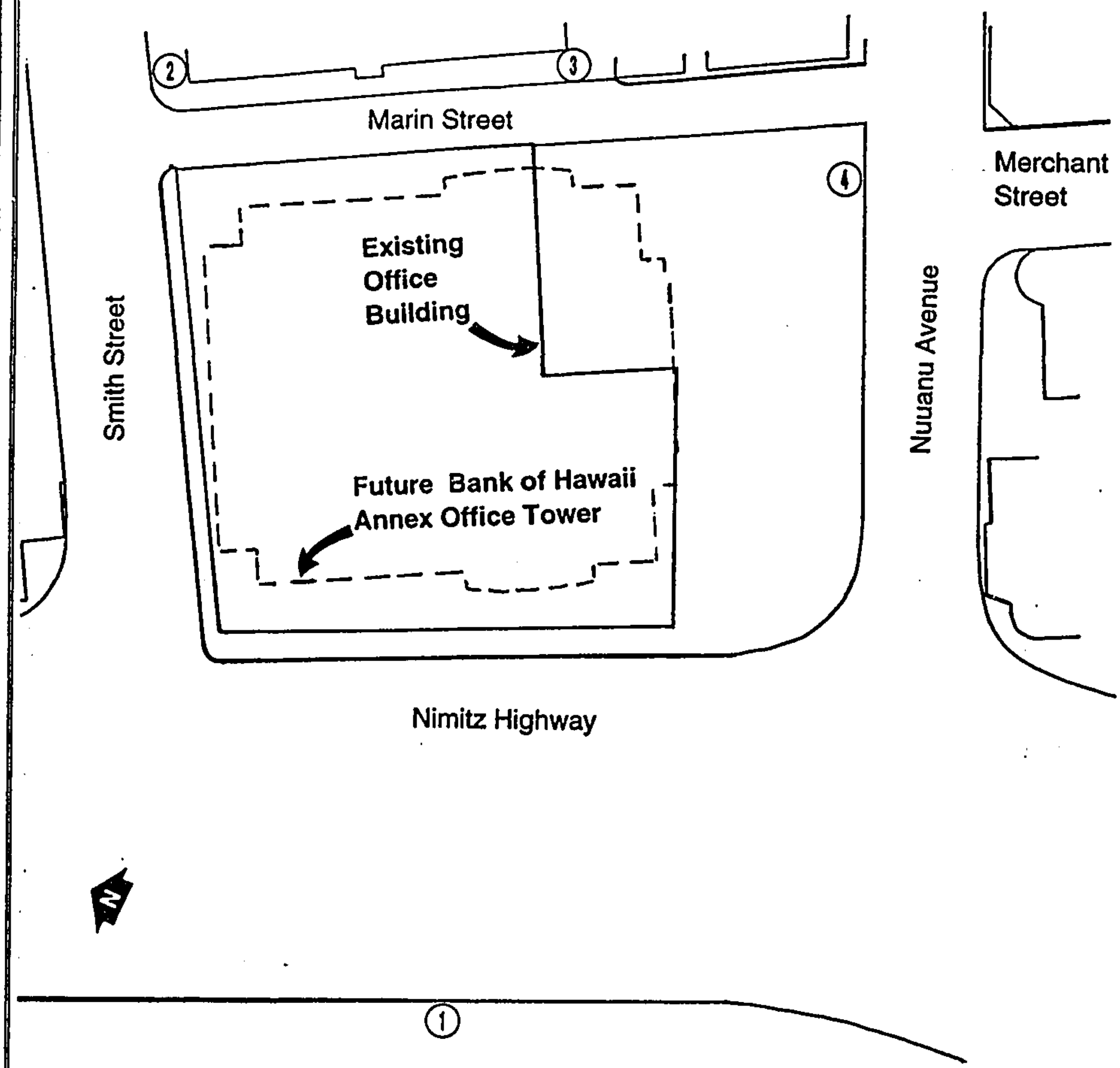


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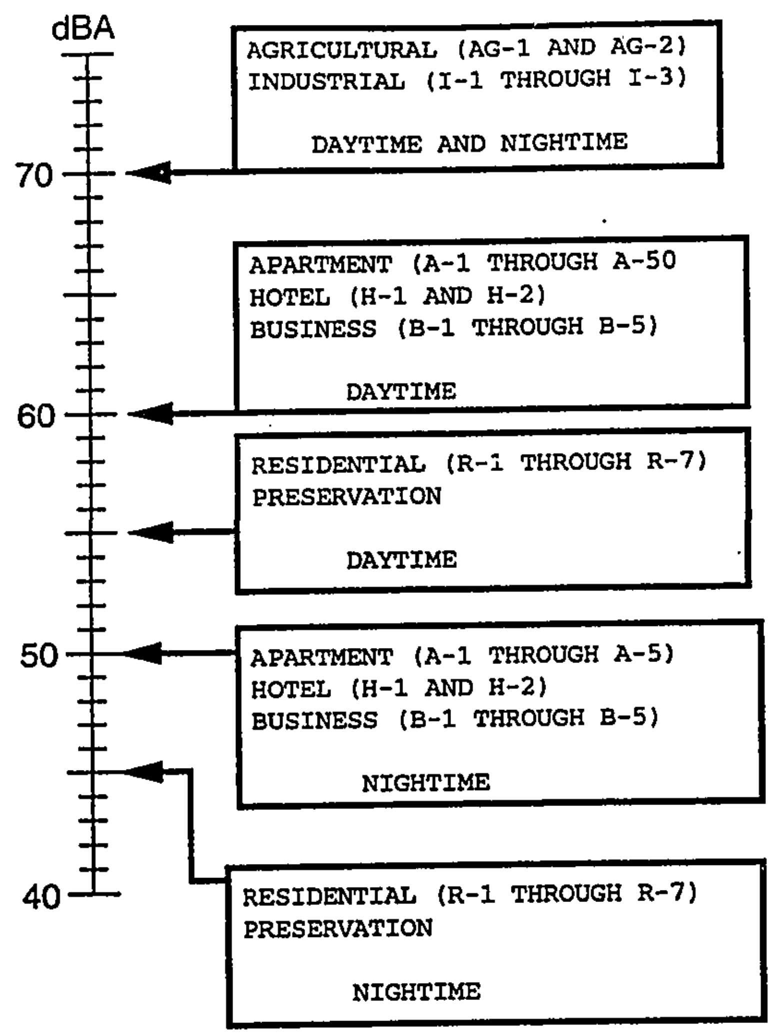
Figure 2 Sound Level Measurement Locations



NOTE: THE REGULATION STATES THAT THE ALLOWABLE LEVELS SHALL NOT BE EXCEEDED FOR TEN PERCENT OF THE TIME WITHIN ANY TWENTY MINUTE PERIOD.

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Figure 3 Hawaii Department of Health Allowable Noise Levels

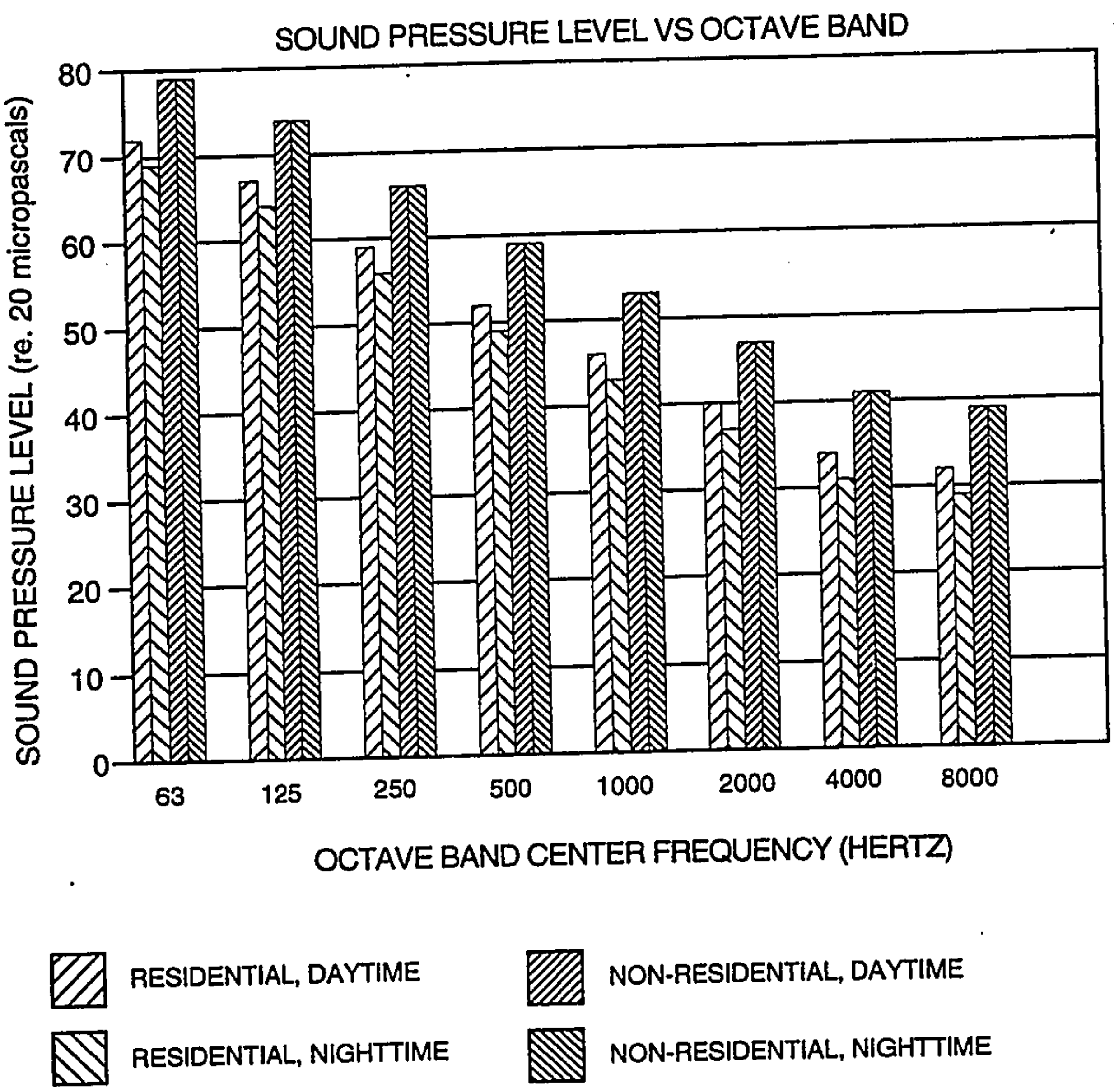

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Figure 4 City and County of Honolulu Land Use Ordinance Allowable Sound Levels

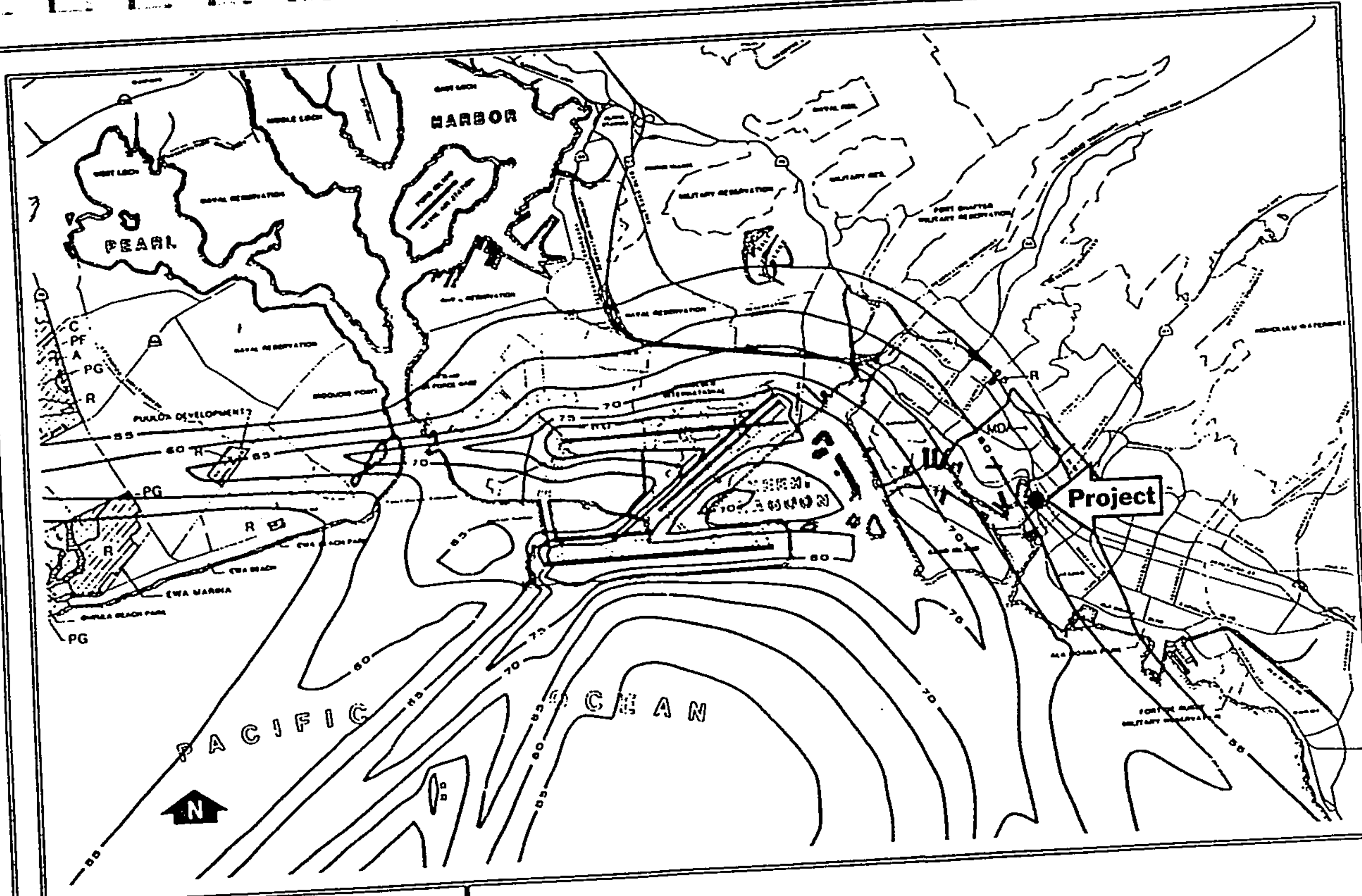

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Figure 5 Honolulu International Airport Ldn Contours for 1992

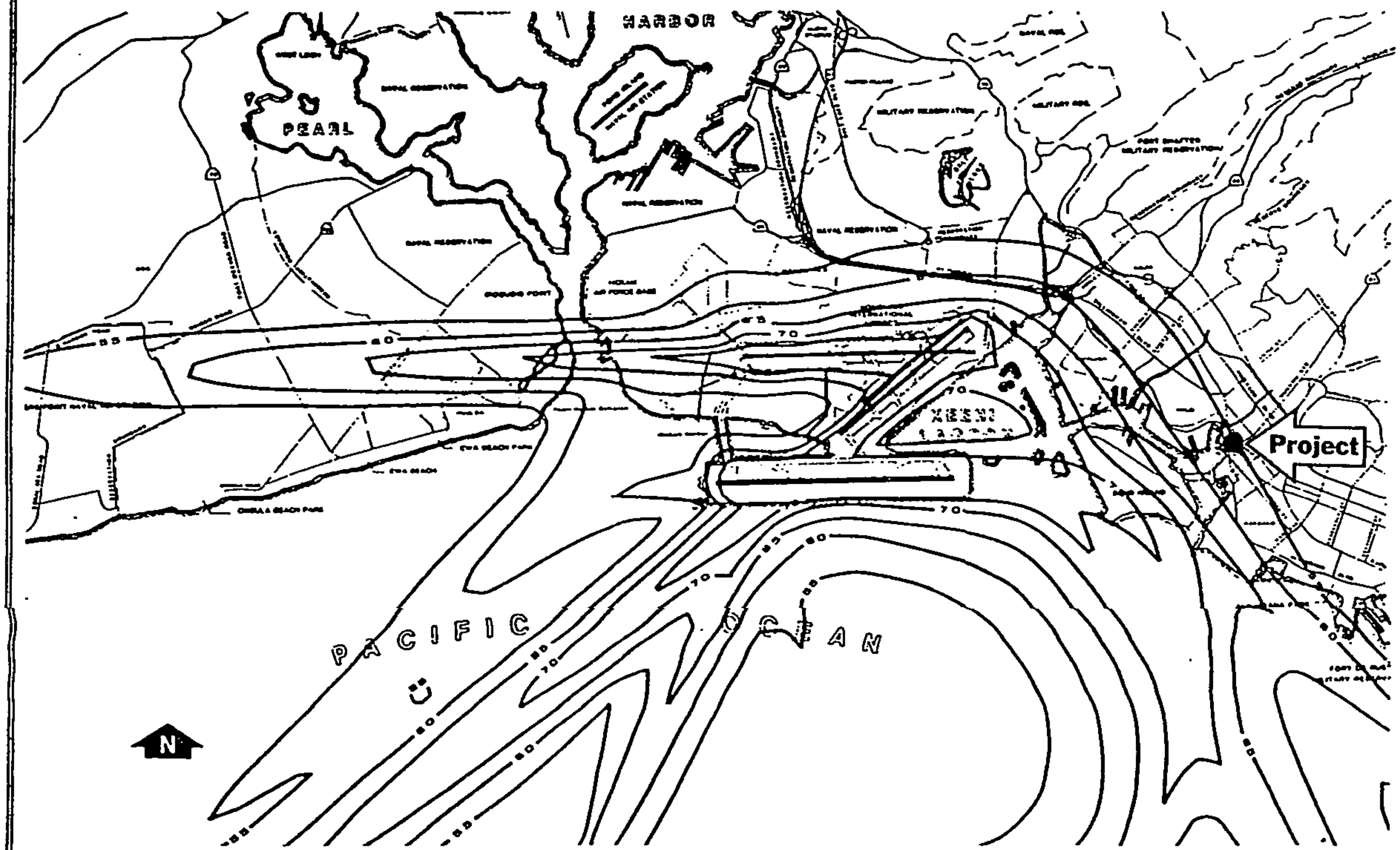

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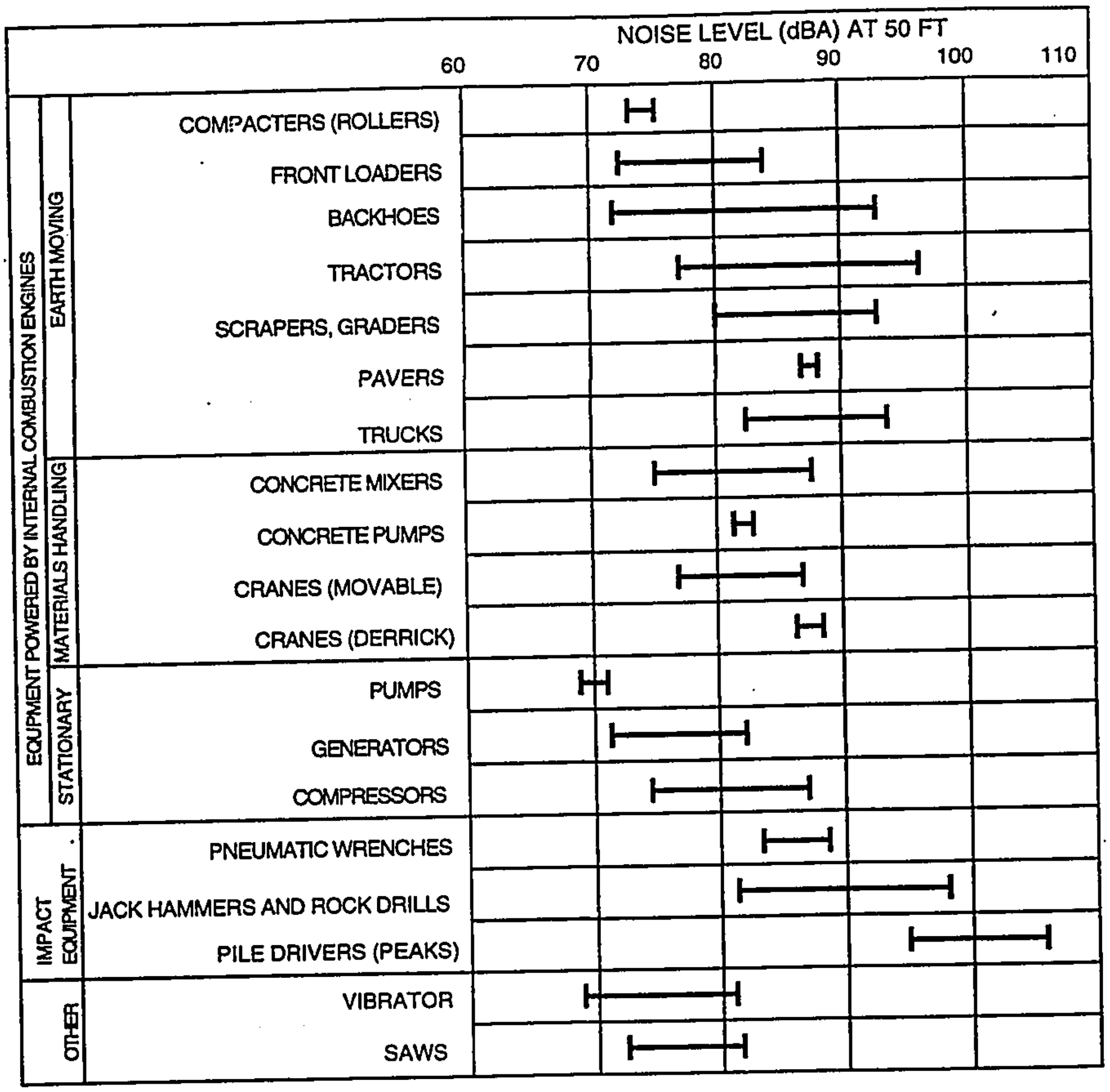
Figure 6 Honolulu International Airport Ldn Contours for 2007



Note: Based on Limited Available Data Samples

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Figure 7 Typical Noise Level Ranges for Construction Equipment

Courtesy EPA 1973

APPENDIX A

ACOUSTICAL TERMINOLOGY

Sound Pressure Level

Sound or noise consists of minute fluctuations in atmospheric pressure capable of evoking the sense of hearing. It is measured in terms of decibels (dB) using precision instruments known as sound level meters. Noise is defined as "unwanted" sound.

Technically, sound pressure level (SPL) is defined as:

$$SPL = 20 \log (P/Pref) \text{ dB}$$

where P is the sound pressure fluctuation (above or below atmospheric pressure) and Pref is the reference pressure, 20 micropascals, which is approximately the lowest sound pressure that can be detected by the human ear. For example, if P is 20 micropascals, then SPL = 0 dB, or if P is 200 micropascals, then SPL = 20 dB. The relation between sound pressure in micropascals and sound pressure level in decibels (dB) is shown in Figure A-1.

The sound pressure level that results from a combination of noise sources is not the arithmetic sum of the individual sound levels, but rather the logarithmic sum. For example, two sound levels of 50 dB produce a combined level of 53 dB, not 100 dB; two sound levels of 40 and 50 dB produce a combined level of 50.4 dB.

Human sensitivity to changes in sound pressure level is highly individualized. Sensitivity to sound depends on frequency content, time of occurrence, duration, and psychological factors such as emotions and expectations. However, in general, a change of 1 or 2 dB in the level of a sound is difficult for most people to detect. A 3 dB change is commonly taken as the smallest perceptible change and a 5 dB change corresponds to a noticeable change in loudness. A 10 dB increase or decrease in sound level corresponds to an approximate doubling or halving of loudness, respectively.

A-Weighted Sound Level

The human ear is more sensitive to sound in the frequency range of 250 Hertz (Hz) and higher, than in frequencies below 250 Hz. Due to this type of frequency response, a frequency weighting system, was developed to emulate the frequency response of the human ear. This system expresses sound levels in units of A-weighted decibels (dBA). A-weighted sound levels de-emphasizes the low frequency portion of the spectrum of a signal. The A-weighted level of a sound is a good measure of the loudness of that sound. Different sounds having the same A-weighted sound level are perceived as being about equally loud. Typical values of the A-weighted sound level of various noise sources are shown in Figure A-1.

Statistical Sound Levels

The sound levels of long-term noise producing activities, such as traffic movement, aircraft operations, etc., can vary considerably with time. In order to obtain a single number rating of such a noise source, a statistically-based method of expressing sound or noise levels developed. It is known as the Exceedence Level, L_n. The Exceedence Level, L_n, represents the sound level which is exceeded for n% of the measurement time period. For example, $L_{10} = 60$ dBA indicates that for the duration at the measurement period, the sound level exceeded 60 dBA 10% of the time. Commonly used Exceedence Levels include L_1, L_{10}, L_{50}, and L_{90}, which are widely used to assess community and environmental noise. Figure A-2 illustrates the relationship between selected statistical noise levels.

Equivalent Sound Level

The Equivalent Sound Level, L_{eq}, represents a constant level of sound having the same total acoustic energy as that contained in the actual time-varying sound being measured over a specific time period. L_{eq} is commonly used to describe community noise, traffic noise, and hearing damage potential. It has units of dBA and is illustrated in Figure A-2.

Day-Night Equivalent Sound Level

The Day-Night Equivalent Sound Level, L_{dn}, is the Equivalent Sound Level, L_{eq}, measured over a 24-hour period. However, a 10 dB penalty is added to the noise levels recorded between 10 pm and 7 am to account for people's higher sensitivity to noise at night when the background noise level is typically lower. The L_{dn} is a commonly used noise descriptor in assessing land use compatibility, and is widely used by federal and local agencies and standards organizations. Qualitative descriptions, as well as local examples of L_{dn}, are shown in Figure A-3.

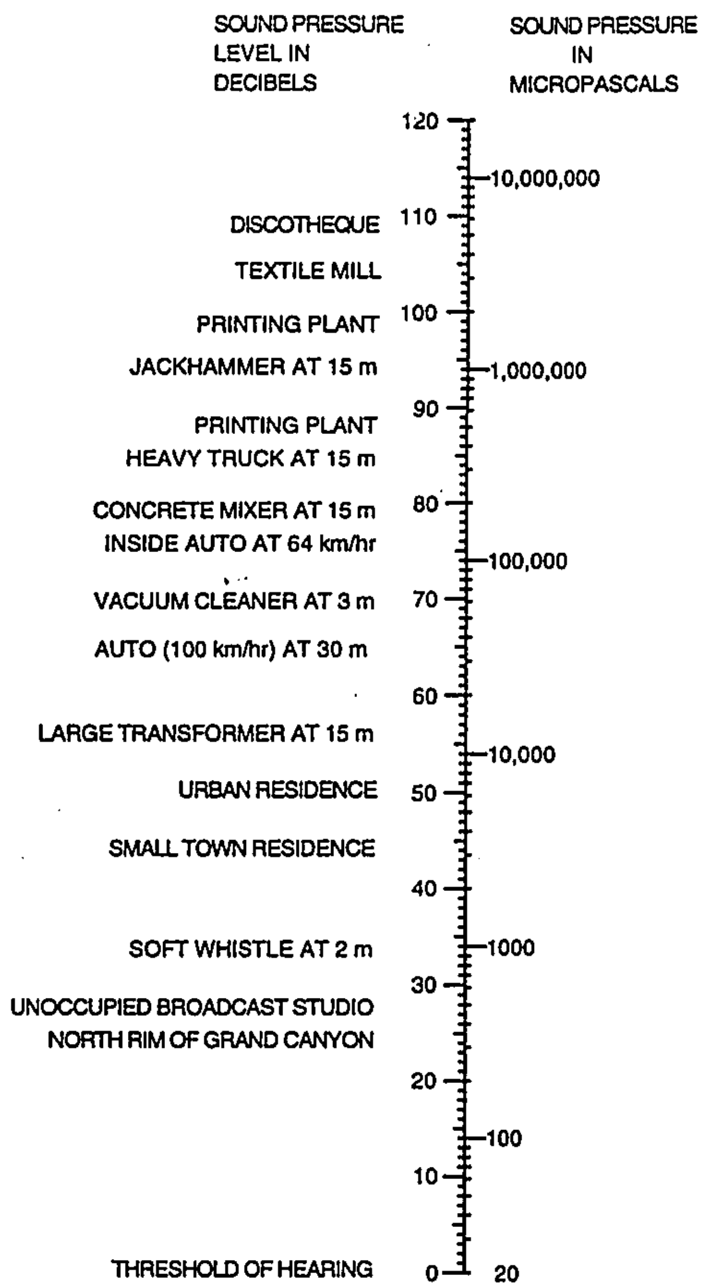

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FIGURE A-1 THE RELATION BETWEEN SOUND PRESSURE, P, AND SOUND PRESSURE LEVEL, SPL. ALSO SHOWN ARE TYPICAL VALUES OF A-WEIGHTED SOUND LEVELS OF VARIOUS NOISE SOURCES.

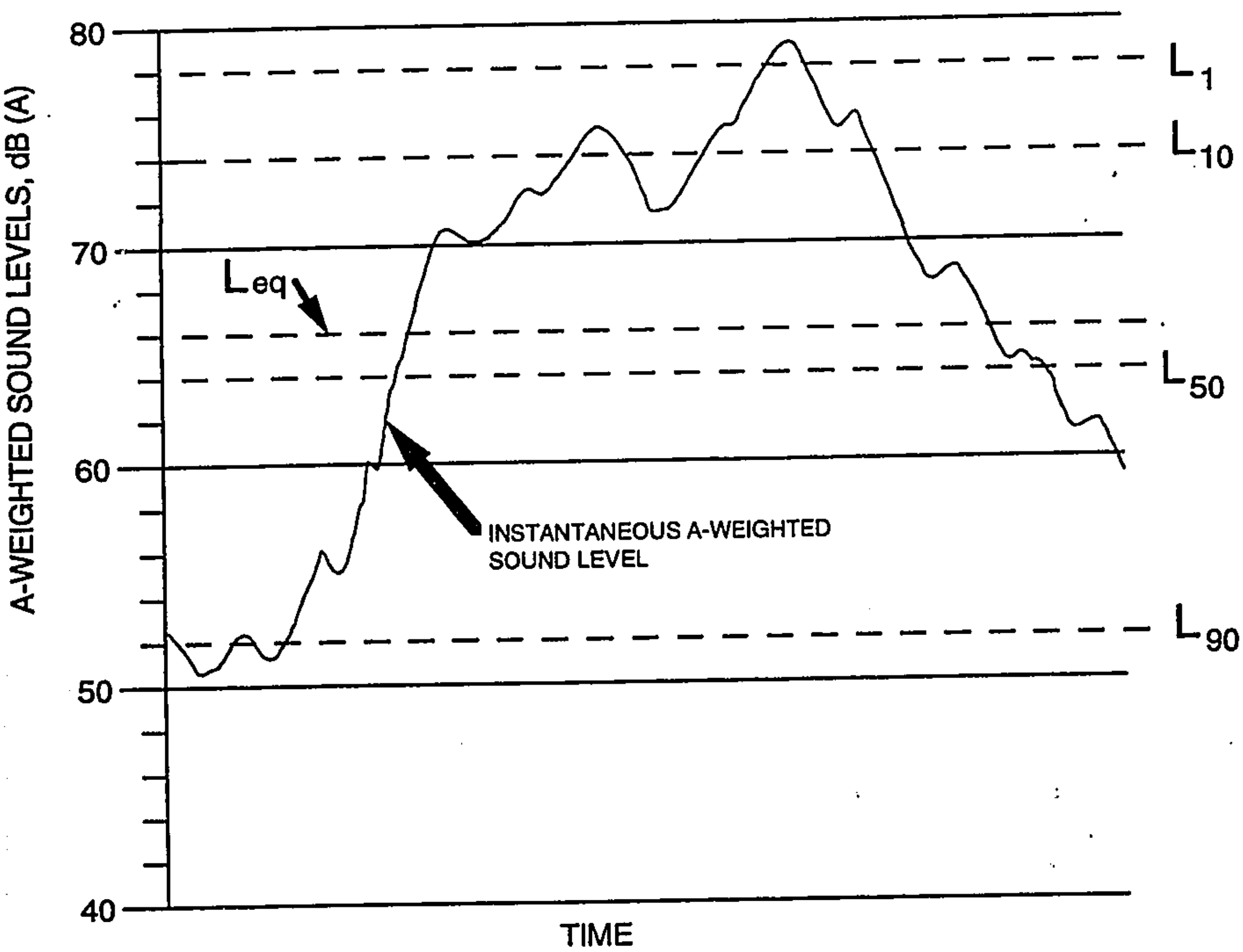

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FIGURE A-2 COMPARISON OF AN INSTANTANEOUS SOUND LEVEL AND THE CORRESPONDING STATISTICAL SOUND LEVELS

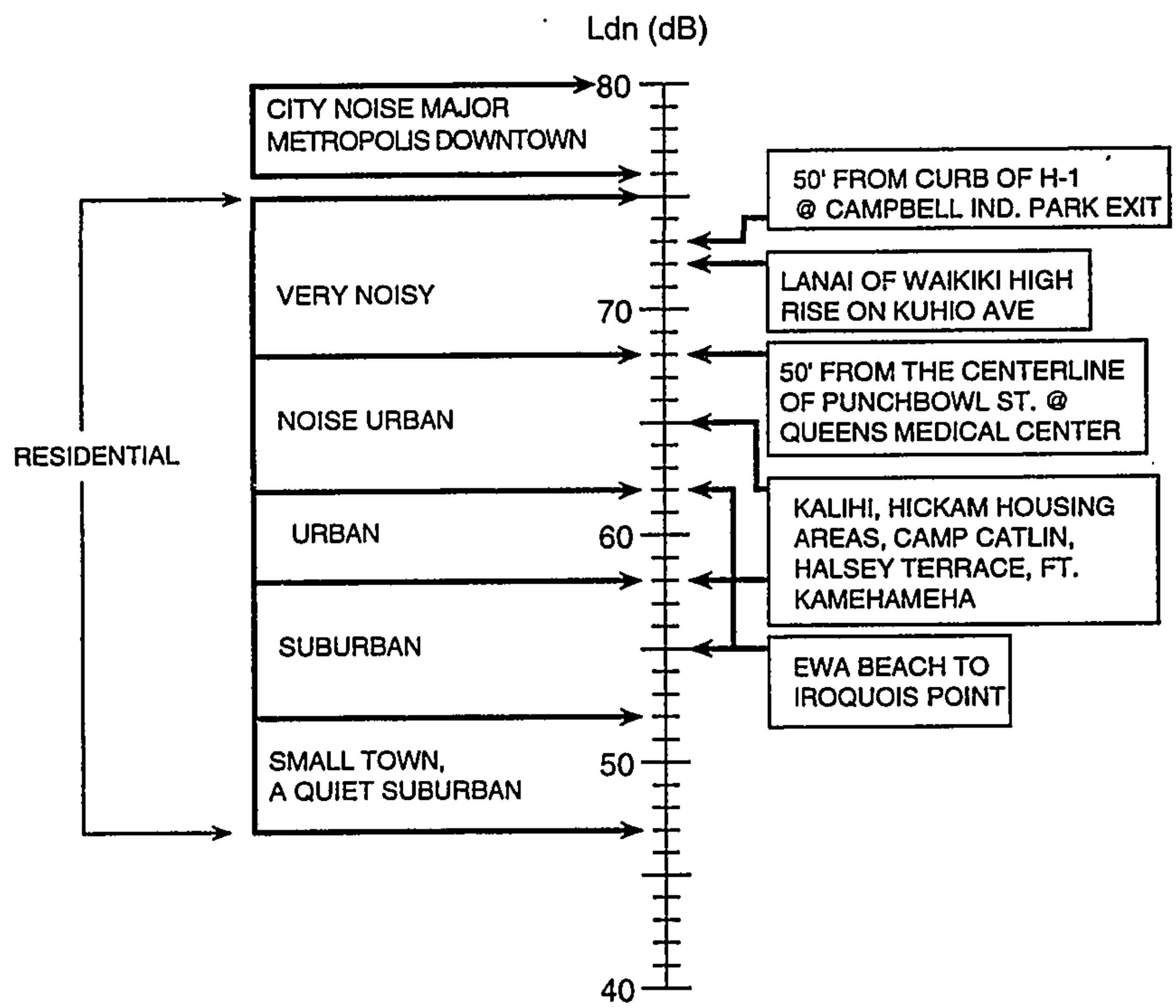

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FIGURE A-3 QUALITATIVE DESCRIPTION OF THE DAY-NIGHT SOUND LEVELS (Ldn) AND AND EXAMPLE Ldn's AT SELECTED LOCATIONS ON OAHU

APPENDIX F:

DLNR-HPD CORRESPONDENCE

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

cc: Terry Tusher (Fax) - 12/15/94

RECEIVED
DEC 15 1994
STRINGER TUSHER & ASSOC.

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

RECEIVED DEC 14 1994

KEITH AHUE, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

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AQUATIC RESOURCES
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CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION DIVISION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

December 8, 1994

Philip Russell
Graham Murata Russell
345 Queen Street, Suite 400
Honolulu, Hawaii 96813

LOG NO: 13380
DOC NO: 9412TD13

Dear Mr. Russell:

SUBJECT: **Bank of Hawaii--Annex Tower Project, 800 Nuuanu Avenue Honolulu, Kona, O'ahu TMK: 1-7-2: 2**

Thank you for the opportunity to review the historical report for this project prepared by P. Klieger of Bishop Museum. Shortly after we met at my office we received from the Department of Land Utilization, City and County of Honolulu (DLU), a request that we provide comments on an application for a Chinatown Special District Permit for this project. We have no objection to demolition of the Honolulu Iron Works building. Because of the likely presence of archaeological deposits significant for the information they contain on the history of early Honolulu, we have asked that DLU attach a condition to any approved permit for this project requiring the completion of the historic preservation review process. A copy of our reply is attached for your information.

The first step in the historic preservation review process for this project will be inventory survey excavations to confirm the presence or absence of archaeological deposits and, if they are present, to collect sufficient information to determine their significance. If significant archaeological deposits are present then it will be necessary to develop a mitigation plan. In this case, because archaeological deposits are likely to be significant only for their information and because they are not likely to be suited for interpretive in situ display, the mitigation plan would focus on data recovery excavations. The historic preservation review process would end with production of an acceptable report on the results of the data recovery excavations.

During our meeting you asked about the timing and logistics of the inventory survey excavations, especially as these related to the demolition of the Honolulu Iron Works building. The historical report indicates that important structures from the early 1800s

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Philip Russell
Page 2

were located at, or in the vicinity of, the present parking lot at the southern end of the parcel. In addition, the morphology of the underlying Pleistocene limestone at the adjacent parcels to the north and south appears to indicate that the thickest, and potentially richest, deposits would be located at the southern end of the parcel. Therefore, we believe that it is reasonable to carry out inventory survey excavations at the parking lot prior to demolition of the *Honolulu Iron Works* building. Typically, subsurface inventory surveys in urban Honolulu are carried out with the aid of a backhoe and can be completed in a relatively short time, on the order of one or two weeks. In your case, use of the parking lot could resume after the inventory survey was complete and trenches had been filled and repaved.

If you have any questions please call Tom Dye at 587-0014.

Sincerely,

DON HIBBARD, Administrator
State Historic Preservation Division

TD:jk

attach DOC NO: 9412TD12

4C

94-08114

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII

KEITH AHUE, CHAIRPERSON
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STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

December 8, 1994

Donald A. Clegg
Director of Land Utilization
Department of Land Utilization
City and County of Honolulu
650 South King Street
Honolulu, Hawaii 96813

LOG NO: 13311 ✓
DOC NO: 9412TD12

'94 DEC 14 PM 2 59

Dear Mr. Clegg:

SUBJECT: **Bank of Hawaii Office Annex**
Honolulu, Kona, O`ahu
TMK: 1-7-2: 2

Thank you for your question regarding the relationship of historic sites to the Chinatown Historic District. The term "historic sites" in HRS Chapter 343-5(a)(5) is ambiguous. It is interpreted by other agencies as "historic properties," defined in HRC Chapter 6E-2 as: "any building, structure, object, district, area, or site, including heiau and underwater site, which is over fifty years old." Thus, the fact that this property is within the Chinatown Historic District means that, pursuant to HRS Chapter 343-5, an environmental assessment would be required for this action.

As noted in Mr. Tusher's letter, the old Honolulu Iron Works building at the site is not significant; the many modifications over the years have compromised the building's integrity, so that it no longer is a good example of a particular period or type of building. We have no objections to the demolition of this building.

A review of historic and other records (Steel Heart--The Industrial Center of Old Honolulu, Klieger, Bishop Museum, 1994) indicates that archaeological deposits might be extant under the present infrastructure and might be significant for the information they are likely to yield on the history of early Honolulu. Because the proposed building includes plans for approximately six stories of below grade parking, which would destroy any extant significant deposits, any approved permit for this project should attach the following condition to determine if significant historic sites are present and, if so, to mitigate any adverse effects.

Donald A. Clegg
Page 2

> The applicant shall, prior to the initiation of construction activities, submit to the Department of Land Utilization a letter from the State Historic Preservation Division (SHPD) that 1) certifies that all fieldwork for the historic preservation review process has been successfully completed, and 2) refers to a binding legal agreement between the applicant and SHPD to complete the reports and archive recovered material according to a specified time schedule, in order to complete the *historic preservation review process.*

We will require the following standard steps for completion of the historic preservation review process: (1) inventory survey (in the form of test excavations and an acceptable survey report) to determine if historic sites are present, to determine whether sites found (if any) are significant according to the criteria of the Hawaii Register of Historic Places, and to determine appropriate mitigation of significant historic sites (if any are present), (2) if significant sites are present and assuming that they are significant solely for their information content, archaeological data recovery to recover and record a reasonable amount of the site's information (recovered in the form of excavation and necessitating an acceptable report and archiving of the material recovered).

If you have any questions please call Tom Dye at 587-0014.

Sincerely,

DON HIBBARD, Administrator
State Historic Preservation Division

TD:jk

APPENDIX G:

ARCHAEOLOGY STUDY

BISHOP MUSEUM

CELEBRATING A
CENTURY OF DISCOVERY

STEEL HEART--THE INDUSTRIAL CENTER OF OLD HONOLULU

A Report on the History of 800 Nuuanu Avenue, Honolulu, O'ahu, Hawai'i (TMK 1-7-02:02)

by
Paul Christiaan Klieger, Ph.D.

Prepared for
Bank of Hawai'i
P.O. Box 2900
Honolulu, Hawai'i 96846

31 October 1994

Anthropology Department
Bishop Museum
1525 Bernice
Honolulu, Hawai'i 96817

The State Museum of Natural and Cultural History
1525 Bernice Street • P.O. Box 19000A • Honolulu, Hawai'i • 96817-0916
Telephone: (808) 847-3511 • Fax: (808) 841-8968

ABSTRACT

The history of the block located at 800 Nuuanu Avenue in Honolulu, Hawai'i was researched and analyzed. While very little pre-Contact (A.D. 1778) information was obtained from ethnohistoric accounts, the early post-Contact era seems well represented at the site. The following *ali'i* of Kamehameha I lived on or in close proximity to the 800 Nuuanu block: 1) Kuihelani, a Governor of O'ahu, 2) Keli'imaika'i, younger brother of Kamehameha I, 3) Isaac Davis, one of Kamehameha's foreign chiefs, 4) members of the extended family of Spaniard D. F. P. Marín, and 5) Kalanimōkū, the king's chief counselor. Most of these chiefs settled here when Kamehameha I brought his court to the village of Kou/Honolulu in 1809. The Native Hawaiian *ali'i* moved out of the neighborhood in the mid-1820s to be closer to the establishment of the Boston missionaries at Kawai-a-Ha'o. Their places were taken by shipping agents and traders, shipwrights and coopers. By the 1850s, a steam powered flour mill was converted into a machine shop and foundry, and Honolulu Iron Works was developed at the site. This business, one of the leading industrial concerns in Hawai'i, has occupied a large portion of the present project area for well over a hundred years. Other areas on the site were occupied by small retail stores and offices until well into the twentieth century.

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LIST OF FIGURES

INTRODUCTION

Under contract to Bank of Hawai'i (BPBM #11-37-67), Bishop Museum has undertaken an historical background study for property at 800 Nuuanu Avenue, Honolulu, Hawai'i (TMK 1st Div. 1-7-02:02). The following report is based on an analysis of ethnographic accounts, cartographic sources, land tenure documents, photographic collections, artwork, newspaper articles, letters deposited in the Hawaii State Archives, and other sources that pertain to the present project area, the immediate neighborhood, and the more general context of Honolulu and the *ahupua'a* of Nu'uanu/Honolulu.

The purpose of this report is to assess the historic value of the subject property, and on the basis of that background, to develop a professional opinion regarding the potential for discovering subsurface archaeological features at the site which may be of historic significance, and to make appropriate recommendations that may be useful in site planning.

ANCIENT SETTING

The current project area is defined as that city block in downtown Honolulu bounded by N. Queen (Nimitz), Marin, and Smith Streets and Nuuanu Avenue (Figure 1). This block has been continuously bounded by trails, streets, or other passageways for over 150 years. Fortunately for historic preservation and other heritage considerations, the block has not experienced quite the degree of cycles of modern construction, demolition, and reconstruction characteristic of other neighborhoods in downtown Honolulu (e.g. Harbor Court--see Lebo et al. 1994). Considering also the absence of deep building foundations in this shorefront area, the potential for archaeological data recovery is high in the project area. Such an archaeological assemblage of features and artifacts, if found, might exhibit a chronological depth extending back the entire history of the modern city to pre-Contact times.

The present project area was most likely part of the ancient fishing village of Kou. Kou, later called Honolulu, was probably the major coastal village of the

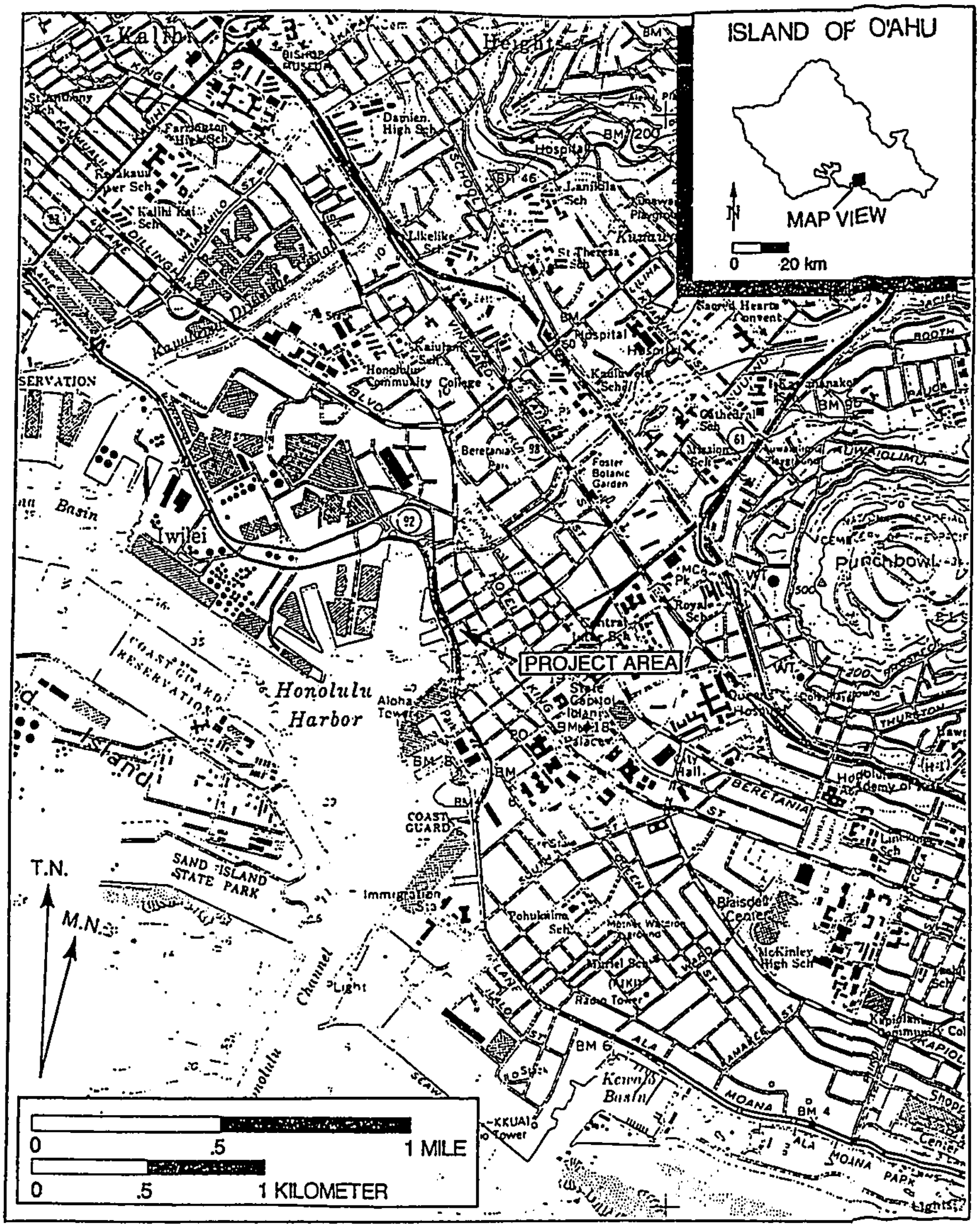

Figure 1. U.S.G.S. Topographic Map of Honolulu showing present project area.

ahupua'a of Nu'uanu or Honolulu[1], one of the major valleys bisecting the leeward front of the Ko'olau Range on O'ahu. Nu'uanu was in Kona District, a traditional land division extending from Moanalua to Maunalua on the southeastern point of the island. The village seems to have extended westernward from Pākākā Point (Aloha Tower, Pier 11), along Māmala Bay, to the fishponds at the mouth of Nu'uanu Stream, and eastward to modern Alakea Street. The Point was a canoe landing. Radiocarbon dates in the general area indicate that humans were present at least by the sixteenth century (M. Goodwin, personal communication, 1994), if not earlier (see Dunn and Rosendahl 1993:16).

During the final days of rule by indigenous O'ahu chiefs (seventeenth and eighteenth centuries), the village center was embellished with a major temple on the Point, Pākākā Heiau, most likely of the *luakini* or human sacrificial class. The temple was probably used during the times of the great O'ahu *mō'ī* Kākuhihewa, and perhaps used as a residence as well by the *ali'i* (Klieger 1994:21). The great temple was dedicated to Kūho'one'enu'u, the O'ahu form of the war god Kū. The temple, located only about two blocks Waikīkī of the present site, apparently remained in existence well into the post-Contact period. According to Westervelt, Pākākā Heiau

> was standing on the western site of the foot of Fort Street long after the fort was built for which the street was named. It was just below the fort. Pakaka was owned by Kinau. It was...built before the time of Kakuhihewa. In this temple the school of the priests of Oahu had its headquarters for centuries. The walls of the temple were adorned all around with heads of men offered in sacrifice [Westervelt 1915:8].

[1]According to the Hawaiian Studies Institute (1987), Honolulu was the name given the *ahupua'a* at the division of O'ahu under paramount chief Mā'ilikūkahi around A.D. 1500. The *ahupua'a* name of Honolulu was also surmised by Stokes (1933:61). According to other sources, however, Honolulu was the name of a district at Lihiha and School Streets, named after a chief who lived during the time of Mō'ī Kākuhihewa around A.D. 1650. The area from Hotel Street to the sea was Kou proper (Gessler 1942:8).

Native O'ahu rule ended in A.D. 1783 when the island was conquered by Kahekili II of Maui. Maui rule was in turn overthrown by Kamehameha I of Hawai'i in 1795. During this period Waikīkī was the main residence of the king. In the post-Contact era, western ship captains discovered that Māmala Bay, or Honolulu Harbor, provided a large break in the fringing reef--the only passageway on O'ahu, or indeed in the entire archipelago, sufficiently large to bring their ships to port. This activity attracted the attention of Kamehameha I, who was utilizing Waikīkī as his O'ahu capital after his conquest of the island in 1795. The basalt boulders which comprised the *heiau* on the Point most likely became the first Honolulu wharf for western ships. The beach at Māmala eventually became the quayside for foreign commerce. The close proximity of foreign merchants coming into Honolulu was also not lost on Kamehameha. By 1809, Kamehameha had moved his court to the village of Kou, now known as Honolulu, and established his residence at the *heiau* of Pākākā.

The king's personal house in Honolulu was Hale Hui, the traditional men's eating house or *hale mua* (Judd 1975:24). The residence probably extended to the corner of Ka'ahumanu and Queen Streets (Klieger 1994), about one block Waikīkī of the present project area and site of the modern Harbor Court Tower. The king surrounded himself with his chiefs, queens, priests, and warriors, as well as his foreign friends who had helped him win the wars of unification. Near the present project area were two ancient *'ulu maika* "bowling" alleys. It is possible that a portion of Merchant or even Marin Street at the present project area was once one of the *'ulu maika* fields. This neighborhood in old Kou, extending to the modern Bishop Street, was once noted for its gaming areas: *maika* fields, a *loku* house for indoor games, and stone *konane* (checkers) boards.

The presence of the royal court must have had a major impact on the present project area. It is known that Kamehameha gave the settlement of Pūlaholaho to his main wife Ka'ahumanu. Pūlaholaho was division of the village of Kou extending from the royal residence to the present location of Nu'uanu Street. Kamehameha the Great would reside here until 1812, when he returned to Kona, Hawai'i to live out the remaining seven years of his life.

According to Ī'ī (1959:66) and Westervelt (1915:8-9), the present project area, in particular the ironworks site, was once known as Ulakoheo (Ulakōheo?). The waterfront of Pūlaholaho, extending from Ulakōheo to Kamehameha's compound was known as Nihoa in honor of Ka'ahumanu's visit of that island (Pukui, et al. 1974:165). Further to the west at the mouth of Nu'uanu Stream was the area known as Kapu'ukolo (I'i 1959).

EARLY POST-CONTACT TIMES

Two of Kamehameha's foreign friends had residences on or very near the present project area. Don Francisco de Paula de Marín from Spain was given an estate by the king. This estate appears on the Russian draftsman Tabulevitch's plan of Honolulu in 1818 (Figure 2), with the present project area immediately to the south. Marín's residence was bounded on the 'Ewa side by a wall which existed between the modern Kekaulike and Maunakea Streets (probably near Gravier Lane) and on the Waikīkī side by the east side of Smith Street at the present project area. Isaac Davis, who was in his turn Governor of O'ahu, was given a Honolulu estate which according to a description of John Papa Ī'ī might have been near the *mauka*/Waikīkī corner of the present project area. Davis, from Milford Haven in England, together with fellow Englishman John Young, had helped Kamehameha against his rival Keōua and other opponents in the war of interisland unification.

While Marín fathered numerous children and successfully passed much of his estate to his children, much of Isaac Davis' lands were taken back by the king. Isaac Davis may have uncovered a plot by Kamehameha's chiefs to poison Kaumuali'i, the last king of independent Kaua'i. When Davis died suddenly in 1810, his body was taken from his dwelling at "'Ai'ēnui" to Kewalo, where he was buried on the land of Alexander (Ii 1959:83-85). All subsequent records of his Honolulu home disappear at this time. Davis' dispossessed children, George Hu'eu, Betty, and Sarah were adopted by John Young (Klieger 1993).

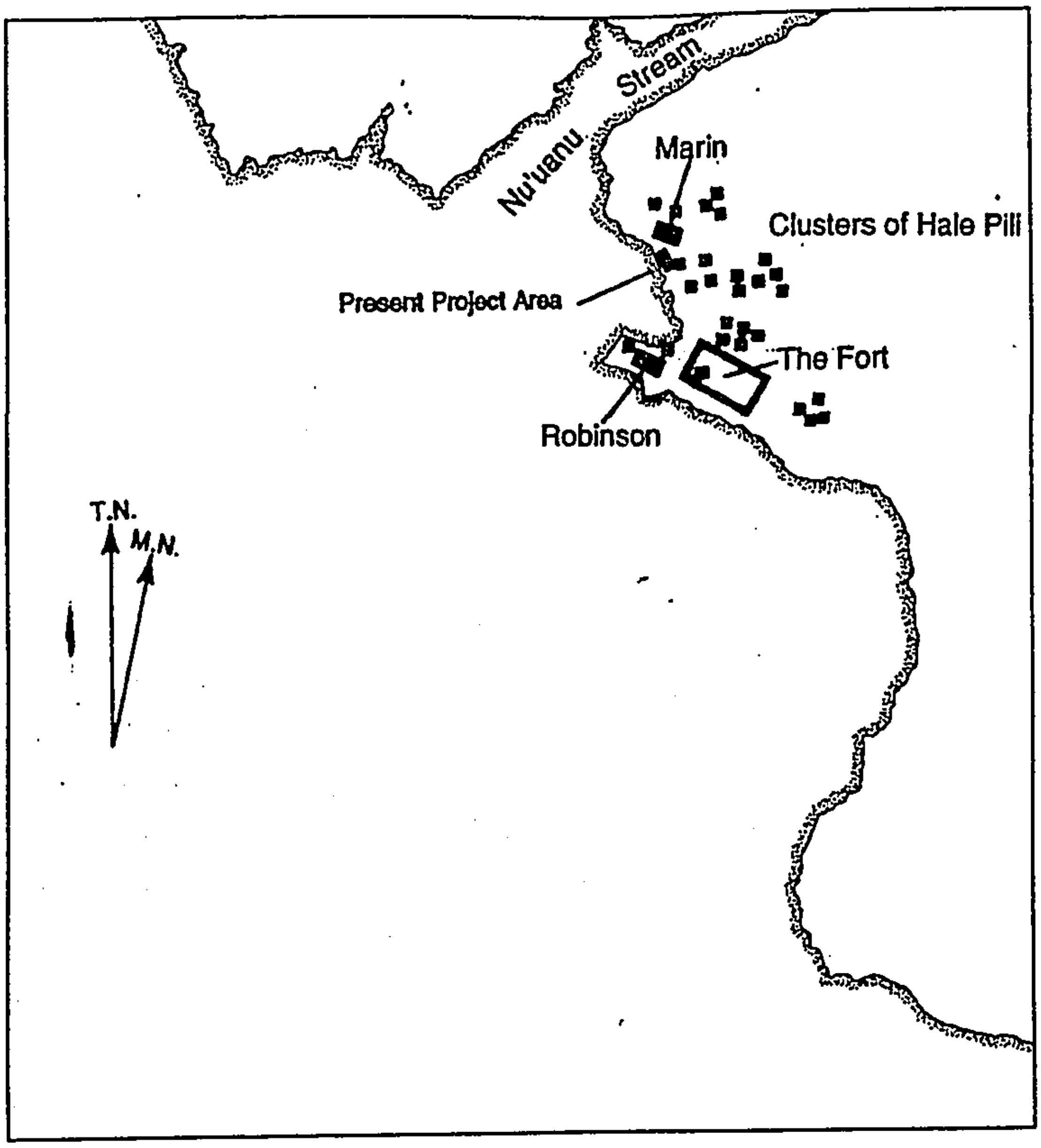

Figure 2. Plan of Honolulu in 1818 redrawn from Tabulevitch. Pākākā Point is evident to the west of the fort. The present project area is just south of Marín. Hawaii State Archives.

Of course, when Kamehameha conquered O'ahu, all its lands resorted to him and he in turn distributed it to his family, chiefs, and favorites on a use-only basis. Land on O'ahu was apportioned under the charge of Kamehameha's chief counsellor (*kālaimoku*) Kalanimōkū (a.k.a. Kalaimoku, Karaimoku, and Billy Pitt--1768-1827). He was chief treasurer, in charge of dividing the land (Kame'eleihiwa 1992:60).

Chief Kuihelani was a steward of Kamehameha, and maintained a warehouse near or on the project area named Ka'aloa Hale (Kamakau 1992:271). He was also appointed governor of O'ahu for a time (Kamakau 1992:389). By Kamakau's account he was an impressive figure:

> "He took up two hogs each more than a fathom long and carried them without help...he was allowed to have ten wives, an honor allowed to no other chief besides, and there was no home happier than his, no governor of a district to be compared with Kuihelani" (Kamakau 1992:183).

'Ī'ī also mentions that his relative Kuihelani had a large family (1959:94). The two or three houses that comprised Marín's place "...was surrounded on the sides, back and part of the front by Kuihelani's property" (Ii 1959:94). Kuihelani probably had a traditional Native Hawaiian residential complex consisting of numerous houses for his wives and children, with separate eating and sleeping structures, perhaps spread over his entire property.

Makai of Kuihelani's home was the residence of Keli'imaika'i, which was on the coral point where the first custom house later stood (Ii 1959:94). Keli'imaika'i was Kamehameha I's younger brother.

> "On the south side of this place was berthed the *Kaaloa*, a ship belonging to Kuihelani, which lay at the extreme north of all the ships previously discussed (Ii 1959:94). Near the *Kaaloa* and in the vicinity of the custom house at the beach was a house for the very first Chinese ever seen here. There were two or three of them..." [Ii 1959:94]

The home of Keli'imaika'i was also most likely composed of several habitation units. Ī'ī (1959:94) further mentions that the Chinese prepared food here for the ship captains that took sandalwood to China. This may be the "old cook house" that appears in this region in later surveys of the present project area.

Kamakau (1992:271) seems to indicate that Ka'ala Hale of Kuihelani was located near the shoreline, for "above" it was Ka'ahumanu's village of Pūlaholaho. By other accounts, Pūlaholaho extended from Pākākā to Nuuanu Avenue, near the beach, which was known as Nihoa (see Klieger 1994). That would keep Ka'aloa Hale close to the shoreline but above the site of the future Customs House that was occupied by Keli'imaika'i. The combined evidence tends to pinpoint Kuihelani's warehouse on or very near the present project area.

According to 'Ī'ī, Kuihelani's residence was just north of George Isaac Davis and his company of people. Davis' estate was associated with the place name of 'Ai'ēnui (Ii 1959:85; Thrum 1911:45-46). This place name, "big debt," was probably ascribed later to the site when it became the location of the first Hudson's Bay Company agency at Marin and Nuuanu. Or it could refer to the neighborhood, which beginning in the 1820s, was composed of foreign merchants who were generous in their offers of credit to *ali'i* during the sandalwood boom. Davis' residence was probably just *mauka* of the 800 Nuuanu block, but their is a possibility that he may have been located on the *makai* side of Marin Street on the present project area. Figure 3 is a reconstruction of the present project area based on the above descriptions.

Unlike the adjacent Marín property, very little is known about the Davis property, and for that matter, Davis himself. The main account of the Davis house in Honolulu is from Archibald Campbell, who stayed with Davis in 1809:

> His house was distinguished from those of the natives only by the addition of a shed in front to keep off the sun; within, it was spread with mats, but had no furniture, except two benches to sit upon. He lived very much like the natives, and had acquired such a taste for poe, that he preferred it to any other food. We had, however, at all times abundance of pork, goats flesh, and mutton, and frequently beef sent by Young from Owhyhee; and in the mornings and evenings we had tea. His wealth, consisting of mats, feathers, and cloth, the produce of the island, and a

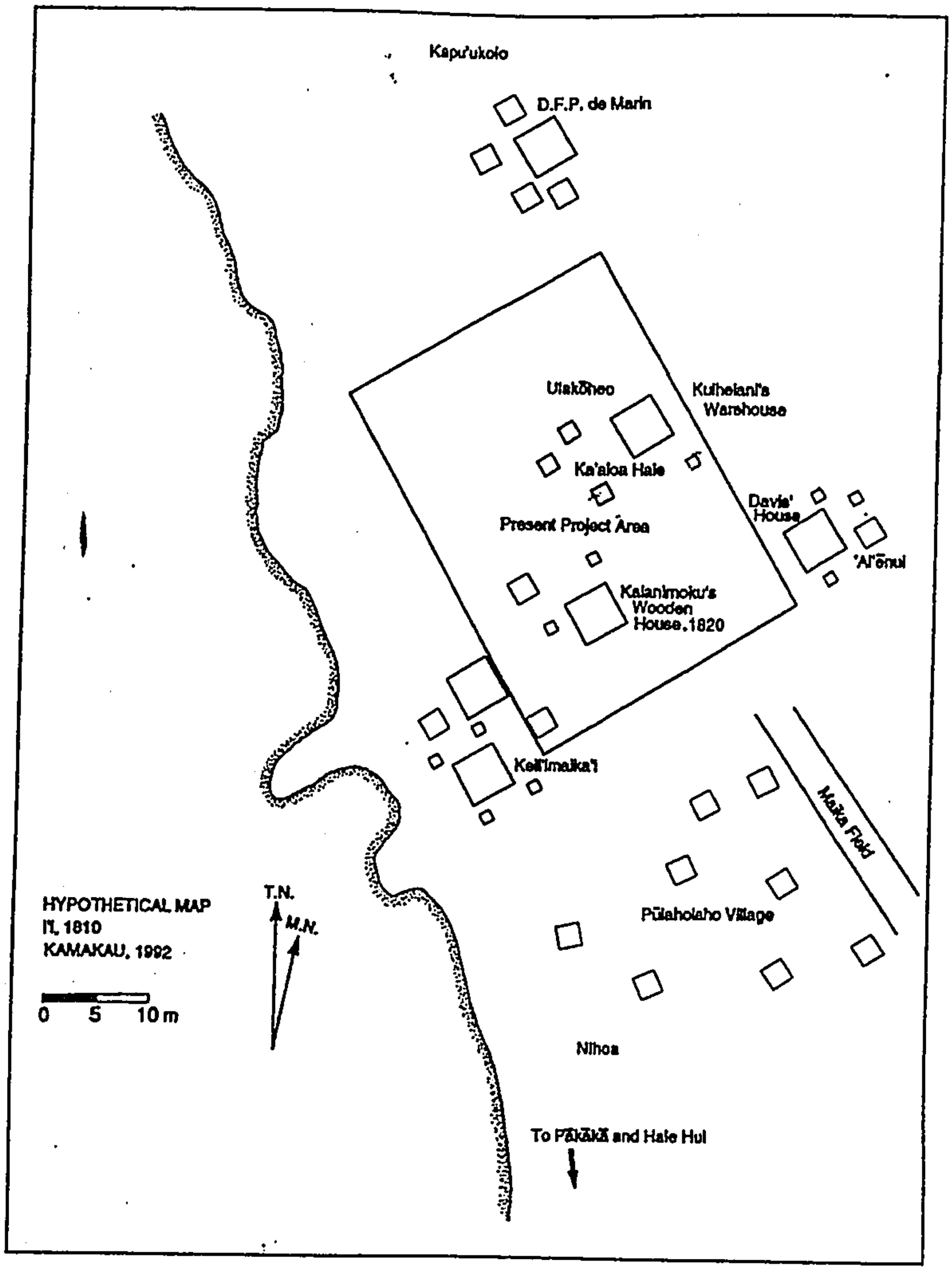

Figure 3. Hypothetical reconstruction of present project area in 1810 based on ʻĪʻī (1959) and Kamakau (1992).

large assortment of European articles, which he had acquired by trading with the ships that touched here, was contained in a large storehouse, built of stone, adjoining his dwelling [Campbell 1969:138-139].

It would be interesting to learn if the stone house was later incorporated and used by others, perhaps into more modern times. During Campbell's visit to Isaac Davis, their neighbor Keli'imaika'i, Kamehameha I's brother, died (Kamakau 1992:197). One of the last accounts of Davis has Kaua'i King Kamuali'i visiting Davis at the latter's home at 'Ai'ēnui, were the king was warned of a plot against his life by O'ahu chiefs (Ii 1959:83).

Under the traditional system of Hawaiian land tenure, the *ali'i nui* or *mō'ī* of each independent polity technically owned all the land. The paramount chief or chiefess would then assign usage rights certain parcels of land to his or her family, retainers, friends, and supporters. It was the responsibility of these assignees to care (*malama*) for the land. These properties, which were essentially life estates, would be usually returned to the paramount at the death of the tenant or with the accession of the new chief. In practice, however, a few favorite families would often retain their lands from generation to generation, from paramount to paramount. Isaac Davis' estate, perhaps located on or near the present project area, seems to have returned to the Crown on his demise in 1810. Tellingly, much of the frontage of the present project area along Nuuanu Avenue was not claimed during the Māhele and remained in government hands until Brenig purchased a section of it in 1878 (BCQLT RP 3187; 14:439). Such could be the case if parcels were repossessed by the Crown. A similar argument could be made, however, for the frontage along Nuuanu just *mauka* of Marin Street and the present project area. During the Māhele, Victoria Kamāmalu was awarded LCA 2671 at the site of old Hudson's Bay agency. While she received most of her land by virtue of being heiress to Ka'ahumanu through her mother, the *kuhina nui* Kīna'u, Victoria received some land from her father, Governor Kekūanaō'a of O'ahu, who was fond of claiming dispossessed lands. He took over Davis' award of half of Hālawa Ahupua'a on O'ahu by the time of the Great Māhele (Klieger 1993).

With the gradual influx of foreigners and western commercialism in the early nineteenth century, demands for fee-simple purchase of land by foreigners became steadily stronger, especially in Honolulu. Queen Regent Ka'ahumanu, mindful of the close association of power and land in Hawai'i, steadfastly refused to grant foreigners the privilege of real estate ownership.

By the 1820s, many *ali'i*, having been accustomed to paying their debts for foreign luxury goods with sandalwood from their lands, fell increasingly into debt to western merchants as the precious wood became depleted. Boston mercantile company of Marshall and Wildes in 1820, under the agency of Captain Babcock, was given control over much of the present project area by Kalanimōkū (BCQLT LCA 38, 1:135). In 1821, Marshall and Wildes built Ka'ahumanu a new wooden frame house on her premises located nearby at Queen and Ka'ahumanu (Charlton Investigation 1846:10). Naming the premises "Nihoa" in honor of her rediscovery of Nihoa Island, she lived here with King Kaumuali'i of Kaua'i for a few years (Klieger 1994). In 1823, Babcock returned to Boston and Thomas Crocker succeeded the administration of Marshall and Wildes (BCQLT LCA 38, 1:135). The firm was vexed by the problem of *ali'i* debt. Writing his boss in 1825, Eliab Grimes states

> You may expect as long as a fresh supply of goods comes to market, it will be found difficult to collect the debts, however, you having by far the best establishment here, you may as well get a share of the trade as well as others, and so long as there is ready money and wood to be got you will find goods coming here [Eliab Grimes to Josiah Marshall, cited in Kuykendall 1947:90].

The conspicuous consumption of the *ali'i*, their taste for expensive foreign luxury items may have been an attempt to maintain their status in the storm of culture change following western Contact, monetization of the economy, and the abolition of the traditional religious system (see Sahlins 1981, 1985). Wildes wrote his partner Marshall in 1825:

> ...and came to this place [Honolulu] where we found French with goods, which he brought out in the Brig Nile which will be an injury to those

who have debts due here...Respecting our old debts I am at a loss what to say, our prospects darken and brighten alternately...I hope you and Bryant & Stugis will make a strong representation to Government, a Ship of War must be sent here or I fear we shall not get all our debts. [Wildes to Marshall 16 October 1825, cited in Kuykendall 1947:90].

In 1825, John Jones, the U.S. Agent for Commerce and Seamen since 1820 (Kuykendall 1947:98) assumed management of the Marshall and Wildes agency (BCQLT LCA 38, 1:135).

Unable to pay for their purchases, several *ali'i* offered land in exchange. Kaikio'ewa, for example, governor of Kaua'i after 1824, offered his creditor William French a large portion of Honolulu. Hearing of this plan, Ka'ahumanu ruled that no chief was to dispose of lands, which were in fact the king's, to foreigners to satisfy debts (Kame'eleihiwa 1992:92-93). As a result the government has to assume most of the liabilities. Some debts were not covered, especially those of O'ahu governor Boki and others not popular in Ka'ahumanu's esteem. Probably in desperation, leases and assignments of land were made by Boki to his creditors such as French. How Kaikio'ewa received this land is unknown, but he was guardian (*kahu*) of the young King Kamehameha III, a very important position. He was known to have been quite loyal to the Kamehameha family (Kame'eleihiwa 1992:100). Another claim to fame was that Kaikio'ewa was with Kamehameha I the day that the Battle of Nu'uanu was won (Kamakau 1992:350).

In 1828, French was apparently given land and a house near the wharf at Honolulu by Boki, which grew into a large mercantile establishment (Hurst and Allen 1992:15). Similarly, British Consul Richard Charlton claimed a sizeable portion of the wharf area, adjacent to the present project area, from a nefarious 299-year lease executed by Kalanimōkū, allegedly with the knowledge of Ka'ahumanu (Hurst and Allen 1992 :17).[2] Kalanimōkū also was responsible for providing Wildes and Marshall

[2] While French was eventually successful in receiving his downtown Honolulu property in fee simple, Charlton's claim was disputed and became the principal motivation for the

with their waterfront property at the future intersection of Queen and Nuuanu Streets. This land probably became available for disposal by the *ali'i* in the mid-1820s when most of the chiefs, including Ka'ahumanu and Kīna'u, were busily moving to Pohukaina on the eastern side of Honolulu to be close to the Christian missionaries, Kaiwai-a-Ha'o Church, and the tomb of Kamehameha II. The end of the royal residence at Pākākā and the Hawaiian village of Pūlaholaho were in sight. The Malden Map of 1828 provides the location of Wildes and Marshall by noting the house of their employee, Capt. Grimes (Figure 4).

THE DIFFICULT 1830s

The American consul John Jones, as the British agent Richard Charlton, was not a good friend of the Protestant mission (Day 1984: 57). Their interests were primarily commercial. Jones married Hannah Holmes, daughter of former O'ahu Governor Oliver Holmes, but also lived with Lahilahi Marín, daughter of Don Francisco de Paula de Marín. The children of Jones by Marín eventually claimed the 'Ewa part of the present project area, an area which had been under the senior Marín's control. Jones built a stone house on Marín's land in 1832 (LCA 810), which he gave to Lahilahi. According to Māhele survey, that house was located in *'āpana* 2, which is now 'Ewa of the present project area, across Smith Street and presently under Marin Tower. *'Āpana 1* of Jones' LCA 810 forms the 'Ewa portion of the present project area, identified by Land Court Application 539 on modern tax map keys. The Māhele survey of the parcel indicates the existence of two structures on that parcel (BCQLT 3:102).

Partly because of his negative attitude towards the American Protestant missionaries, John Jones was dismissed as U.S. consul. He abandoned Hawai'i in 1838 (Day 1984:57), leaving his children and wives behind. He had been previously succeeded as commercial attaché by Peter Brinsmade (Day 1984:15) in 1834 (BCQLT 1:135).

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intervention of the British navy in 1843 which resulted in a temporary loss of Hawaiian sovereignty (the Paulet Affair).

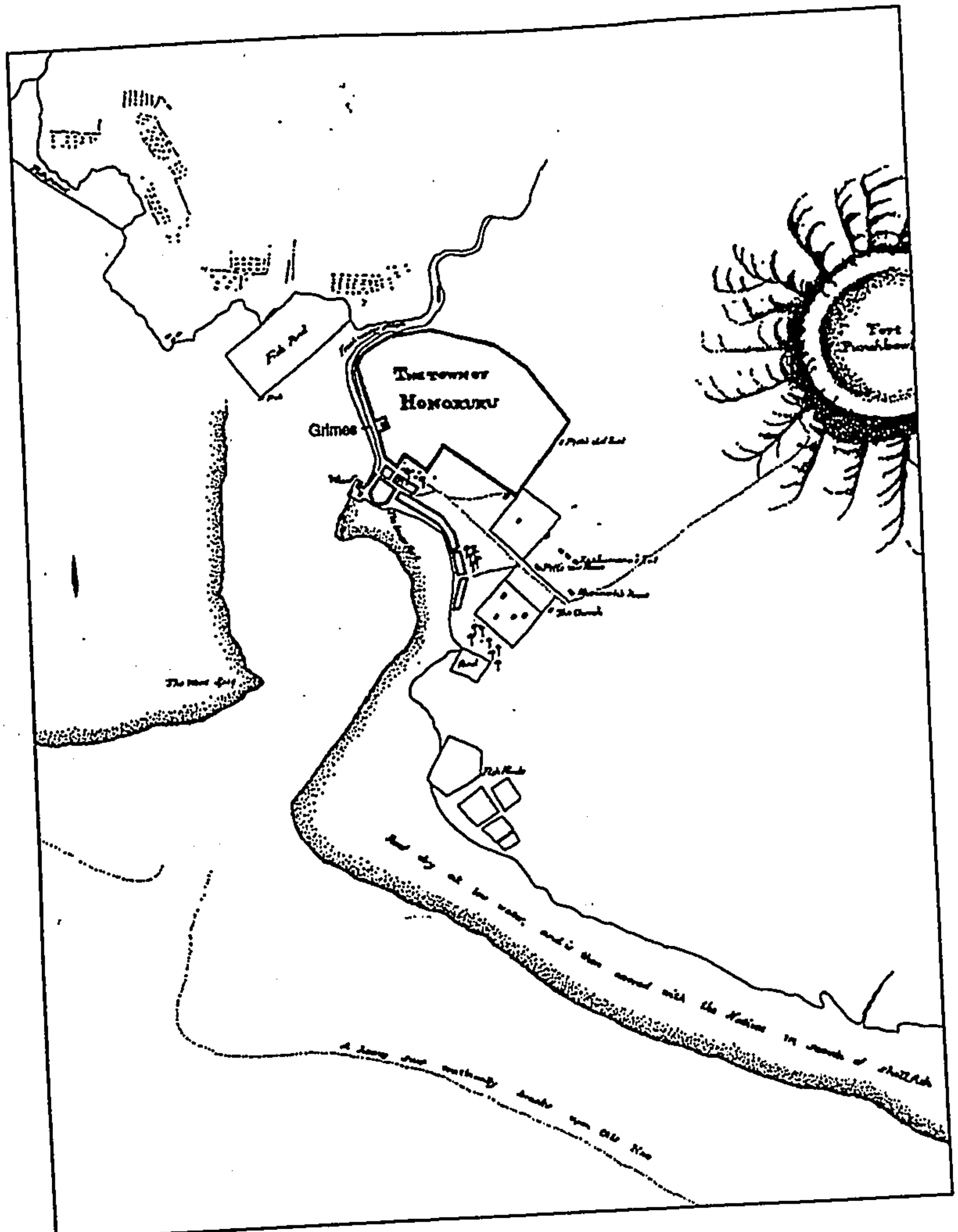

Figure 4. Malden (H.M.S. *Blonde*) Map of Hónolulu, 1825. Redrawn from map in Hawaiian Historical Society collections.

Not too much is known of Captain William S. Hinckley of Boston, but he was involved in the first attempted transfers of title to real estate in Honolulu, at least in the western sense. One of these properties included the present project area. Hinkley was one of the first foreigners to have successfully badgered the king and premier for land on O'ahu, notably at Luakaha in Nu'uanu (Cooke 1938:2). It may have been Governor Kaikio'ewa who originally "gave" the land at lower Luakaha to Hinkley, as suggested by Laura Fish Judd in 1847 (Judd 1928 [1880]:130), but there is no other documentation of this. Mindful of Ka'ahumanu's attitude towards the possible alienation of *'āina*, King Kamehameha III wrote his former *kahu* in 1834:

> If you wish to give away any 'Āina to foreigners, you should give to them in the same manner as we [on O'ahu] allow each foreigner 'Āina. Just as Olohana [John Young, Sr.] resides. And, if we should decide to remove them, then we take back the 'Āina. Don't you completely cede any 'Āina to them. That is my command to you. (Kame'eleihiwa 1992:171).

It seemed, however, that by "common practice" lands somehow acquired, enclosed, and improved upon could receive a sort of long-term lease from the Crown or government, although the granting of allodial titles would wait until the Great Māhele of 1848-1853. The slowly changing Hawaiian land tenure in the 1830-1840s did not prevent, however, foreigners from buying and selling their interests (and insecure title) to particular lands.

In 1833, William Hinkley attempted to acquire the property of Marshall and Wildes at the present site, and made a proposal with Ladd and Co. (Brinsmade, Ladd, and Hooper) for the purchase of the entire premises (BCQLT 1:135). Jones sold Marshall and Wildes' interest to Hinkley, at which point an old bill of sale was produced, which indicated that the late chief counsellor Kalanimōkū had received a wooden house in consideration of the sale of this property to Marshall and Wildes. The lot was partitioned--Hinkley sold one half of his newly acquired property to Ladd and Co. The wooden building of Kalanimōkū was moved to the *mauka* side of the project area. The structure and associated grass houses were later occupied by Eliab Grimes.

It is thus highly possible that Kalanimōkū had a residence on the project area, perhaps between the residences of Keli'imaika'i (*makai*), Kaihelani, and Davis (*mauka*).

Ladd and Co. apparently received a 50-year lease to their various properties, which probably included the corner lot at Nuuanu and Queen Streets, from the government in 1835 (Day 1984:15) While also experimenting in *kukui* nut oil and silk, Ladd and Co. were the first sugar planters to survive in Hawai'i (Koloa Plantation). Their business on Queen Street did not survive long, however.

The Hinkley lot was on the *mauka* side of the block, while Ladd & Co. occupied the *makai* portion. On the 'Ewa side of the property was the residence of Lahilahi Marín Jones and Jones' children (LCA 810). An easement probably extended from the Hinkley lot through the Ladd premises to the wharf. Figure 5 depicts these properties as they possibly appeared in 1836.

By 1837, Hinkley had run up substantial debts to both William French and Hudson's Bay Company. As partial settlement to those creditors, Hinkley surrendered his presumed title to his Luakaha property in upper Nu'uanu Valley. In late 1836 or early 1837, Hinkley sold his interest in the partitioned Marshall and Wildes property on the *mauka* side of the present project area to Stephen Reynolds (BCQLT 1:135). On 6 April 1837, Hinkley transferred his claim to the Luakaha land to William French for $200 (FR 1:13) and promptly left the Islands. Reynolds quickly sold his interest in the old Marshall and Wildes property to Eliab Grimes and Josiah Thompson for $6,000 (FT 1:50).

The first proper wharf in Honolulu was a sunken hulk located at the foot of Nuuanu Street. In 1837 it was taken up and a new pier was constructed at the joint expense of Ladd & Co. and Grimes (FR :41-42). This wharf was just north of Reynold's wharf, and it was leased "from [O'ahu Governor] Kekūanaō'a," a reference to the government (BCQLT 1:135).

The year 1837, it should be added, was generally a sad time for the young town of Honolulu. During that year, King Kamehameha III moved his court and the seat of government to Lahaina on Maui, where it would remain until 1845.

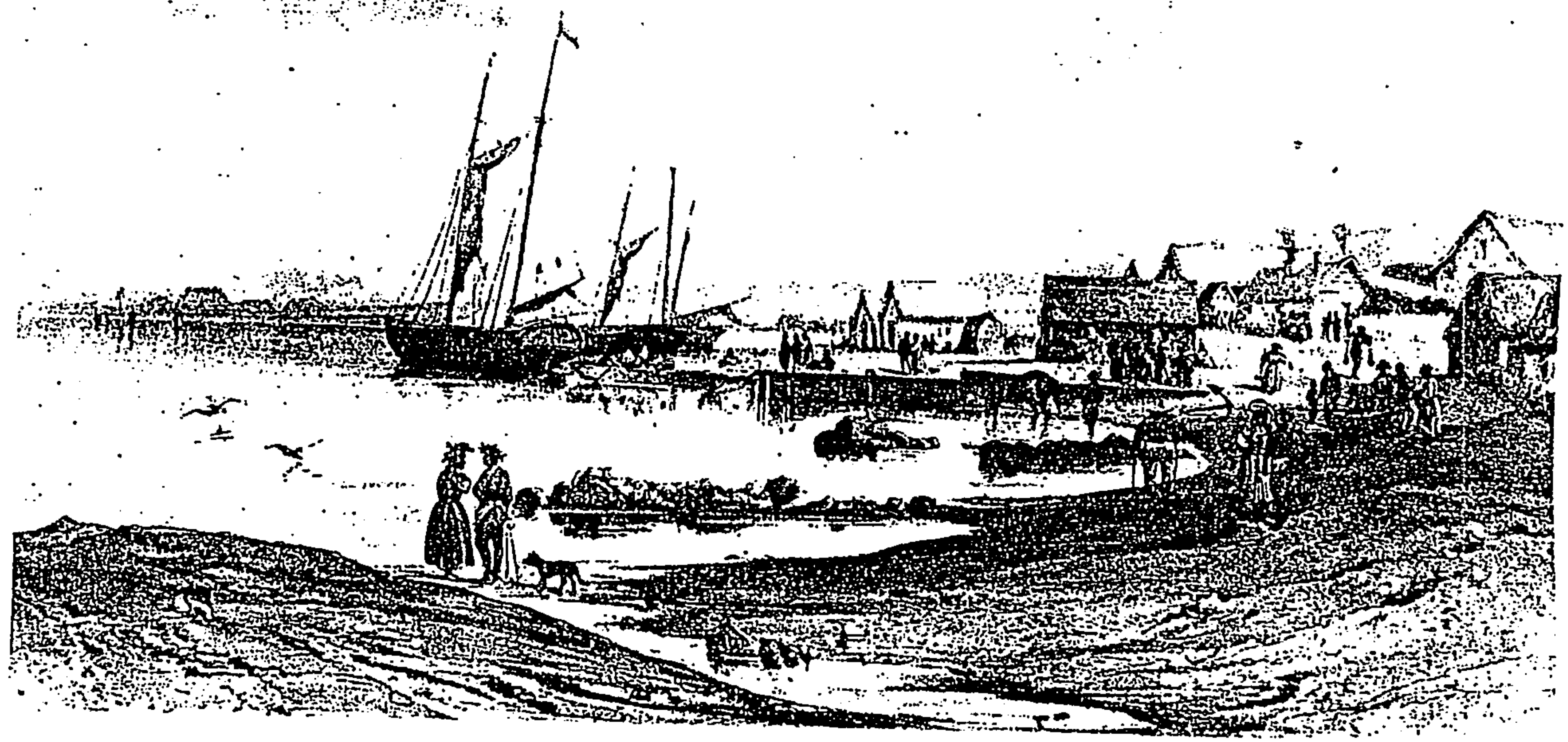

Figure 5. Queen Street looking 'Ewa in 1836. Lauvergne. The foot of Nuuanu Street can be seen in the middle distance. The buildings on the extreme middle right may be the premises of Ladd & Co. on the present project area. Hawaii State Archives.

THE GREAT MĀHELE

During the times of the Great Māhele, the children of John Jones by Lahilahi Marín received the 'Ewa portion of the present project area under LCA 810. Eliab Grimes received the *mauka* portion of the old Marshall and Wildes property with LCA 38, and Ladd and Co. continued their lease from the government to the *makai* section of the block. By 1847, Paul Marín had sold a large section of his father's property 'Ewa of the project area to the government, which utilized the large lot as a public market (Figure 6).

The property of the Jones' children was surveyed in 1857 as part of Māhele procedures. It shows two structures on *'āpana* 1 of LCA 810 in the present project area. The neighbor to the Waikīkī side of the property is a J. J. Caranaves (?) (BCQLT LCA 810, 3:102-103). Stephen Reynolds, testifying for the Jones children in 1848, recalled that several "straw houses" existed at the back of Caranaves' premises (FT 241). Caranaves does not seem to have be a part of the Ladd & Co. property, and may have been the cooper noted on Grimes' survey.

HONOLULU FLOUR MILL AND IRON WORKS

The first and largest heavy industry in Hawai'i was established on the present site in 1854. So important was Honolulu Iron Works to the industrial economy of the Islands that publisher Thomas Thrum used the health of the company as one of his major economic barometers for the rest of the archipelago. The innovations produced by the foundry made it one of the leading manufacturers of sugar mill equipment in the world.

Honolulu Iron Works began as a small flour mill on the 'Ewa side of the 800 Nuuanu block (possibly near the corner of Smith and Marin Streets). Honolulu Flour Co. was a three-story silo-shaped building, illustrated in 1854 by Emmert (Figure 7), and was established by an Eastern United States millwright named Hunter. One of the early cash crops produced in Hawai'i, wheat was grown in Makawao on Maui and at Kā'u, Hawai'i during the 1840s and 1850s and was ground at Honolulu. The mill was a financial concern of George Gower of Lahaina and H. Croswell of Makawao. Material

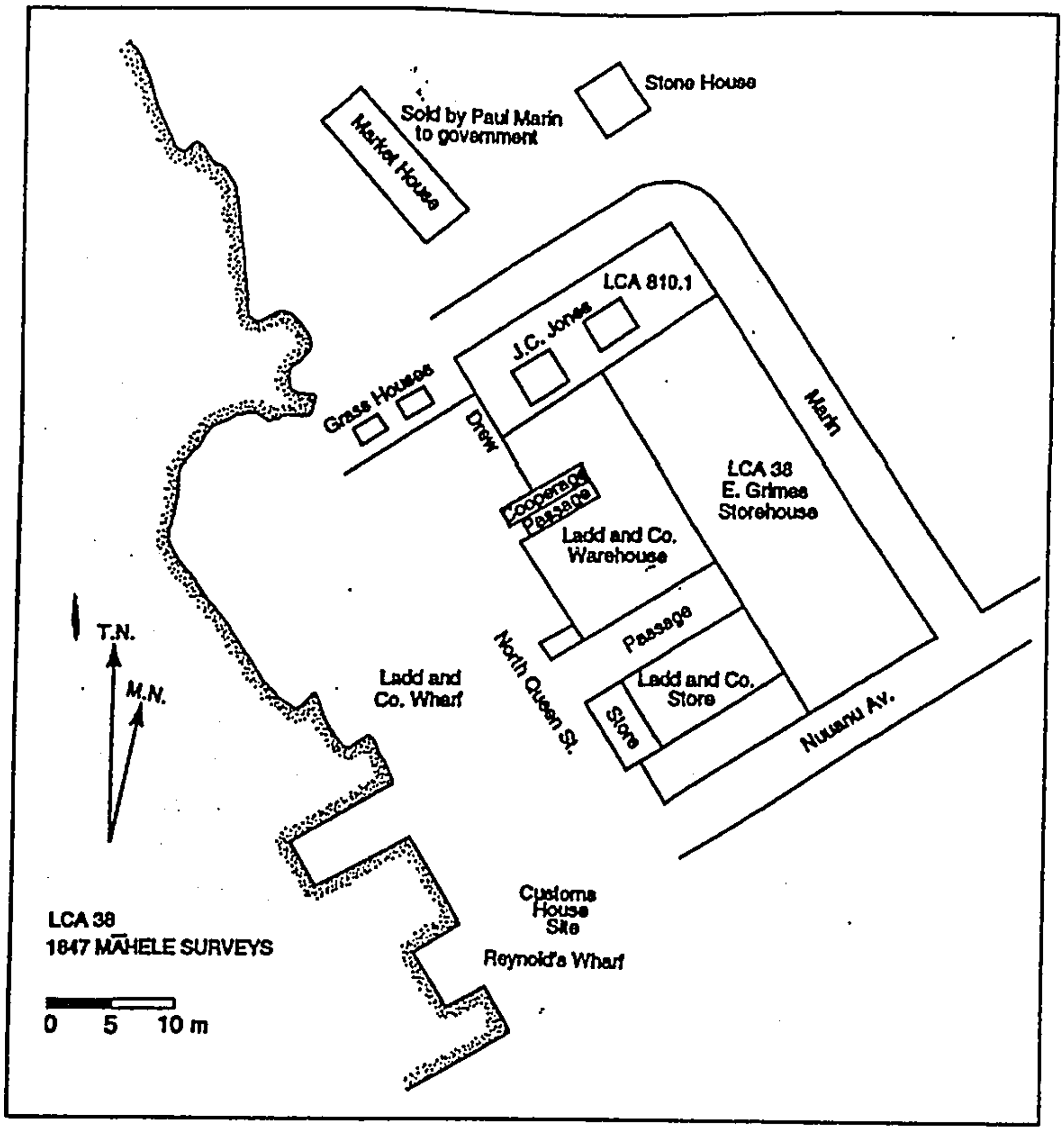

Figure 6. Present project area ca. 1847 based on Māhele documents (LCA 38 and LCA 810).

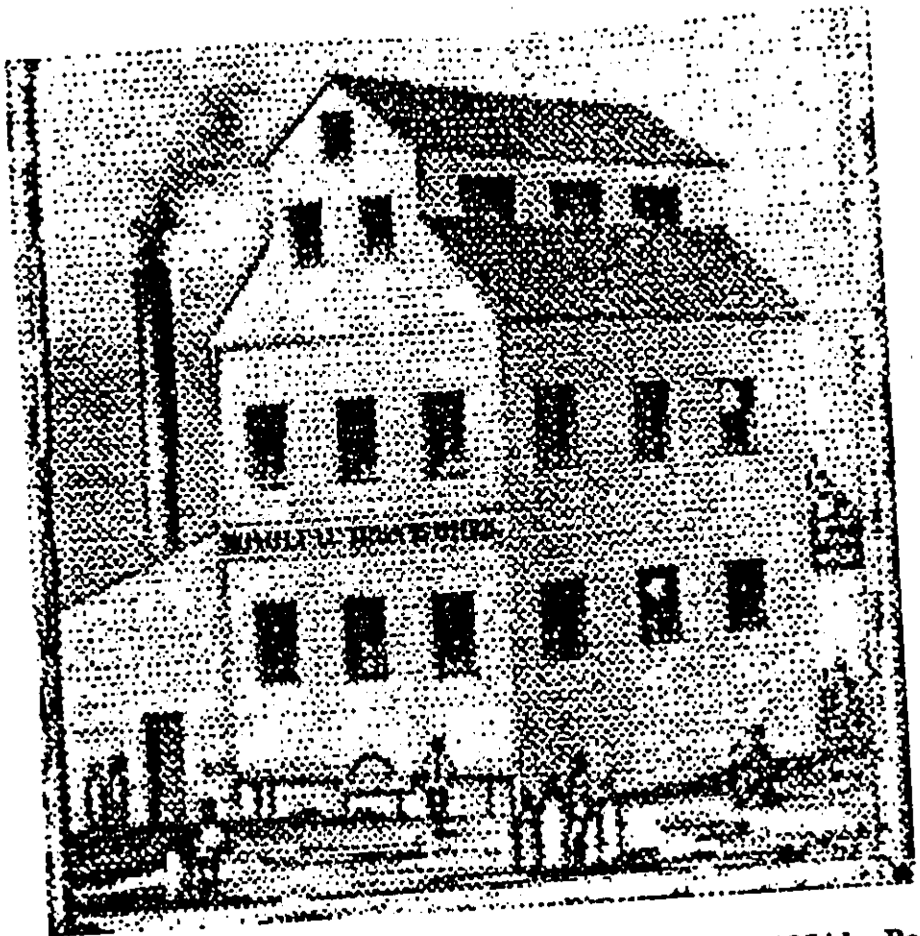

Figure 7. Sketch of Honolulu Flour mill and Iron Works in 1854 by Paul Emmert (detail).

for the construction of the steam-powered mill was brought from Boston to Honolulu, and upon arrival, a decision was made to erect the mill in the city near the waterfront. A bakery was soon added to transform some of the wheat flour to ship biscuit, a product in great demand by the whaling fleets (Thrum 1914:84-96).

Although wheat from as far away as Chile was ground at Honolulu Flour Co., the business added a small machine shop and foundry in 1854 (Honolulu Advertiser 1926:2). The shop was established by American inventor David M. Weston, and was financially helped in partnership with prominent Honolulu businessmen Peirce (Day 1984),Thurston, Gulick, and others (Thrum 1914:94-95).

As wheat cultivation was phased out in Hawai'i, it was replaced by a greater interest in sugar. Weston put his mind to advancing the technology of sugarcane processing. His major invention was the suspended centrifugal (1851) which spun excess moisture from the pressed cane juice and separated the sugar from the molasses. It became the standard device used around the world, and was of course a great boon to Hawaiian planters. It is still known as the Weston centrifugal. Weston's invention was so successful that he moved back to the U.S. in 1860 to devote his energies in producing these machines on a large scale (Honolulu Advertiser 1926:2). In December of that year, the original flour mill and machine shop burnt down (Thrum 1914:94-95). It is not known where the exact location of the original mill was, but a remnant may have survived in the 5-foot coral wall noted in the Gurrey Map of 1900 on the corner of Smith and Queen Streets.

The foundry was quickly rebuilt on the *mauka* portion of the block along Marin Street with coral blocks by new owner Thomas Hughes. The building survived until 1914. Hughes was helped with capital from the Janion, Green and Co., the predecessor of the Theo. H. Davies Company, Ltd. Hughes sold his interest to Alexander Young, who succeeded as manager of the foundry. The Jones family apparently sold their property on the 'Ewa side of the present project area on 20 February 1860 (Liber 12:336). On the Waikīkī corner of the block stood the shipwright concern of Johnston and Foster in 1860 (Thrum 1914:94-95). In 1862, rice pioneer Seth Ford built a rice mill adjacent to the new foundry. Like the flour mill before, it probably utilized the same power plant as the ironworks.

800 NUUANU IN THE LATE 1860s

According to Greer (1966), in 1869 the present project area included Honolulu Iron Works on the corner where Marin Street turned sharply *makai* (future Smith Street) (Figure 8). The Prendergast rice mill was located on the *makai* side of the block, on the Queen/Marin corner. If this was the original location of the flour mill, it is possible that some machinery may have been salvaged from the 1860 fire and used for the rice mill. Prendergast had assumed the mill from rice pioneer Seth Ford. Moving Waikīkī along Queen Street, G.W. Macy ran an *'awa* store in 1869. East of this was Tibbets and Sorenson (Foster's Old Stand), then J. H. Thompson, a general blacksmith. The old government customs house still stood at the foot of Nu'uanu Street, but was occupied by W. G. Woolsey, a sail maker.[3] *Mauka* of the Custom House was a government storehouse at the corner of Queen and Nuuanu on the project area, followed by the Native Hawaiian shipmaster H. Maluaiko'o. On the corner of Nuuanu and Marin was M. C. Challamel & Co. (N. A. Blume), a wine and liquor importer (Greer 1966:49).

During these times, a market was located on the 'Ewa corner of the waterfront end of Nuuanu. It was described as a "...straggling, open space, with a number of shabby stalls partially surrounding it..." (Pacific Commercial Advertiser January 13, 1872). The neighborhood was colorfully described by Greer, paraphrasing Pacific Commercial Advertiser of 18 March 1871:

> Honolulu in 1869 had no public park or promenade; hence the overpowering attraction of the Saturday afternoon fish market--an established social institution. From four p.m. to sunset it drew the biggest crowd in town. Hawaiian ladies, young and otherwise, came decked out in silks and satins. Men on horseback or in carriages forced their way through the mob, with occasionally disastrous results. An illustrative case: On a Saturday in March, 1871, two young men

[3]Built in the 1840s, it was finally demolished in 1904 (Scott 1968:72, 890).

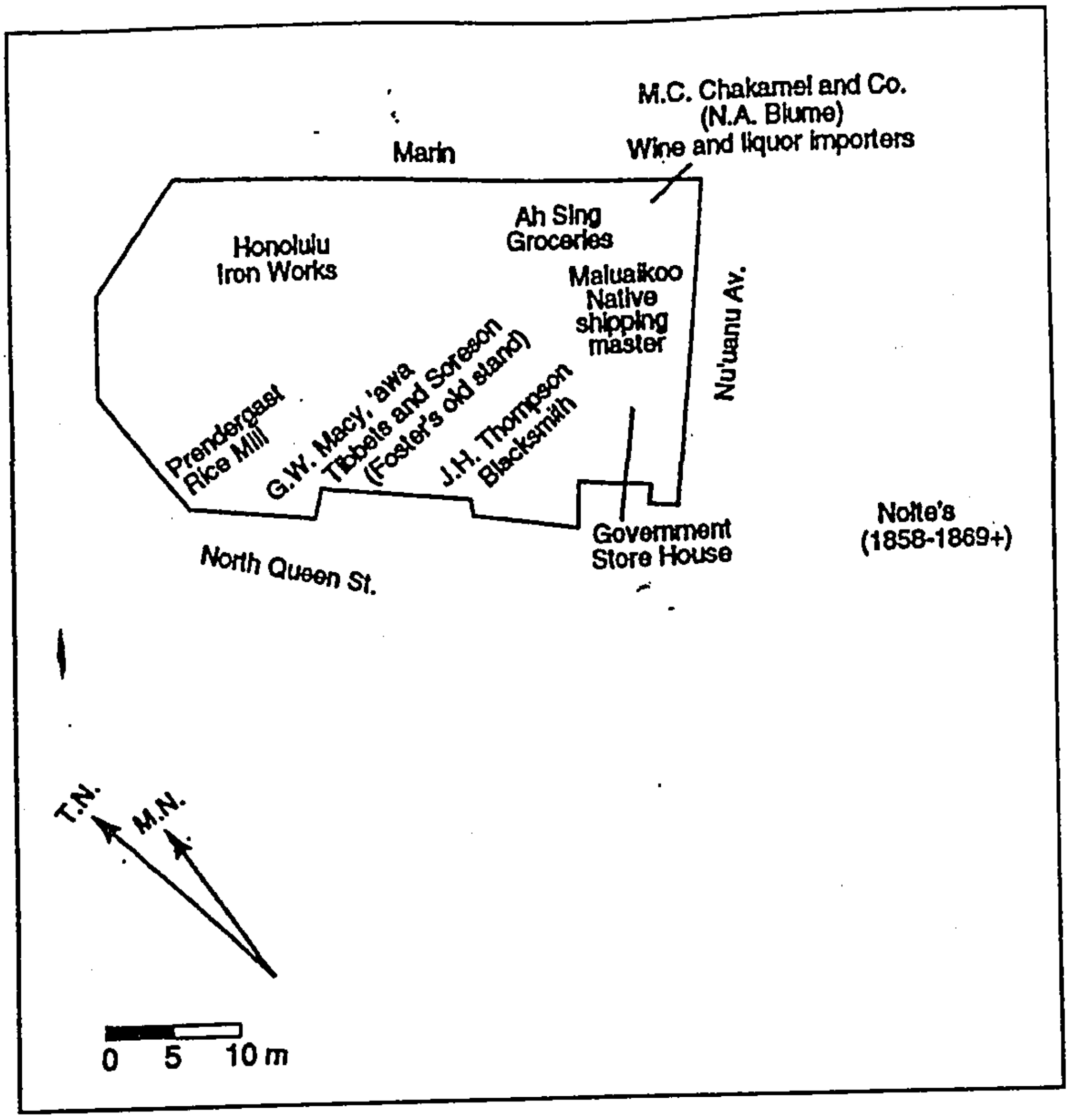

Figure 8. The present project area in 1869 based on Greer's (1966) reconstruction. Building shapes and features were not illustrated.

driving a buggy with as many horses lost control when the animals scared and bolted. A duo of old women were spread-eagled as the team raced to the old Marine (Marin) homestead at the end of the lane [Greer 1966:9].

The present project area in the late 1860s was adjacent to numerous restaurants, coffee houses and saloons on Nuuanu Avenue.. H. J. Nolte's Old Corner (established in 1858) was located on the Waikīkī/*mauka* corner of Nuuanu and Queen. B. Bastal's What Cheer Coffee Saloon on Nuuanu between King and Merchant served such delights as ham and eggs, beefsteak, mutton chops, oyster stew, cigars and tobacco from 3 am to 9:30 pm (Greer 1966:7).

Sunday nights were popular at neighborhood coffee shops. Around 8:30 pm, after church, Hawaiian youths would descend upon Nuuanu Street:

> The customers, who never did a day's work, were clean and well-dressed in fine white linen suits...A babel of voices droned on; 'extravagantly sweetened" coffee or tea was sipped with gusto; plates of cake and bread melted away." [Greer 1966:8].

In 1863 Nuuanu Street was straightened from King to Queen Streets to more closely match the course of the road *mauka* of King Street. The adjustments do not seem to have impacted the present project area.

EXPANSION OF HONOLULU IRON WORKS

In 1875, the Honolulu foundry was incorporated as Honolulu Iron Works with Theo. Davies as president (*Honolulu Advertiser* 1936:15). Davies always seemed to be at the right place at the right time: The Reciprocity Treaty of 1876 between King Kalākaua and the United States government gave the sugar industry the impetus for great development in Hawai'i. Hawaiian products could be imported to the United States duty free. As primarily a sugar mill outfitter, Honolulu Iron Works' business boomed--in 1877 Honolulu Iron Works began to make extensive alterations of the former Ladd premises adjacent to their shop, erecting brick buildings and rendering the whole "fireproof." This new complex was photographed a few years later by manager

Hedemann (Figure 9). In 1877, the company employed 110 to 120 people, maintained a payroll of $5,000 per month, and had built 26 boilers, 6 centrifugals, and numerous parts for six sugar mills (Thrum 1878:54). J. Nott of Ka'ahumanu Street was supplying the copper fixtures, which were then installed by in-shop coppersmiths (Figure 10). The new brick building was about 90 long by 54 feet wide (*Honolulu Advertiser* 1949).

Products made by Honolulu Iron Works in the 1880s included multiple milling machines, multiple effect evaporators, filter presses, juice heaters, and furnaces (*Honolulu Advertiser* 1936:15). The new technology was quickly adapted by the planters, with the result that Honolulu Iron Works went on "double gang" shifts working around the clock (Thrum 1886:64). In 1888, the company extended their premises again (Thrum 1889:88). The plant now extended to other two story brick buildings located *mauka* across Marin Street. In 1892, Honolulu Iron Works bought out competitor Union Iron Works (Thrum 1893:117). Figures 11, 12, and 13 depict the foundry in the late 1880s.

THE BRENIG AND OTHER BUILDINGS

In 1883, the two-story Brenig Building was built on the old Ladd & Co. property on the corner of Nuuanu and Queen, now covered by the open parking lot at 800 Nuuanu Avenue. Moving his business a block down from the *mauka* corner of Marin and Nuuanu, Charles Brenig ran a dry good store from the new location. In the 1890s, the brick Brenig Building contained the Seaman's Club (2nd floor), the stevedore firm of McCabe, Hamilton, and Renny, and M.J. Bissel steamship agency (Figure 14). It was later painted bright red and became well known as the Red Front Store, and housed the Hawaiian Express Company. A photograph taken in 1913 illustrates an old painted sign on the building offering "Captains' Slop Supplies" (sailors' bedding and gear) (Figure 15). With the death of Charles Brenig, his widow claimed that Samuel Damon had unlawfully taken possession of the premised under a spurious will (Secretary of Interior to Governor, 1902). The Bureau of Conveyances has a copy of a bill of a lease from Damon to Honolulu Iron Works dated 23 March

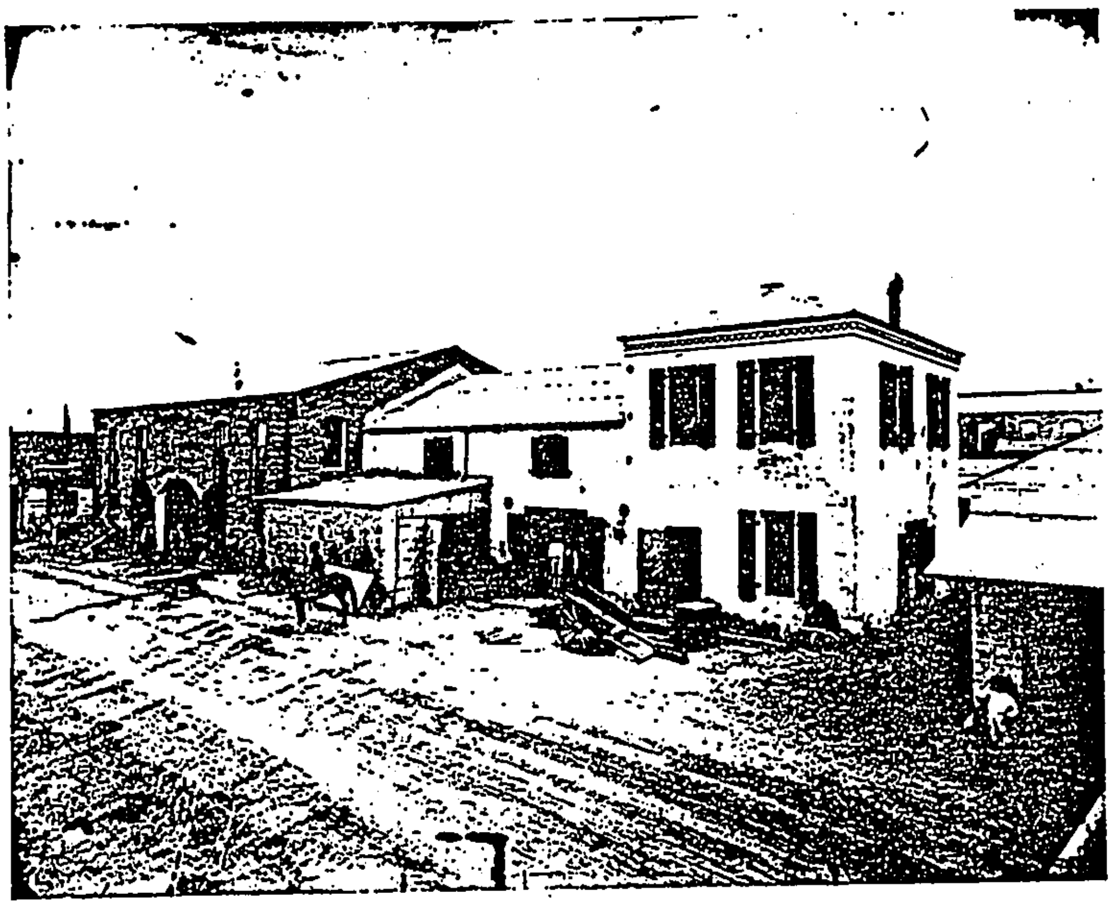

Figure 9. Honolulu Iron Works along Queen Street, ca. 1887. Photo most likely taken from an upper floor of the Customs House. Plan of these buildings can be seen in the Gurrey Map of 1900. C. J. Hedemann. Bishop Museum CA 78062.

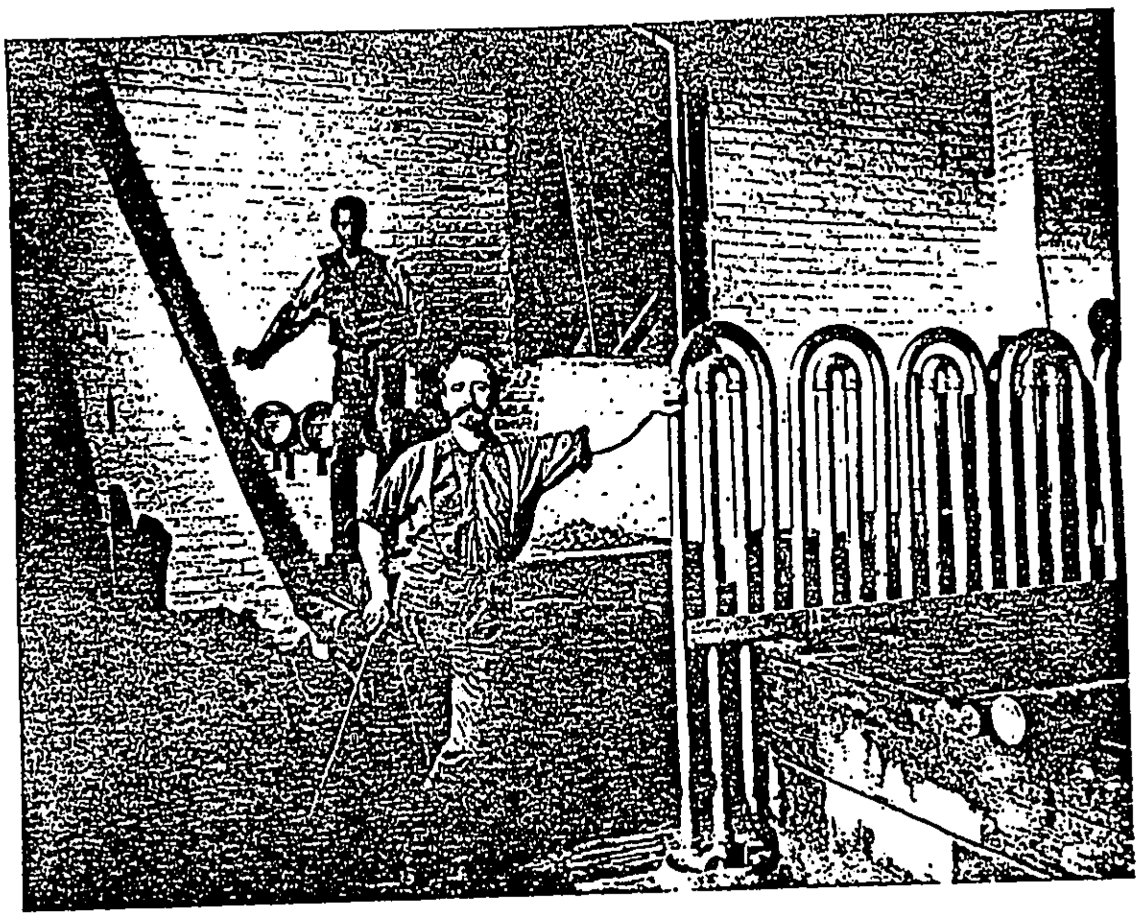

Figure 10. Coppersmiths Andrew Brown (front) and Louis Phelp of Honolulu Iron Works, ca. 1888. C. J. Hedemann. Bishop Museum C 788138.

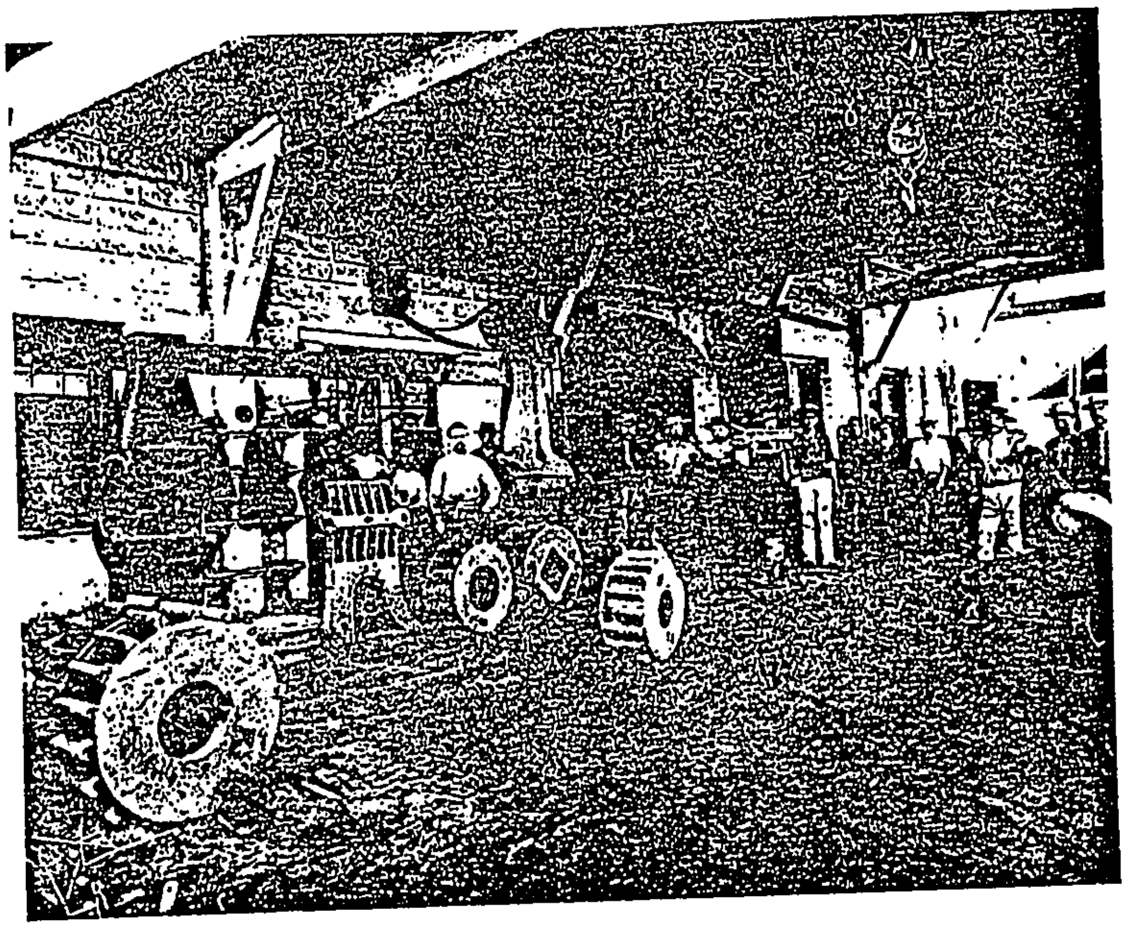

Figure 11. Interior of Honolulu Iron Works foundry, c. 1888. C. J. Hedemann. Bishop Museum ABM 78130.

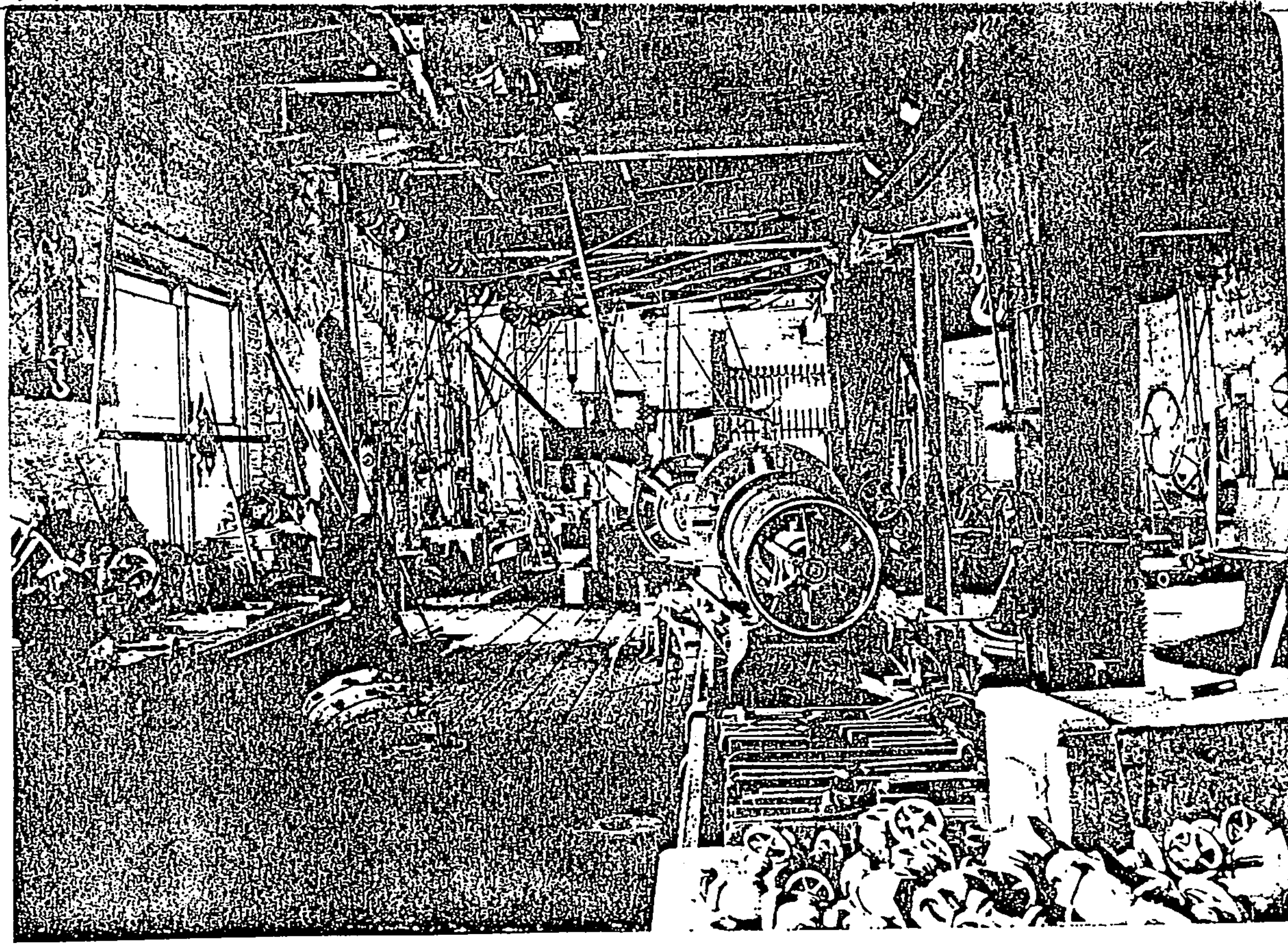

Figure 12. Honolulu Iron Works machine shop. ca. 1888? C. J. Hedemann. Bishop Museum ABM 78128.

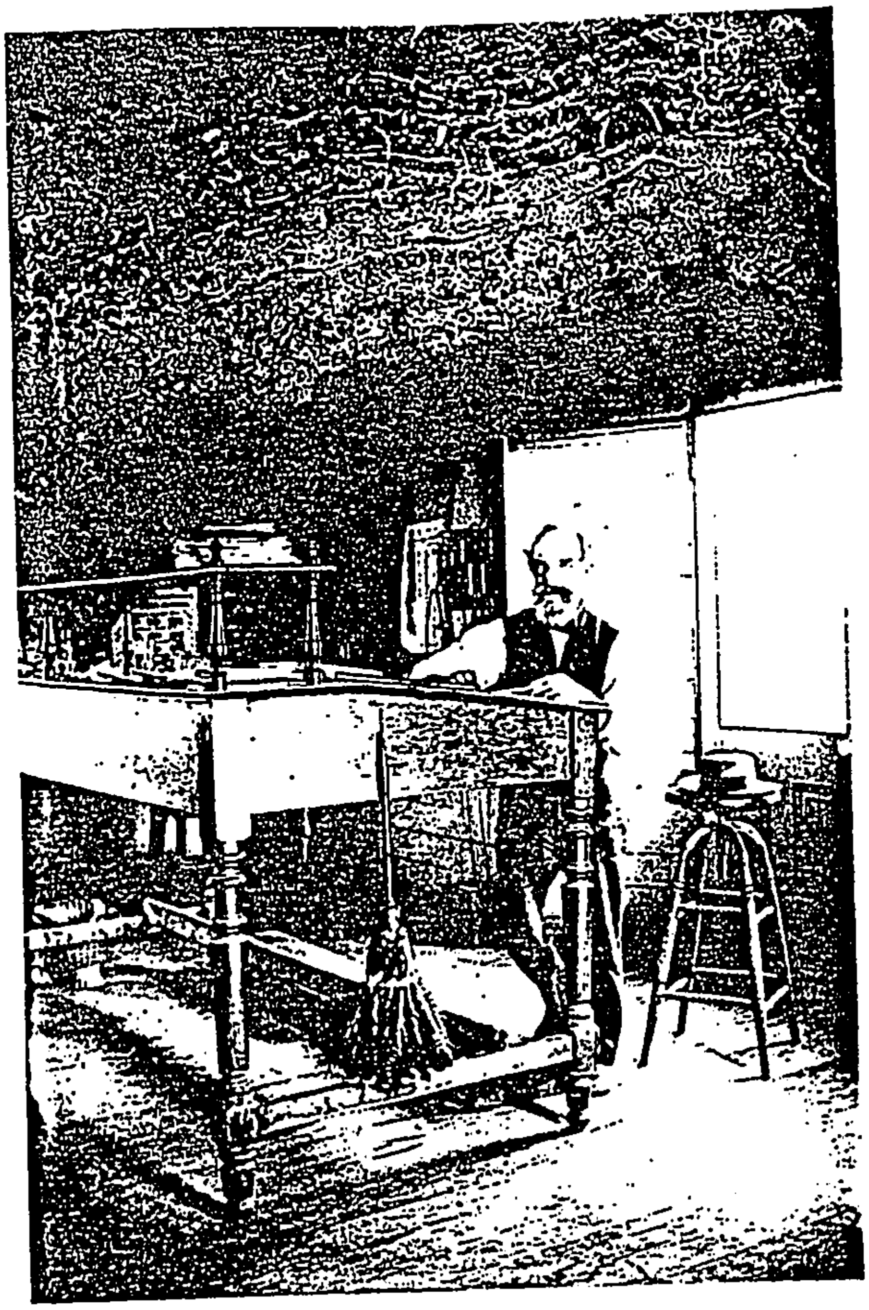

Figure 13. Honolulu Iron Works timekeeper Edward Hutton, 1888.
C. J. Hedemann. Bishop Museum CP 155,275.

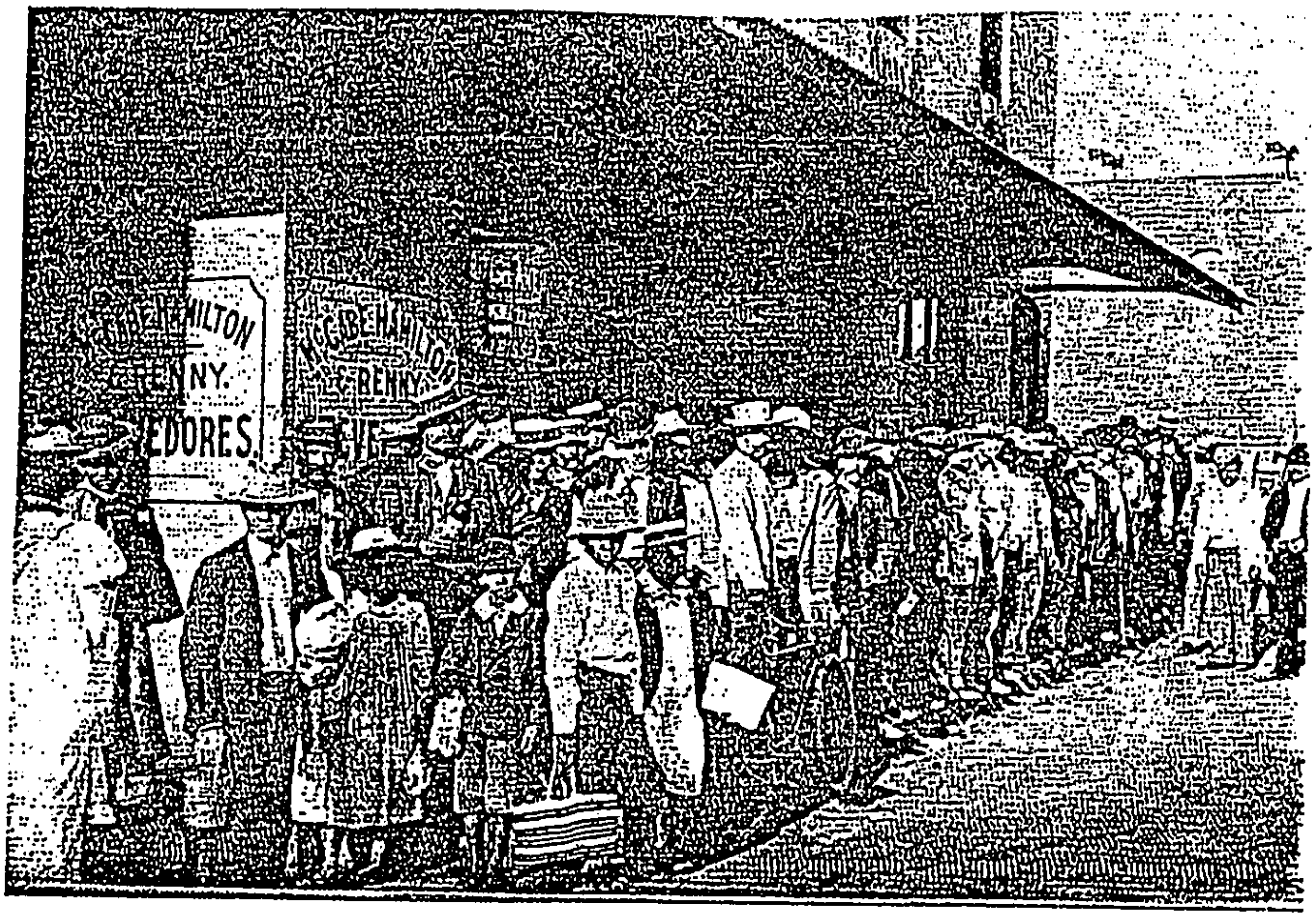

Figure 14. Patron wating for the streetcar at the Brenig's Building in the 1890s. R. J. Baker. Scott 1968:280.

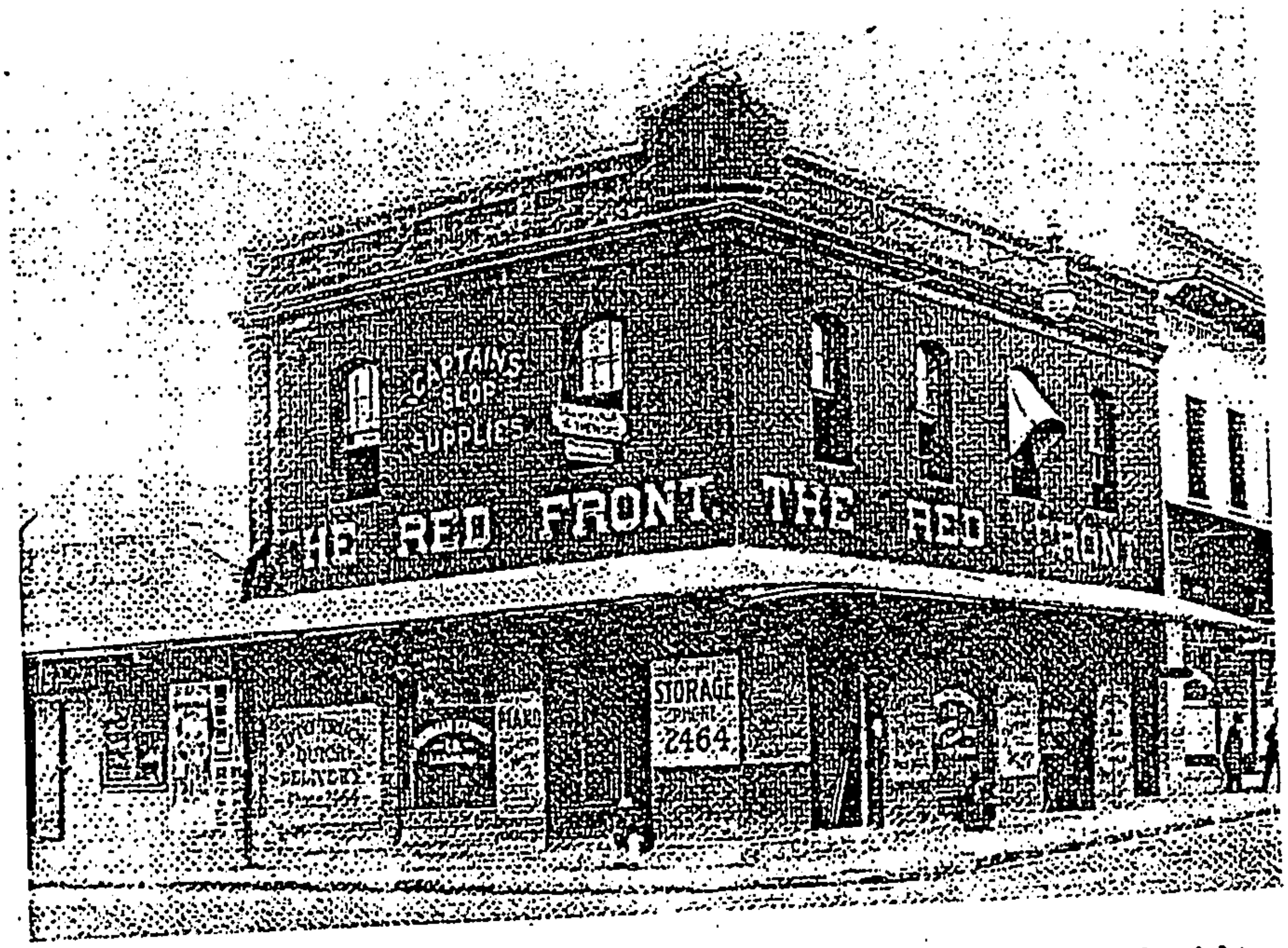

Figure 15. The Red Front (Brenig's Building) in 1913. Salvation Army is to the right. Scott 1968:414.

1901 (Liber 218:394). The Iron Works were to pay Damon $225 per month for 21 years. The Brenig building survived until the 1920s.

A two-story Salvation Army reading room and hall was constructed adjacent to the Brenig Block along Nuuanu ca. 1900. Along Queen street next to Brenig's, a single story wooden frame building served as a restaurant for many years.

THE PROJECT AREA IN THE TWENTIETH CENTURY

In 1896 Young retired as manager of Honolulu Iron Works and J.Christian Hedemann succeeded. Previously, Hedemann had been head draftsman of the firm (Davis 1988). Hedemann was a noted photographer and became Danish Consul for Hawai'i in 1909 (Secretary of State to Governor, 1909). The offices of Honolulu Iron Works, now located on the corner of Marin and Nuuanu, subsequently flew the Danish flag (Figure 16). Hedemann retired in 1917, but not before providing a wonderful collection of interior and exterior photographs of the old foundry at the 800 Nuuanu block, some of which are presented here (see also Davis 1988). Figures 11 and 12 seem to depict a coral block building. Perhaps this is the foundry of 1860. The Gurrey Map of 1900 illustrates the project area in great detail, and shows the location of a coral building on the *mauka* side of the block (Figure 17). Hedemann was succeeded as manager by W. G. Hall (*Honolulu Advertiser* 1936:15).

The turn of the twentieth century was a time of great change at the present project area. Having outgrown their original location, Honolulu Iron Works began construction of a new, steel frame mill on a section of Kaka'ako, on Allen Street facing Pier 3 (Thrum 1901:171-172). The old coral block building of 1860 at Marin and Smith Streets was converted to offices and showrooms. Plumbing and engineers' supplies were sold in the Iron Works brick buildings on the *mauka* side of Marin Street. In addition, the merchandise division sold brass and malleable fittings, oil, packing supplies, boiler tubes, valves, engines, machine tools, boilers, coal and coke (*Paradise of the Pacific* 1901:72). While much of its business revolved around the sugar industry, Honolulu Iron Works also repaired warships and other vessels, and once even constructed an iron steamship.

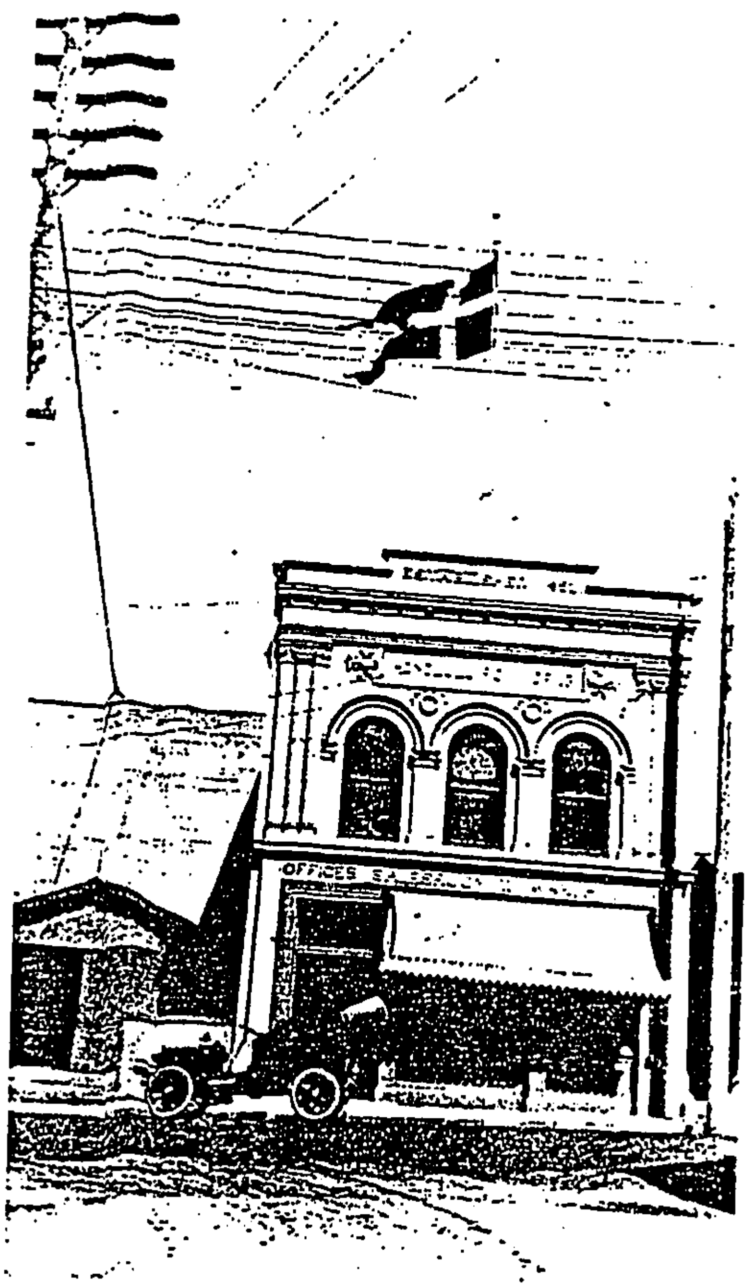

Figure 16. Office headquarters of Honolulu Iron Works flying Hedemann's Danish Consulate flag, ca. 1910s. C. J. Hedemann (?). Bishop Museum CN 92561.

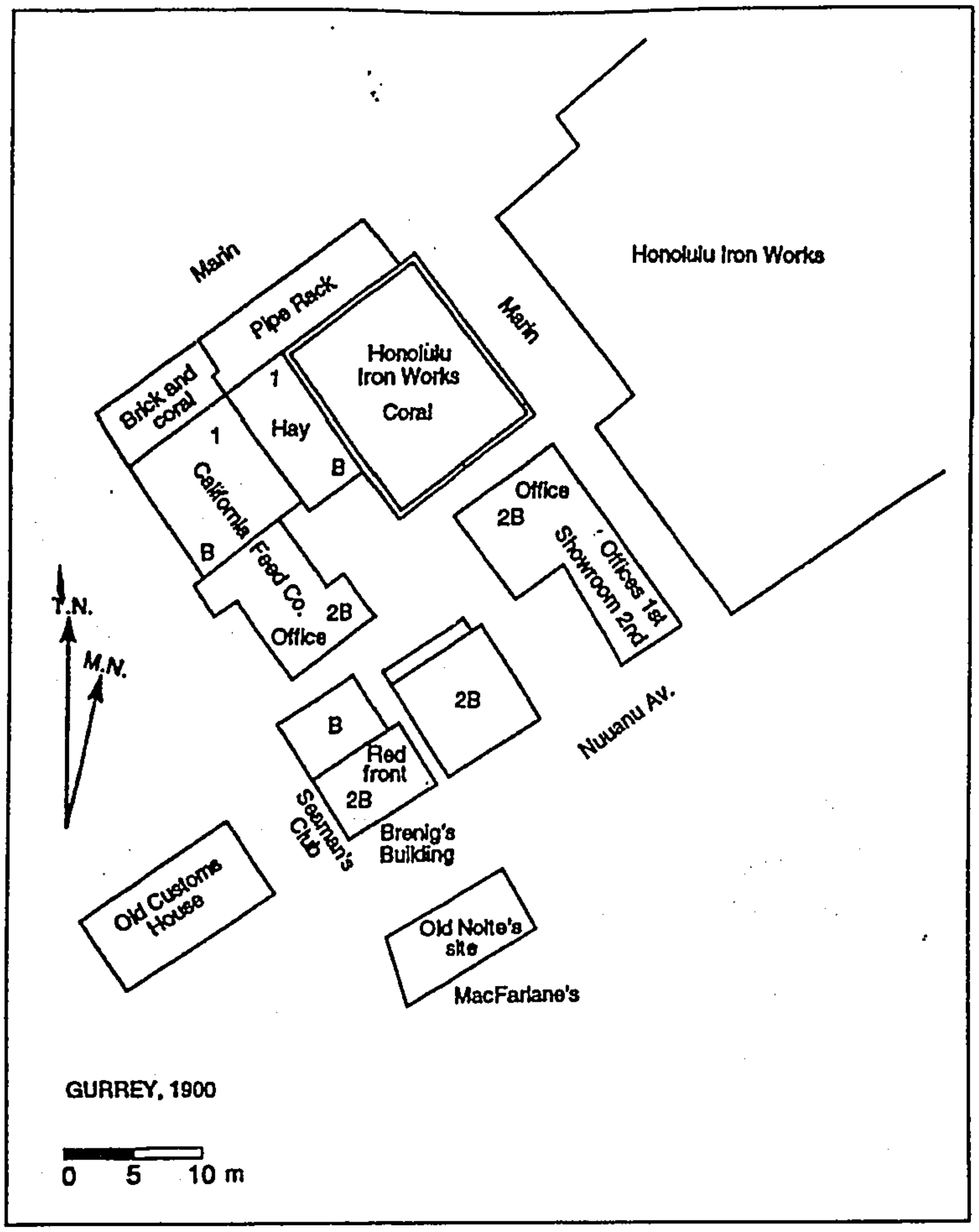

Figure 17. Gurrey Map of the present project area in 1900.

In 1901, bubonic plague broke out in the Chinatown district of Honolulu, adjacent to the project area. Lacking crematoria, the furnaces of the old foundry at Marin and Smith were used by the city to dispose of the deceased. As the epidemic raged on, public health officials made a fateful decision to set fire to parts of affected Chinatown in an attempt to destroy the elements of contagion. The conflagration, however, soon raged out of control, and most of Chinatown was destroyed. The old Honolulu Iron Works was saved, however, by the efforts of the pumps on the *Iroquois* in port at the Nuuanu wharf (Thrum 1901:102).

In 1914, the old coral block building at Smith and Marin Streets, and the brick buildings along Queen Street were demolished and a four-story, concrete reinforced, "fireproof" structure was erected for Honolulu Iron Works. The new building covered about 2/3's of the block (Figure 18). It was used as a warehouse and office (1st, 3rd and 4th floors) and a showroom (2nd) (Figure 19) for Honolulu Iron Works. This building is still extant, and is presently used by Bank of Hawai'i as an annex. An enclosed loading dock existed on the 'Ewa side of the building, and most likely extended from Queen to Marin Streets.

Few details of construction of the 1914 Honolulu Iron Works building have been found, but it appears from a recent pedestrian survey that the building was built up from a concrete foundation pad placed in a very shallow subsurface excavation pit (probably less than four feet in depth) or even over rubble fill.

As seen in the Sanborn Insurance Map of 1914 (Figure 20), a driveway led from the *mauka* section of Marin Street into the center of the block on the Waikīkī side. Brenig's Building still existed and was used for storage. A photograph taken at the foot of Nuuanu in the early 1920s shows a corner of the Brenig Building, followed by the Salvation Army and the flagpole-topped Honolulu Iron Works office. Nolte's Corner still existed as "Wo Hop Hing Kee," selling sailors' outfits and cold drinks (Figure 21).

Between 1924 and 1926, Brenig's Building and the Salvation Army had been demolished and were replaced by an off-street parking lot. The old office of Honolulu Iron Works still remained at the corner of Marin and Nuuanu Streets, however (Sanborn 1927). During this time, Smith Street was extended from King to Queen Street. Land

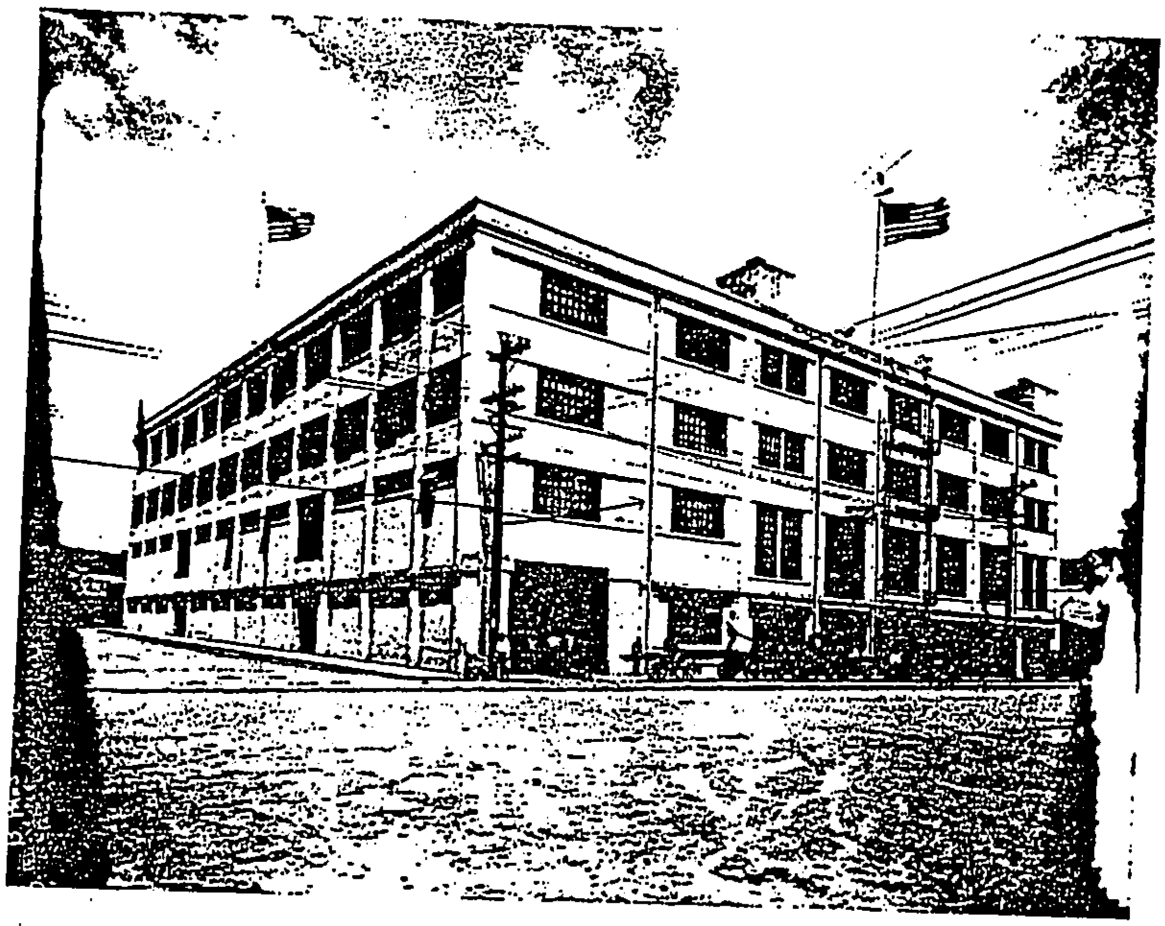

Figure 18. Showroom and warehouse building of Honolulu Iron Works at 800 Nuuanu, built in 1914. L. E. Edgeworth. Bishop Museum CD 24064.

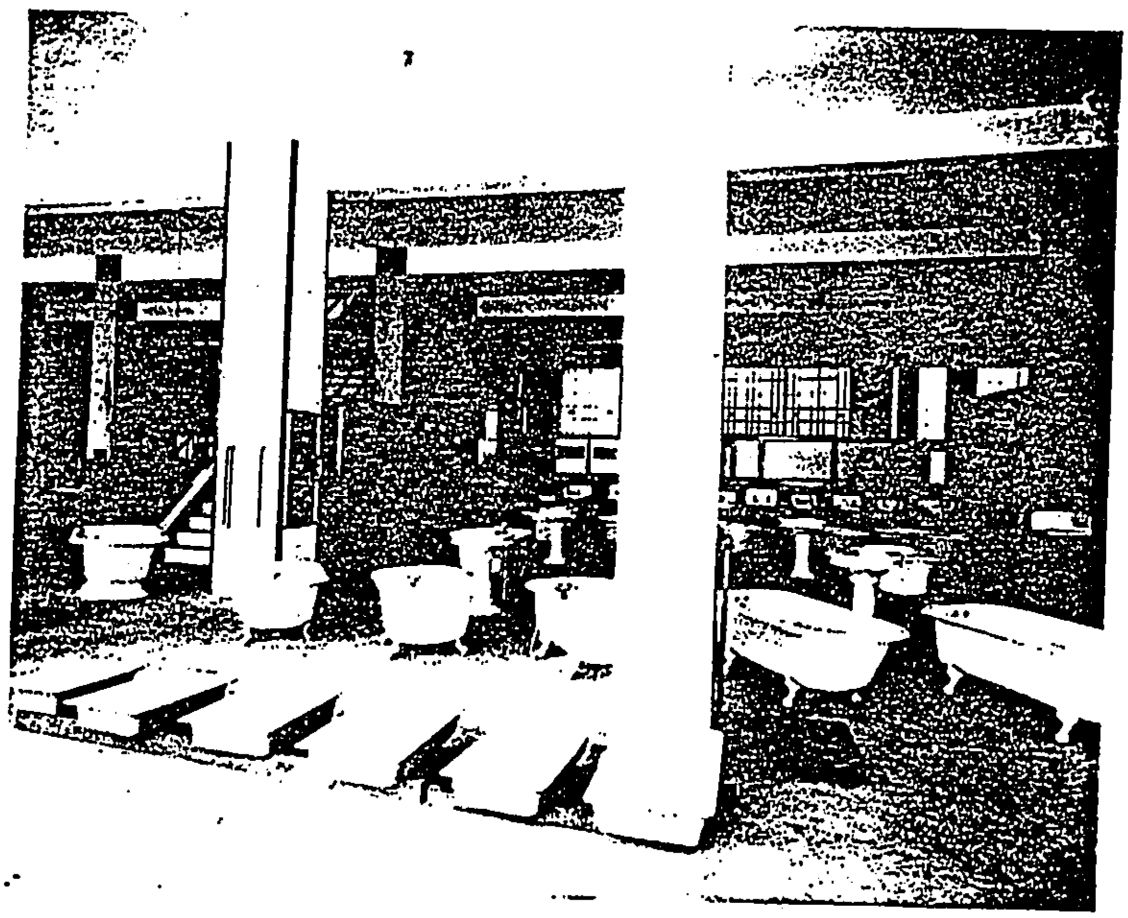

Figure 19. Showroom of Honolulu Iron Works at 800 Nuuanu. Date unknown.
L. E. Edgeworth. Bishop Museum CA 24125.

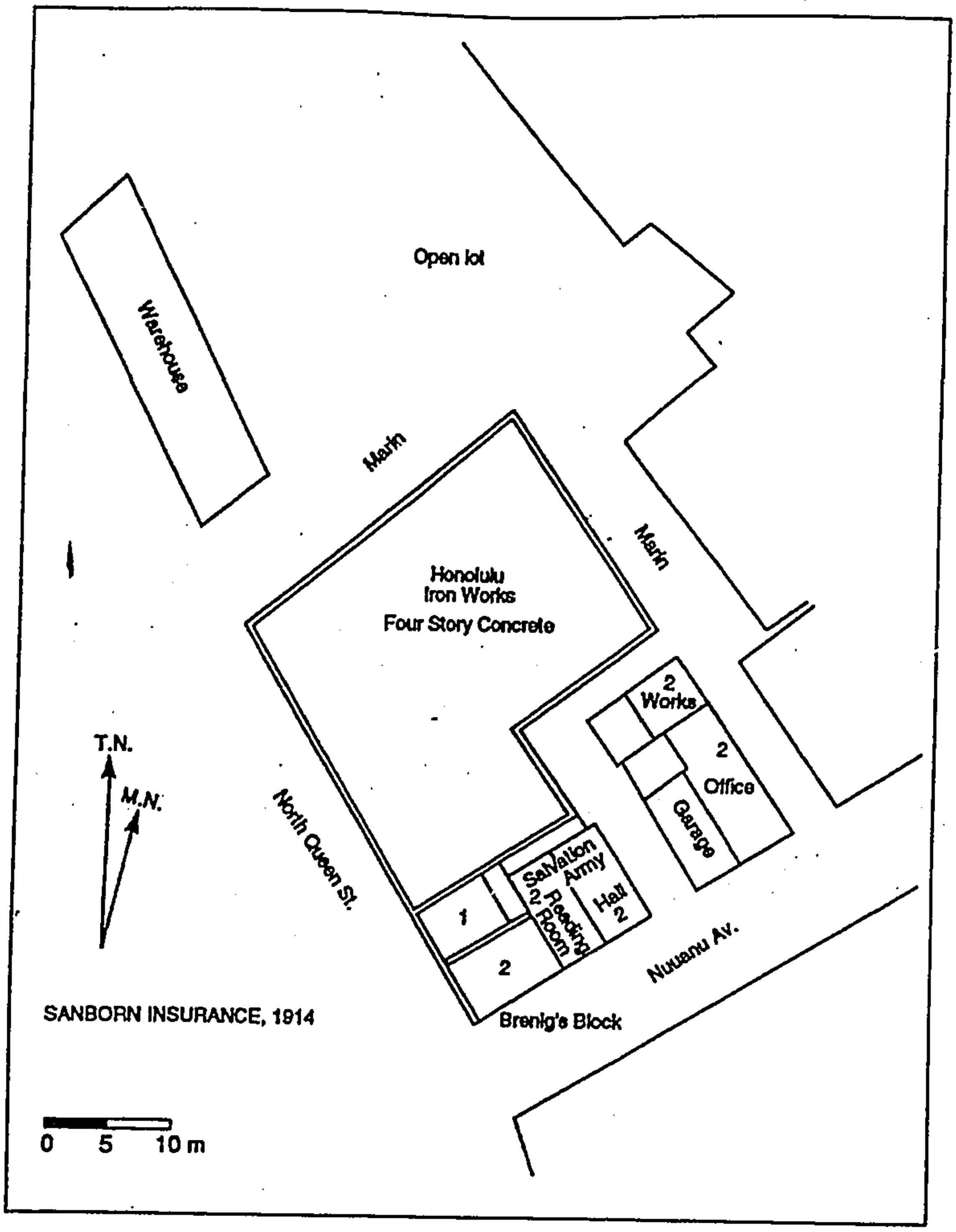

Figure 20. Sanborn Insurance Map of the present project area in 1914.

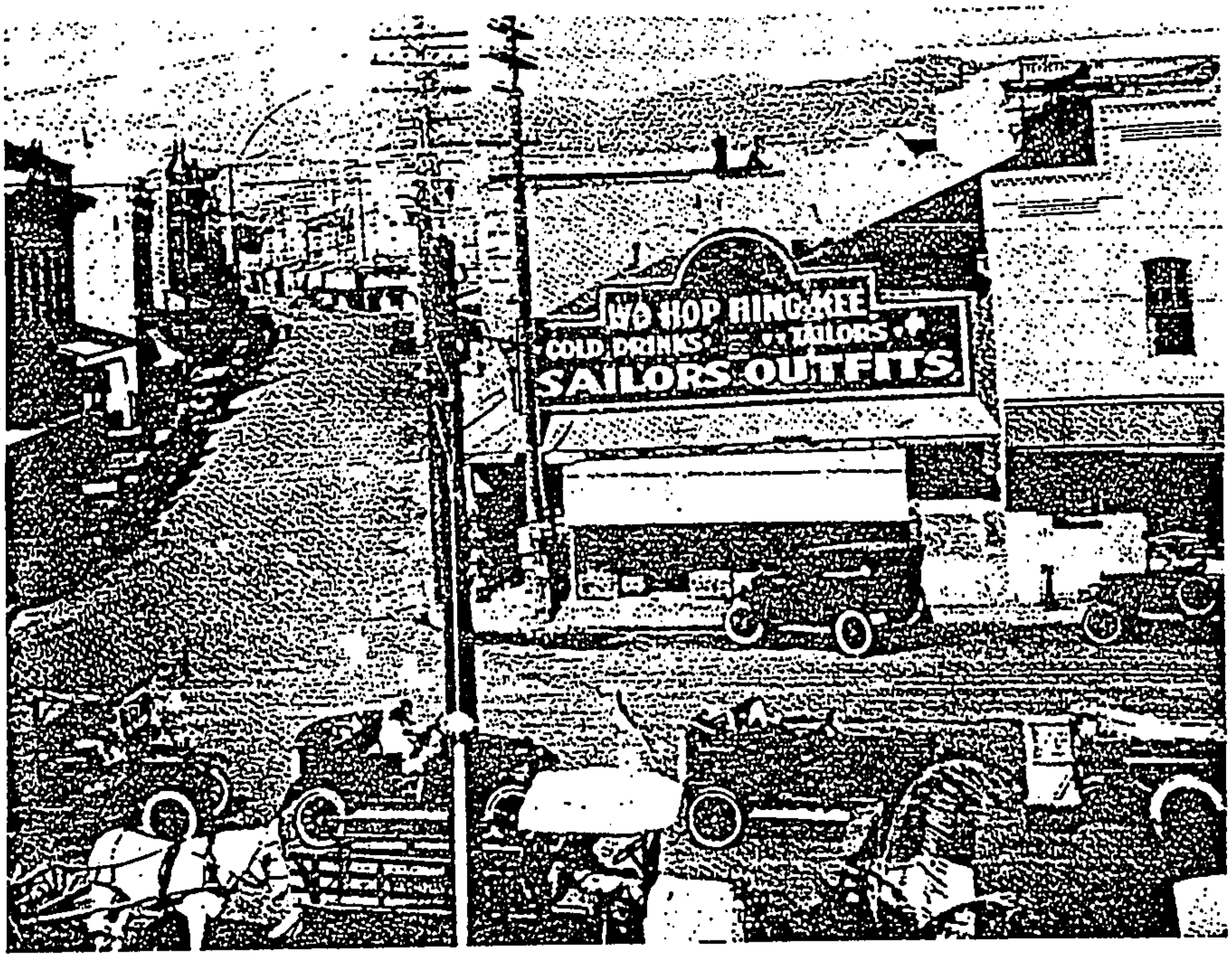

Figure 21. View of foot of Nuuanu Avenue ca. 1920. At the extreme left is the awning of Brenig's, followed by Salvation Army and Honolulu Iron works main office. Hawaiian Historical Society.

owner Angela Cunha was required to exchange a portion of her property on both sides of the old Marin Street to the Territory for this extension (Land Patent 4868, Liber 23:951). From 1927 onwards, the Waikīkī section of the present project area has been primarily a parking lot (Figure 22).

In the 1940s, the S. M. Damon estate leased the Waikīkī portion of the block to Honolulu Iron Works, which was then subleased to Standard Oil of California. On 31 July 1968, Honolulu Iron Works sold their interest on the present block to Bishop Corporation for $1,050,000 (Liber 6140:341), which was subsequently transferred to Bank of Hawai'i, the present owners, in 1972.

CONCLUSION

The present project area has been continuously occupied by humans through residence and commercial activity for several centuries. The parcel at 800 Nuuanu has seen a progression of cultural change from the days of the traditional Native Hawaiian fishing village, through the instant of European Contact in 1778, through the early settlement of King Kamehameha I and court nearby. Later, the present project area became the earliest and one of the most significant sites of Hawaiian industrialization. If the adjacent properties of Harbor Court, Nuuanu Court, and Marin Tower are any indication, 800 Nuuanu is highly important archaeologically. The potential for the discovery of pre- and post-Contact evidence of human occupation is great.

With the present documentation alone, it is difficult to precisely locate pre-Contact and early post-Contact Native Hawaiian habitation features on the property. However, ethnohistoric recollections, such as those from 'Ī'ī and Kamakau, tend to support the one-time possession and/or residence of the following *ali'i* on or in close proximity to the 800 Nuuanu block: 1) Kuihelani, 2) Keli'imaika'i, 3) Isaac Davis, 4) family of D. F. P. Marín, and 5) Kalanimōkū. It is almost certain that Kuihelani and Marín's daughter lived on the property. Most of Native Hawaiian *ali'i* and *ali'i haole* settled here when Kamehameha I brought his court to the village of Kou/Honolulu. The Native Hawaiian *ali'i* moved out of the neighborhood in the mid-1820s to be closer to the religious establishment of the Boston missionaries. Their places were taken by

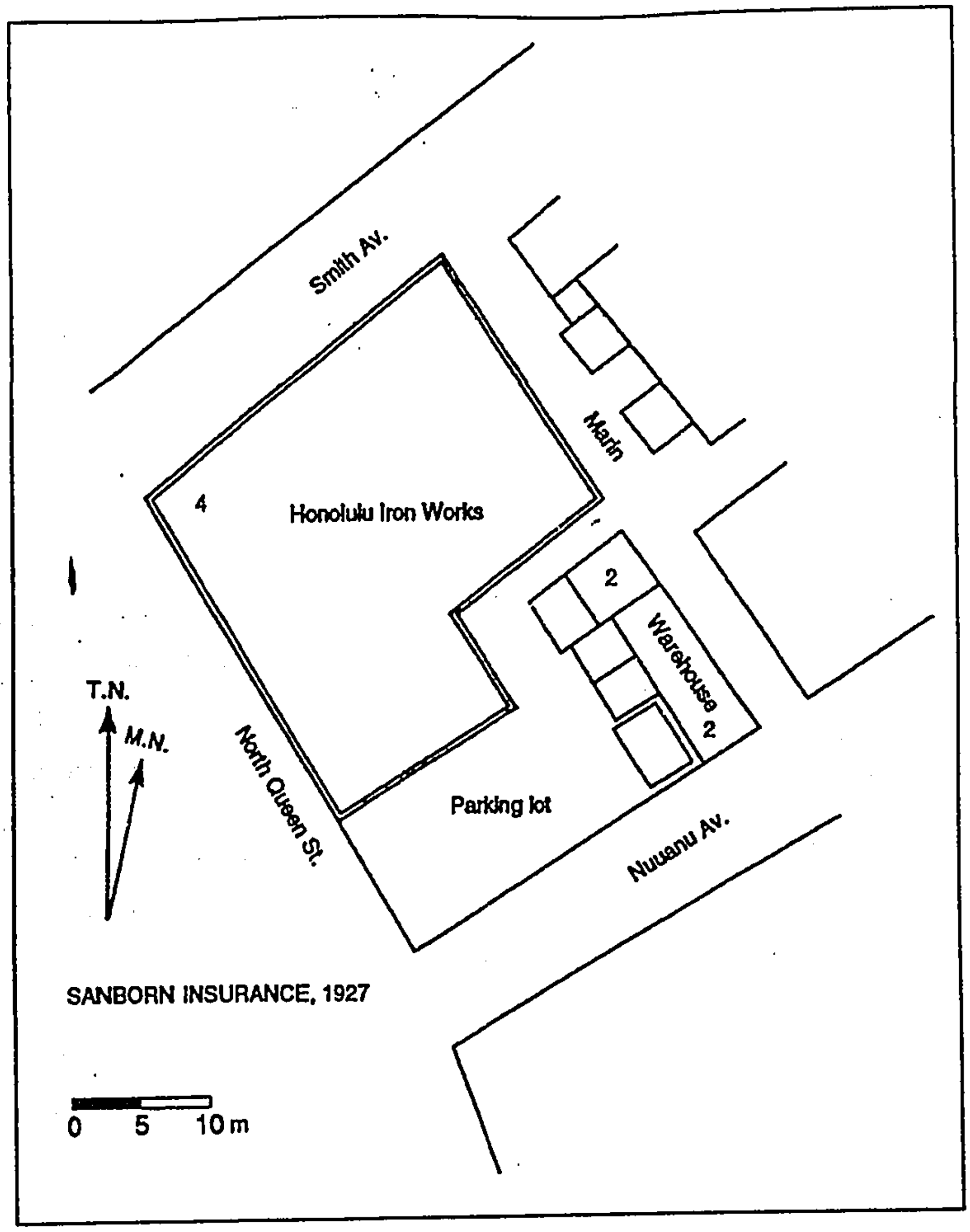

Figure 22. Sanborn Insurance Map of the present project area in 1927.

shipping agents and traders, shipwrights and coopers. By the 1850s, a steam powered flour mill located on the present property was converted into a machine shop and foundry, and Honolulu Iron Works was born. Probably no single aspect of the process of industrialization in the Hawaiian Islands was as important as the vanguard of technology brought forth from Honolulu Iron Works. Building ships to sugar mills, this company maintained a presence at 800 Nuuanu for over a century.

RECOMMENDATIONS

The land at 800 Nuuanu Avenue is associated with personages important to the history of Honolulu and to Hawai'i as a whole. Since an archaeological inventory survey with subsurface testing has not yet been done on this property, a proper assessment of the potential of the site to yield archaeological data or other information relative to the criteria of significance set forth in the National Register Criteria for Evaluating Historic Properties cannot be made. However, there are a few general observations that can and should be made:

1) there is a high probability that Hawaiian *ali'i* and foreign friends of King Kamehameha I lived on this property. This does not necessarily place the project area in the highest ranks of historical significance. 2) Similarly, although the foundry and Honolulu Iron Works are important in the economic history of Hawai'i, they are not necessarily more important than other businesses in Honolulu. The exception is that we know practically nothing archaeologically about the early period of industrialization in Hawai'i. 3) There does, however, exist a high potential for the discovery of features and artifacts relating to both pre- and post-Contact human habitation in old Honolulu at the present project area. As far as can be determined from documents, no substantial building foundation excavations of the block at 800 Nuuanu have ever occurred here. The Honolulu Iron Works building of 1914 seems to have been placed directly on the surface of the site, or even built up a bit, perhaps with rubble from older buildings. The concrete slab foundation of the building generally follows the slope of the land, which ranges from about 5.5 to 3.7 m (18 to 12 feet) above mean sea level (*mauka* to *makai*). It seems highly unlikely that the hard coral bedrock underlying much of Honolulu was

excavated for the construction of any extant or former building at the property, and it is known that Nimitz Highway itself is on fill. Therefore, the prospects of discovering relatively undisturbed cultural deposits from earlier periods of occupation underneath all sections of 800 Nuuanu block are high.

An examination of three geological test borings made at the present project area from a point on Marin Street to a point near the front of 800 Nuuanu on Nimitz (Dames and Moore 1991:pl. 3), indicates that a hard coral ledge at the site probably exists between 1 to 1.5 meters below surface. The coral was deposited during the Pleistocene, so most cultural deposits in Hawai'i lie above these sorts of formations. The soil above the coral at the present project area are described by Dames and Moore as a silty sand and gravel, which the geologists refer to as a fill. This would most likely be the "cultural layer" of particular interest to archaeologists. It does not appear that the 1914 Honolulu Iron Works building significantly extends below surface--perhaps less than one meter at its greatest extent.

Although on a different scale, the upper soil profile illustrated by Dames and Moore seems comparable to the soils at the adjacent parcel, Nuuanu Court (TMK:2-1-02:26), located immediately Waikīkī of the present lot on Nimitz Highway. These soils were described in an archaeological inventory survey by Dunn and Rosendahl (1993). At Nuuanu Court, the top of the coral bedrock ranged from 1.00 m below surface on the Nuuanu ('Ewa) side at BT-6 (backhoe trench) to 2.40 m below surface on the Bethel (Waikīkī) side at BT-2 (Dunn and Rosendahl 1993: A-7-A-12). Further Waikīkī, the coral ledge under Harbor Court tower was even deeper below the surface (Lebo, et al. 1994). On the 'Ewa side of 800 Nuuanu, the Marin Tower excavations revealed that the coral ledge was much nearer the surface than at the Bank of Hawai'i annex according to Dames and Moore's borings (Roger Blankfein, International Archaeological Research Institute, personal communication, 1994).

Examining the building sequences and historical planviews of the site, it seems probable that there may be large sections of the present parcel that are relatively undisturbed by past episodes of construction. There may be an overburden of fill, which would tend to preserve evidence of earlier human habitation beneath. In sum, the lack of deep excavations at the site, coupled with the proximate presence of historical personages, would most likely warrant archaeological inventory survey procedures to determine and test the extent of these possible cultural resources.

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APPENDIX H:

TRAFFIC IMPACT ANALYSIS

TRAFFIC IMPACT ANALYSIS REPORT

BANK OF HAWAII

ANNEX TOWER

IN HONOLULU, HAWAII

Prepared For

BANK OF HAWAII

AND

STRINGER TUSHER & ASSOCIATES, LTD.

Prepared By

BARTON-ASCHMAN ASSOCIATES, INC.
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October 3, 1995

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Executive Summary

Barton-Aschman Associates, Inc. has been retained to conduct a Traffic Impact Analysis Report (TIAR) for a proposed Bank of Hawaii Annex Tower in Honolulu. The proposed development is to consist of approximately 286,000 gross square feet of floor area. Parking is to be located in a six-level underground parking structure and will consist of 570 spaces. The proposed Annex Tower is located on the mauka side of Nimitz Highway between Smith Street and Nuuanu Avenue.

The existing building on the site will be demolished.

The proposed office tower will generate 495 trips during the morning peak hour and 471 during the afternoon peak hour. A summary of the trips generated on a typical day is as follows:

AM Peak Hour			PM Peak Hour		
In	Out	Total	In	Out	Total
431	64	495	75	396	471

Traffic generated by the project will have impacts on the surrounding roadway system. However, in no case does the level-of-service fall below 'D', which is generally accepted an a minimum level-of-service for peak hour conditions in urban areas. Therefore, no mitigation measures are required.

1. INTRODUCTION

Barton-Aschman Associates, Inc. has been retained to conduct a Traffic Impact Analysis Report (TIAR) for a proposed Bank of Hawaii Annex Tower in Honolulu. The proposed development is to consist of approximately 286,000 gross square feet of floor area. Parking is to be located in a six-level underground parking structure and will consist of 570 spaces. The proposed Annex Tower is located on the mauka side of Nimitz Highway between Smith Street and Nuuanu Avenue.

The following report has been prepared to describe the traffic characteristics of the project and likely impacts to the adjacent roadway network. This introductory chapter discusses the location of the project, the proposed development, and the study methodology.

Project Location and Description

The location of the proposed project is shown on Figure 1. The project site is bounded by Nimitz Highway to the south, Smith Street to the west, Marin Street to the north, and Nuuanu Avenue to the east,

As previously noted, the project is to consist of 286,000 gross square feet of floor area. Parking is to be located in an underground parking structure containing 570 spaces. The Annex Tower will be above the parking structure.

Access and egress to the parking structure will be located along Smith Street.

Figure 1

Location Map

Study Methodology

In order to conduct this traffic study, a number of tasks were performed, which are discussed in the following paragraphs.

1. Data Collection

The data used in this study were collected during the previous traffic studies for the Waterfront at Aloha Tower prepared by Barton-Aschman Associates, Inc. in 1993 and 1994 and supplemented with traffic counts conducted for this study to verify the traffic volumes. These counts were conducted during June 1994.

2. Analysis of Existing Traffic Conditions

Using the data collected, existing traffic conditions in the vicinity of the project were determined. Traffic conditions can be described by the level-of-service (LOS) at each study intersection.

The planning method described in the 1985 Highway Capacity Manual (HCM) was used to determine the level-of-service at the intersections. A comparative analysis is presented for each scenario (i.e. existing and future conditions without and with the project) using this method. A more detailed explanation of the methodology, the level-of-service concept and the results are presented in Chapter 2.

3. Determination of 1999 Cumulative Traffic Projections

The year 1999 was used as the design year. This does not necessarily represent the project completion date. It represents occupancy for purposes of conducting the impact analysis. A more detailed description of this process and the resulting cumulative traffic projections are presented in Chapter 3.

4. Analysis of Project-Related Traffic Impacts

The next step in the traffic analysis of the project was to estimate the daily and peak-hour (morning and afternoon) traffic that would be generated by the proposed development. This was done using standard trip generation rates.

These trips were distributed based on the origin of the visitors and employee and the available approach and departure routes. The project-related traffic was then superimposed on 1999 cumulative traffic volumes at the subject intersections. The HCM method was then used again to conduct a level-of-service analysis for this condition which was compared to 1999 cumulative conditions to determine the impacts of this project.. The 1999 cumulative traffic projections are presented in Chapter 4. The analysis of the project-related impacts and the conclusions of the analyses are presented in Chapter 5.

2. ANALYSIS OF EXISTING CONDITIONS

This chapter presents the existing traffic conditions and volumes on the roadways adjacent to the proposed project. The level-of-service concept and the results of the level-of-service analysis for existing conditions are also presented. The purpose of this analysis is to establish the base conditions for the determination of the impacts of the project which are described in a subsequent chapter.

The study intersections were selected based upon the access routes to and from the project. The intersections analyzed and existing lane configurations on the adjacent street network are shown on Figure 2.

Existing Intersection Controls

The intersections along Nimitz Highway and King Street are controlled by traffic signals. The signals are typically two phase. Pedestrian crossing signals are also provided.

There is no right-of-way control at the intersection of Smith Street at Marin Street as the only traffic movements allowed are right turns from Smith Street into Marin Street and mauka-bound through traffic. The intersection of Marin Street at Nuuanu Avenue is 'STOP" sign controlled. Traffic along Marin Street yields to traffic along Nuuanu Avenue. Traffic may turn right onto Nuuanu Avenue or proceed toward Diamond Head along Merchant Street.

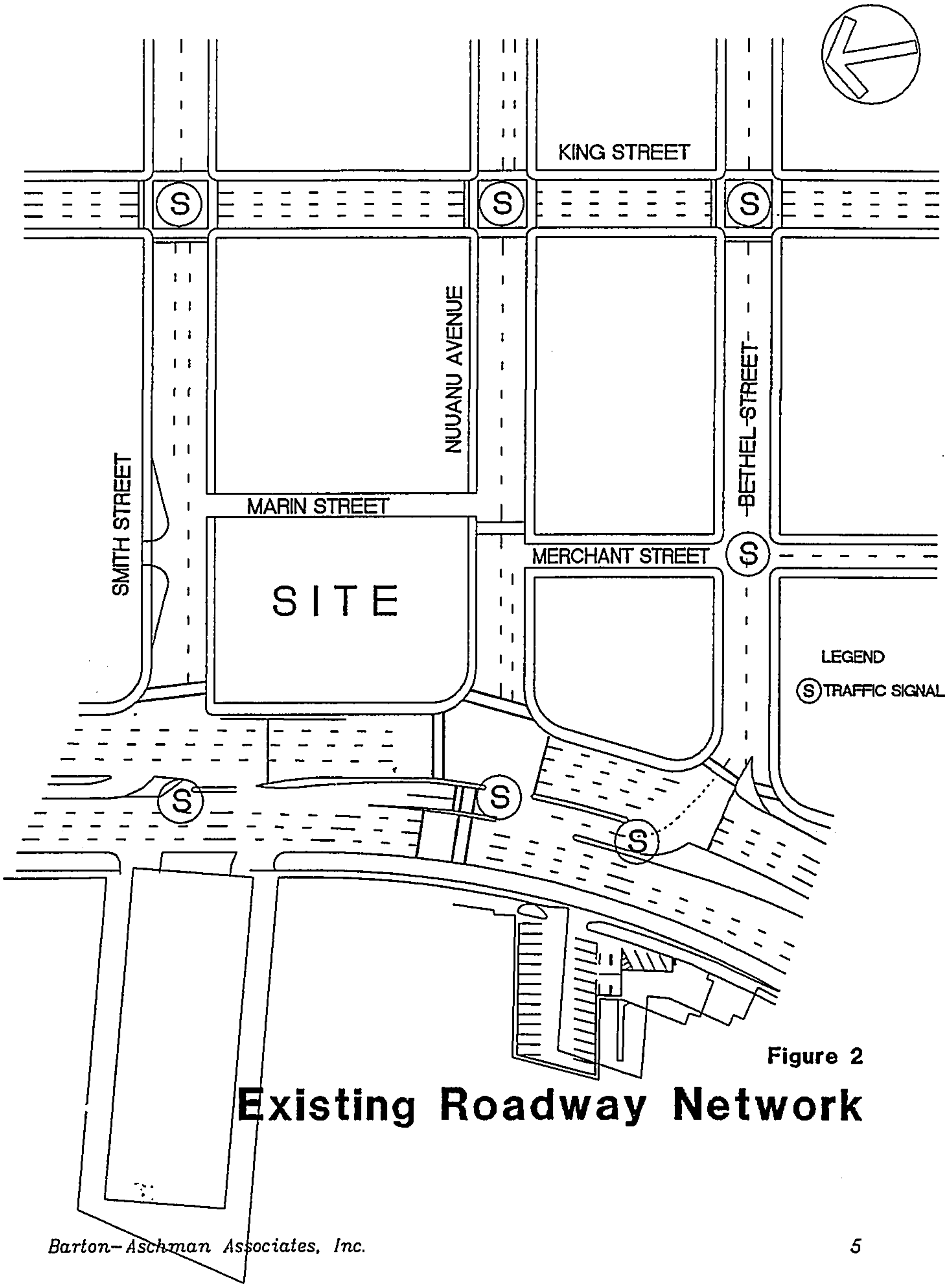

Figure 2

Existing Roadway Network

Existing Peak Hour Traffic Volumes

The existing weekday morning and afternoon traffic volumes were obtained from the previous traffic studies completed in the area by Barton-Aschman Associates in August 1990 and March 1993. Traffic counts completed along Nimitz Highway indicate that 1993 hourly traffic volumes are less than 1990 hourly traffic volumes. Use of the previous traffic counts was determined appropriate for use in this study since there have been no significant new developments along the adjacent section of Nimitz Highway since the 1990 counts were conducted.

Traffic counts were conducted in June 1994 for the intersections along King Street. The results of these updated counts were used to evaluate traffic conditions along King Street.

The AM and PM peak hour traffic volumes used in the following analyses are shown in Figure 3. It should be noted that the existing traffic volumes shown do not include any traffic from Harbor Court since it was unoccupied at the time of the traffic counts. Traffic associated with Harbor Court was estimated and included with traffic generated by related projects and is discussed in Chapter 3 of this report.

Level-of-Service Concept

Signalized Intersections

The planning method described in the 1985 Highway Capacity Manual (HCM) was used to analyze the operating efficiency of the signalized intersections adjacent to the study site. This method involves the calculation of a volume-to-capacity (V/C) ratio which is related to a level-of-service. A maximum intersection capacity based on the number of phases was used for the V/C calculations.

"Level-of-Service" is a term which denotes any of an infinite number of combinations of traffic operating conditions that may occur on a given lane or roadway when it is subjected to various traffic volumes. Level-of-service (LOS) is a qualitative measure of the effect of a number of factors which include:

- Space,
- Speed,
- Travel Time,
- Traffic Interruptions,
- Freedom to Maneuver,
- Safety
- Driving Comfort, and
- Convenience

There are six levels-of-service, A through F, which relate to the driving conditions from best to worst, respectively. The characteristics of traffic operations for each level-of-service are summarized in Table 2. In general, LOS A represents free-flow conditions with no congestion.

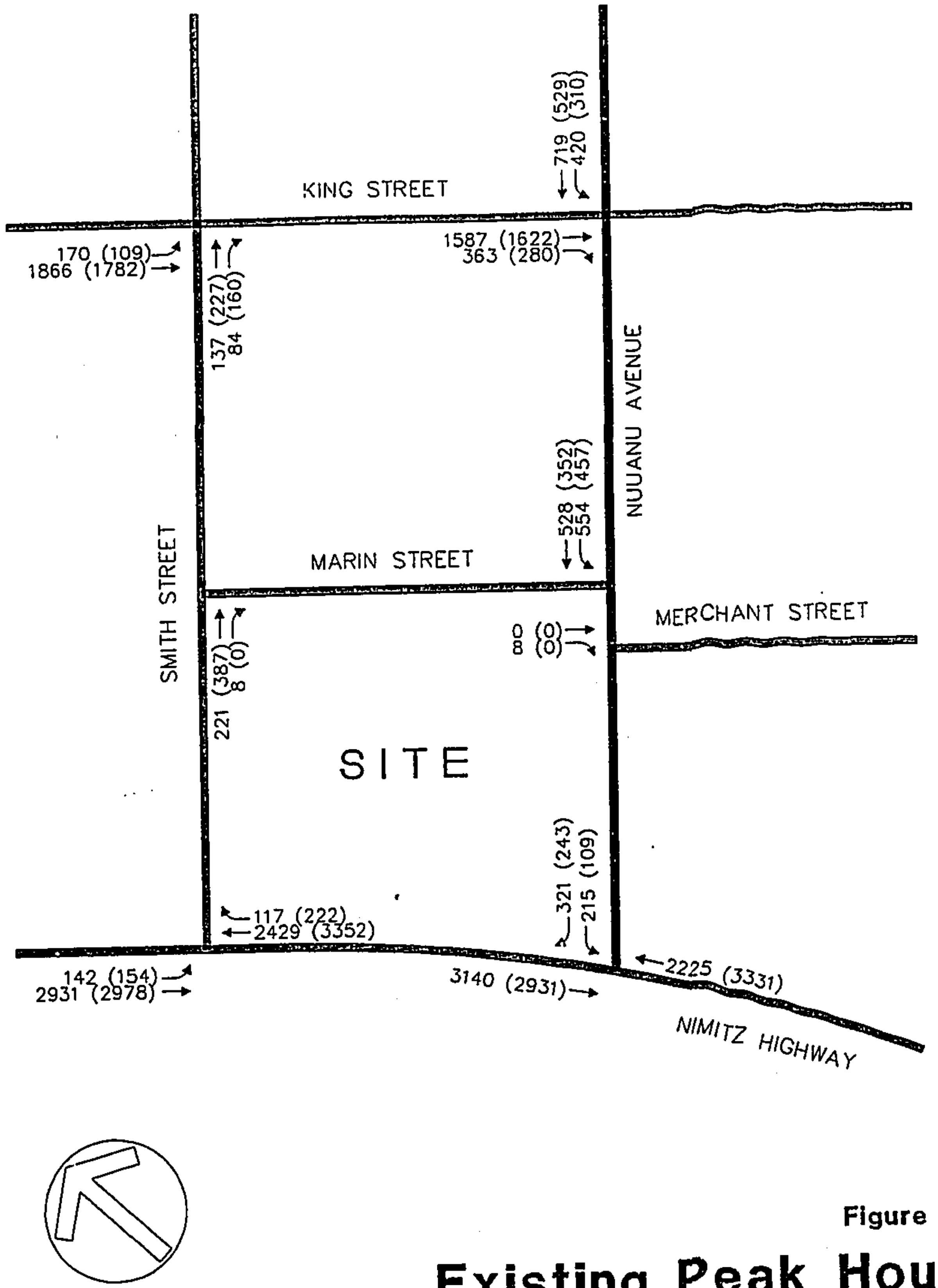

Figure 3

Existing Peak Hour Traffic Volumes

LOS F, on the other hand, represents severe congestion with stop-and-go conditions. Level-of-service D is typically considered acceptable for peak hour conditions in urban areas.

Table 1 Level-of-Service Definitions for Signalized Intersections[1]

Level of Service	Interpretation	Volume-to-Capacity Ratio[2]	Stopped Delay (Seconds)
A,B	Uncongested operations; all vehicles clear in a single cycle.	0.000-0.700	<15.0
C	Light congestion; occasional backups on critical approaches	0.701-0.800	15.1-25.0
D	Congestion on critical approaches but intersection functional. Vehicles must wait through more than one cycle during short periods. No long standing lines formed.	0.801-0.900	25.1-40.0
E	Severe congestion with some standing lines on critical approaches. Blockage of intersection may occur if signal does not provide protected turning movements.	0.901-1.000	40.1-60.0
F	Total breakdown with stop-and-go operation	>1.001	>60.0

Notes:
(1) Source: Highway Capacity Manual, 1985.
(2) This is the ratio of the calculated critical volume to Level-of-Service E Capacity.

Corresponding to each level-of-service shown in the table is a volume/capacity ratio. This is the ratio of either existing or projected traffic volumes to the capacity of the intersection. Capacity is defined as the maximum number of vehicles that can be accommodated by the roadway during a specified period of time. The capacity of a particular roadway is dependent upon its physical characteristics such as the number of lanes, the operational characteristics of the roadway (one-way, two-way, turn prohibitions, bus stops, etc.), the type of traffic using the roadway (trucks, buses, etc.) and turning movements.

Unsignalized Intersections

Like signalized intersections, the operating conditions of intersections controlled by stop signs can be classified by a level-of-service from A to F. However, the method for determining level-of-service for unsignalized intersections is based on the use of gaps in traffic on the major street by vehicles crossing or turning through that stream. Specifically, the capacity of the controlled legs of an intersection is based on two factors: 1) the distribution of gaps in the major street traffic stream, and 2) driver judgement in selecting gaps through which to execute a desired maneuver. The criteria for level-of-service at an unsignalized intersection is therefore based on delay and the potential, or reserve capacity, of each turning movement. Table 3 summarizes the definitions for level-of-service and the corresponding reserve capacity. A subsequent calculation to determine an overall LOS was made, and these results are presented in tables to summarize traffic conditions using parameters similar to those used for signalized intersections.

Table 2 Level-of-Service Definitions for Unsignalized Intersections[1]

Level-of-Service	Expected Delay to Minor Street Traffic	Reserve Capacity[3]
A	Little of no delay	>400
B	Short traffic delays	300-399
C	Average traffic delays	200-299
D	Long traffic delays	100-199
E	Very long traffic delays	0-99
F	See note (2) below	

Notes:
(1) Source: Highway Capacity Manual, 1985.
(2) When demand volume exceeds the capacity of the lane, extreme delays will be encountered with queueing which may cause severe congestion affecting other traffic movements in the intersection. This condition usually warrants improvement of the intersection.
(3) Reserve capacity is defined as "the capacity of a lane at an unsignalized intersection minus the demand for that lane."

Existing Level-of-Service Analysis

The intersections were analyzed using the signalized level-of-service (LOS) planning method. Results of these analyses are shown in Table 4. The calculated level-of-service were confirmed by field observations.

Table 3 Existing Level-of-Service Analysis[3][5]

Intersection	AM Peak Hour		PM Peak Hour	
	V/C[1]	LoS[2]	V/C[1]	LoS[2]
Nimitz Hwy. at Smith St.	0.480	A	0.558	A
Nimitz Hwy. at Nuuanu Av.	0.672	B	0.657	B
Marin St. at Smith St.	NA[4]	NA[4]	NA[4]	NA[4]
Marin St. at Nuuanu Av.	NA[4]	NA[4]	NA[4]	NA[4]
King St. at Smith St.	0.387	A	0.416	A
King St. at Nuuanu Av.	0.722	C	0.517	A

NOTES:
(1) V/C = Volume-to-Capacity Ratio
(2) LoS = Level-of-Service
(3) Level-of-Service calculated using planning method described in Highway Capacity Manual.
(4) NA = Not Applicable
(5) Levels-of-Service shown does not include traffic generated by Harbor Court. See Chapter 3 of this report.

As shown in the table, all of the subject intersection operated at Level-of-Service C or better, which indicates acceptable operating conditions. The high levels-of-service along Nimitz Highway are misleading because the traffic is backing up from the adjacent intersections at Bishop Street and Alakea Street. Under free flow conditions, these intersections would carry more traffic and the levels-of-service would be lower.

The level-of-service calculation was not applicable to the intersection of Smith Street at Marin Street since there is no merging of traffic. The only traffic movements allowed are the through movement along Smith Street and the right turn from Smith Street to Marin Street.

The traffic volumes for Marin Street at Nuuanu Avenue indicated only right turn movements were occurring. Since there is no westbound traffic from Merchant Street to Nuuanu Avenue (Merchant Street is one-way eastbound) and there is no northbound traffic along Nuuanu Avenue (Nuuanu Avenue is one-way southbound), the level-of-service analysis yielded inconclusive results.

Existing Site-Related Traffic

Since the existing building on the site will be demolished, traffic generated by the existing development has been estimated to determine the net increase in traffic expected from the project. The site plan of the existing development is shown as Figure 4.

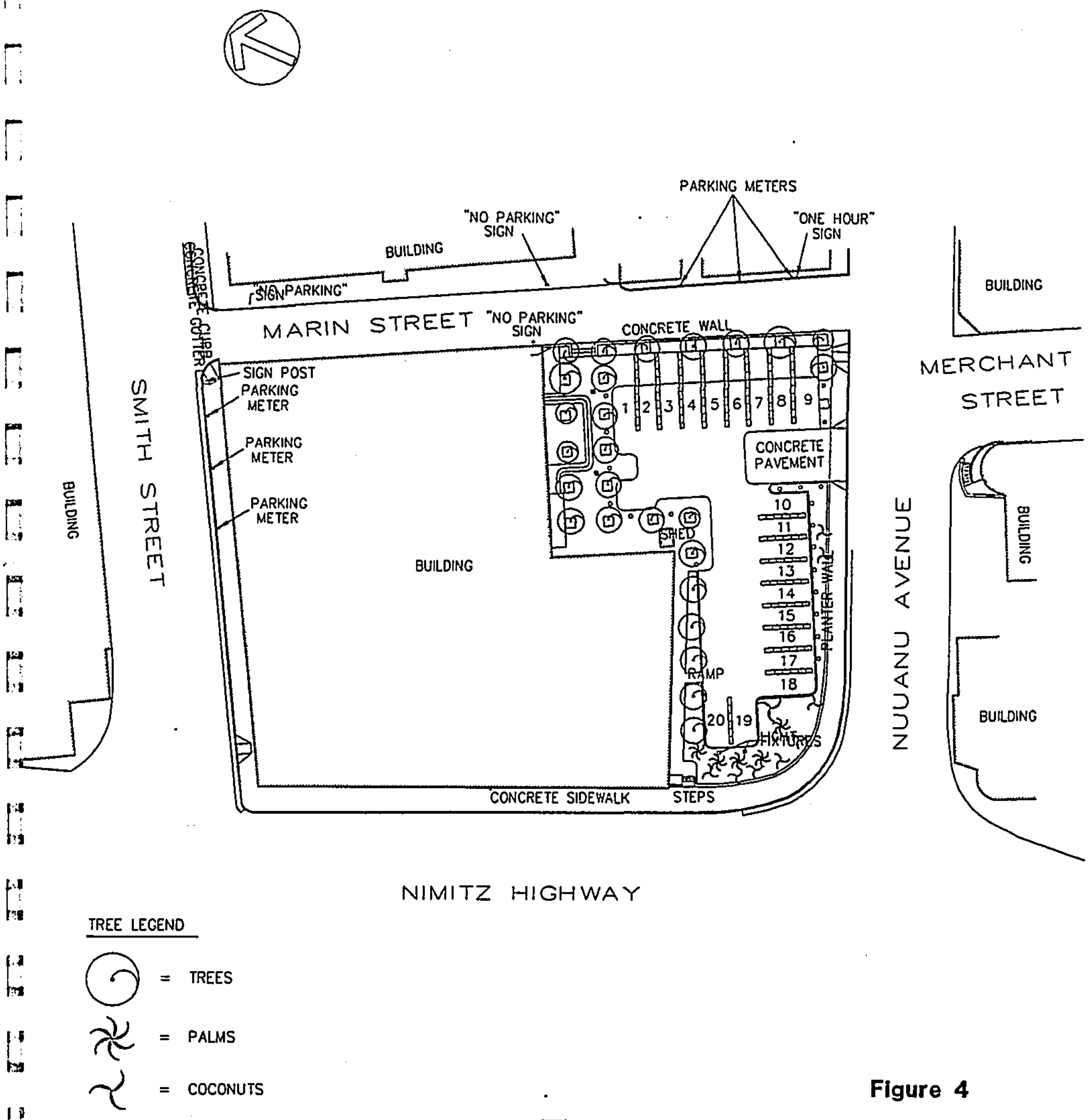

Figure 4

Existing Site Plan

To determine the existing site-related traffic characteristics, the number of trips that are generated by the site was estimated based on approximately 500 employees using standard trip generation rates provided by the Institute of Transportation Engineers. The resulting estimate of trips is summarized in Table 4. As shown, it is estimated that the existing development generates 255 trips during the morning peak hour and 242 trips during the afternoon peak hour.

Parking on-site is restricted to visitors only, employees that drive to work must park at an off-site location. Therefore, only a small portion of the trips generated by the existing development actually have origins or destinations on the study site.

Table 4 Trip Generation Analysis for Existing Site

Number of Employees	500		
Period	Equation	Trips	
Weekday Total	Ln(T) = 0.87 Ln(E) + 2.06	1749	
AM Peak Hour Total	Ln(T) = 0.98 Ln(E)-0.55	255	
AM In	87%		222
AM Out	13%		33
PM Peak Hour Total	Ln(T) = 0.98 Ln(E)-0.60	242	
PM In	16%		39
PM Out	84%		203

Notes:
T = Trips
E = Number of Employees

The traffic that would use an off-site location and the traffic that would use the existing parking lot exit was estimated using traffic approach and departure information developed as part of the traffic study for several projects in Honolulu (Aloha Tower, Pacific Nations, and One Ali'i Place). The results of this calculation are presented graphically as Figure 5. This figure presents the morning and afternoon peak hour traffic volumes at the study intersections generated by the existing site development. The trips shown in this figure will be credited against the trips assigned to the various traffic movements to estimate the net increase in traffic and thus the traffic impacts of the proposed project. These calculation will be discussed in more detail in Chapter 4.

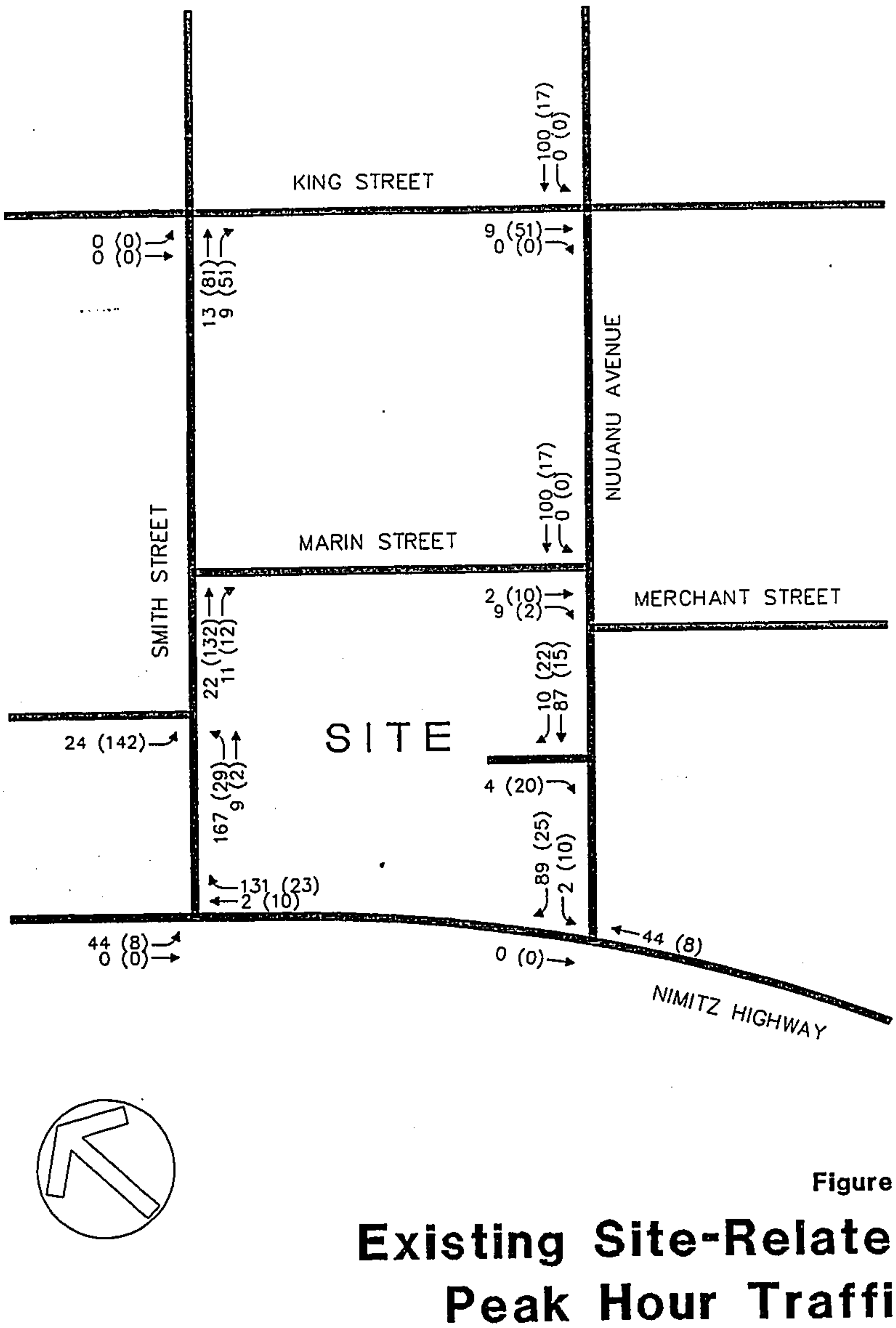

Figure 5

Existing Site-Related Peak Hour Traffic

3. PROJECTED CUMULATIVE TRAFFIC CONDITIONS

The purpose of this chapter is to discuss the assumptions and data used to estimate 1999 cumulative traffic conditions. Cumulative traffic conditions are defined as the traffic conditions resulting from background growth and related projects.

Future traffic growth consist of two components. The first is ambient background growth that is a result of regional growth and cannot be attributed to a specific project. This growth rate is typically estimated by analyzing historical counts taken over a period of several years. The second component is estimated traffic that will be generated by other development projects in the vicinity of the proposed project.

Background Traffic Growth Rate

To determine the background growth rate of traffic in the study area, historical traffic counts from 1985 through 1992 for Nimitz Highway at a nearby location were obtained from Hawaii Department of Transportation (HDOT). These counts were conducted between Bishop Street and Fort Street, which is three blocks east of the site.

These counts are summarized in Table 5. As shown the average annual growth rate was calculated to be 3.68 per cent per year over the past ten years. This average annual growth rate was used to estimate future background traffic growth. However, it should be noted that peak hour traffic counts at the intersection of Nimitz Highway at Bishop Street in 1989 and 1992 indicated that there had actually been a slight reduction in peak hour traffic along Nimitz Highway. It is believed that this is only a short term effect resulting from the demolition of

City-owned parking structures between Smith Street and Maunakea and at the intersection of Queen Street at Bethel Street. The long term trend is expected to continue at the average historical rate.

Table 5 Historical Traffic Volumes Along Nimitz Highway[1][2]

Year	24-Hour Traffic Volume	Percent Growth
1985	61,203	NA
1987	59,642	-1.28
1989	67,294	6.41
1990	68,073	1.16
1991	72,103	5.92
1992	76,965	6.74
Average (1985-1992)	NA	3.68

Notes:
(1) Source: Hawaii Department of Transportation Traffic Counts
(2) Location of the counts are along Nimitz Highway between Bishop Street and Fort Street.

Related Project Generated Traffic

The second component in estimating cumulative traffic volumes is the traffic generated by other proposed projects in the vicinity. Related projects are defined as those projects that are under construction or have been approved for construction by the City and would significantly impact traffic in the study area.

It was determined that two projects would significantly affect traffic at the study intersections. The projects are the Waterfront at Aloha Tower and Harbor Court.

The traffic study prepared by Barton-Aschman Associates, Inc. was used to determine the number of Waterfront generated trips that would affect traffic at the study intersections. Peak hour trips generated by Harbor Court were estimated using trip generation rates and/or equations presented in Trip Generation, Fifth Edition. This is the standard reference for trip generation analyses.

A summary of the trips generated by each project is summarized in Table 6

Table 6 Summary of Trip Generation of Related Project[1]

Project	Weekday Total	AM Peak Hour			PM Peak Hour		
		Total	In	Out	Total	In	Out
Harbor Court	3390	585	509	76	549	88	461
Aloha Tower (Phase 1)	7015	219	153	66	1196	598	598
TOTAL	10405	804	662	142	1745	686	1059

Notes:
(1) Source: Traffic studies prepared for The Waterfront at Aloha Tower by Barton-Aschman Associates, Inc.

1999 Cumulative Traffic Volumes

Estimated 1999 cumulative traffic volumes are calculated by applying the background growth rate to existing traffic volumes and adding trips generated by related projects. The resulting 1999 cumulative peak hour traffic projections are shown in Figure 6.

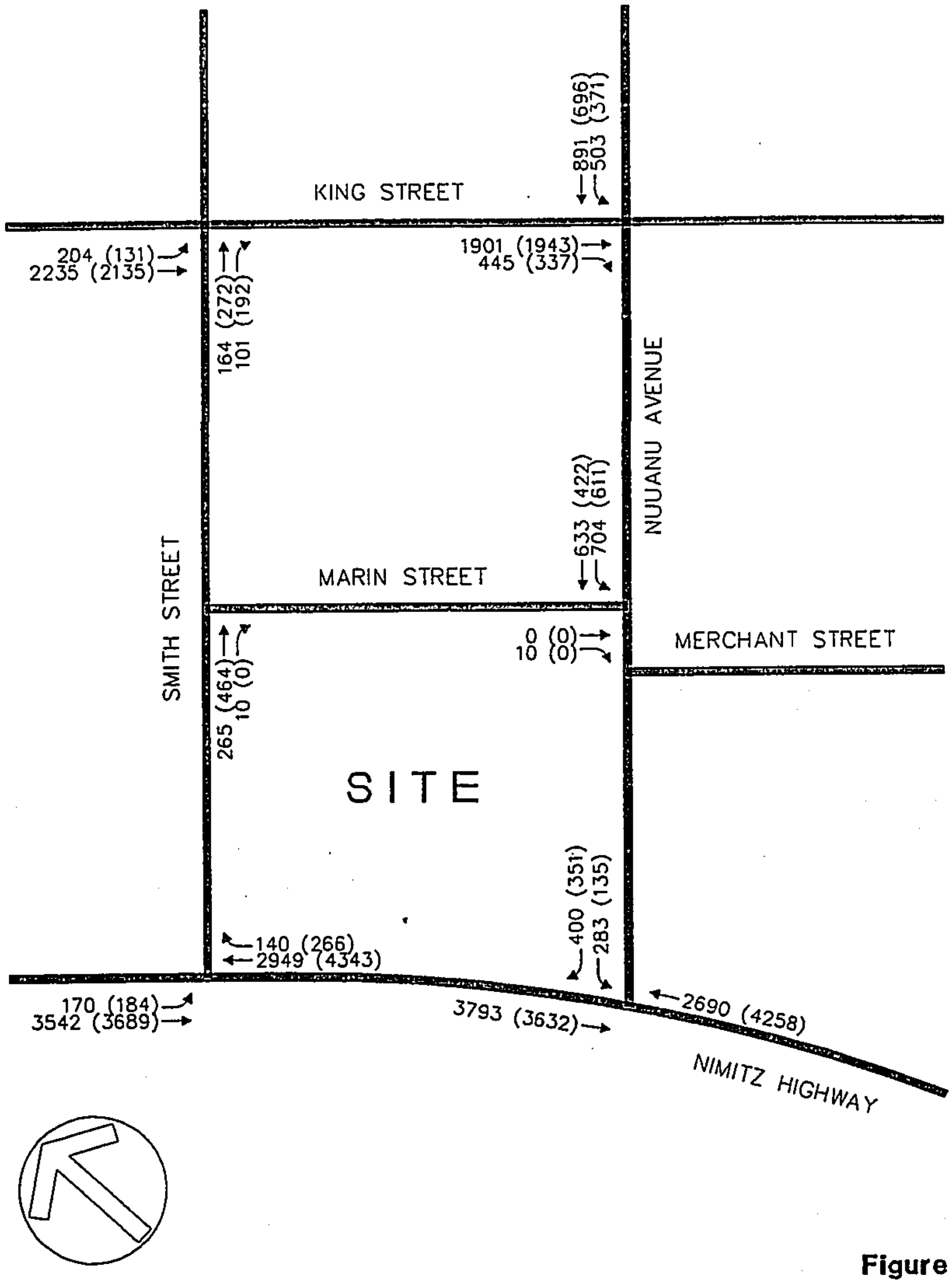

Figure 6

Cumulative Peak Hour Traffic Volumes Without Project

4. PROJECT-RELATED TRAFFIC CONDITIONS

This chapter discusses the methodology used to identify the traffic-related impacts of the proposed project. Generally, the process involves the determination of weekday and peak-hour trips that would be generated by the proposed project, distribution and assignment of these trips on the approach and departure routes, and finally, determination of the levels-of-service at affected intersections subsequent to implementation of the project.

Trip Generation

Future traffic volumes generated by the project were determined using trip generation equations contained in Trip Generation, Fifth Edition, prepared by the Institute of Transportation Engineers. The trip generation analysis and the resulting daily and peak hour volumes are summarized in Table 7.

Trip Distribution

The project-related trips were distributed based on the future distribution of population as shown in the HALI 2010 socio-economic data and the anticipated approach routes to the project site. This information was obtained from previously conducted traffic studies in the area, which have been generally accepted by the reviewing agencies.

The approach and departure distributions are shown in Figure 7.

Table 7 Trips Generated By Proposed Development

Gross Floor Area in Square Feet	286,000		
Period	Equation	Trips	
Weekday Total	Ln(T) = 0.75Ln(A) + 3.77	3017	
AM Peak Hour Total	Ln(T) = 0.86Ln(A) + 1.34	495	
AM In	87%		431
AM Out	13%		64
PM Peak Hour Total	Ln(T) = 0.83Ln(A) + 1.46	471	
PM In	16%		75
PM Out	84%		396

Notes:
T = Trips
A = Square Feet of Gross Floor Area

Trip Assignment

Using the trip generation and trip distribution previously discussed, project-related traffic was assigned to the various traffic movements at the intersections studied. The assignment of total project related vehicles is presented as Figure 8.

1999 Cumulative Plus Project Peak Hour Traffic Volumes

Future traffic volumes with the project were determined by superimposing the project-generated traffic on the 1999 cumulative traffic volumes presented in Chapter 3. The resulting traffic volumes are shown for the peak hours on Figure 9.

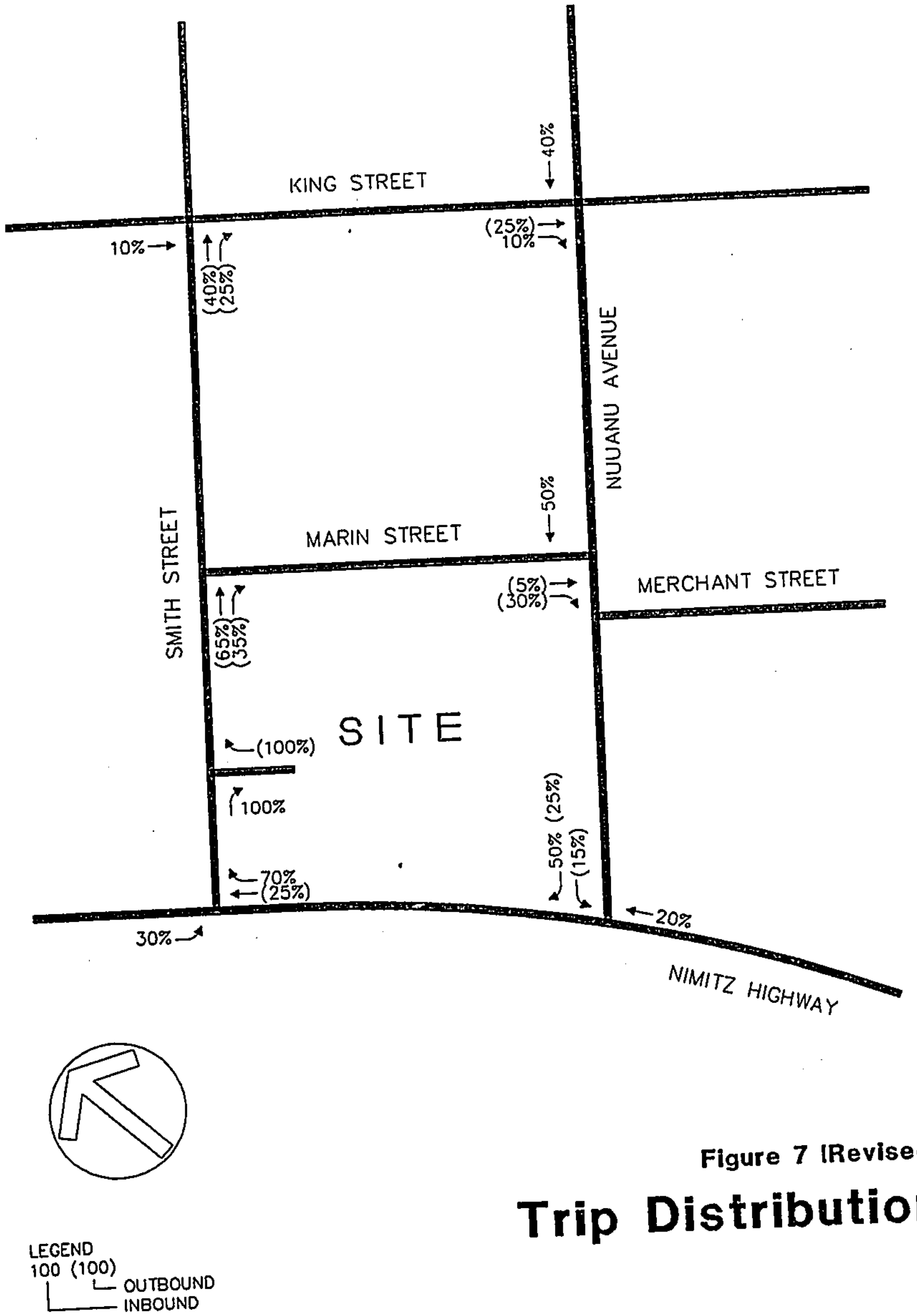

Figure 7 [Revised]

Trip Distribution

Barton-Aschman Associates, Inc.

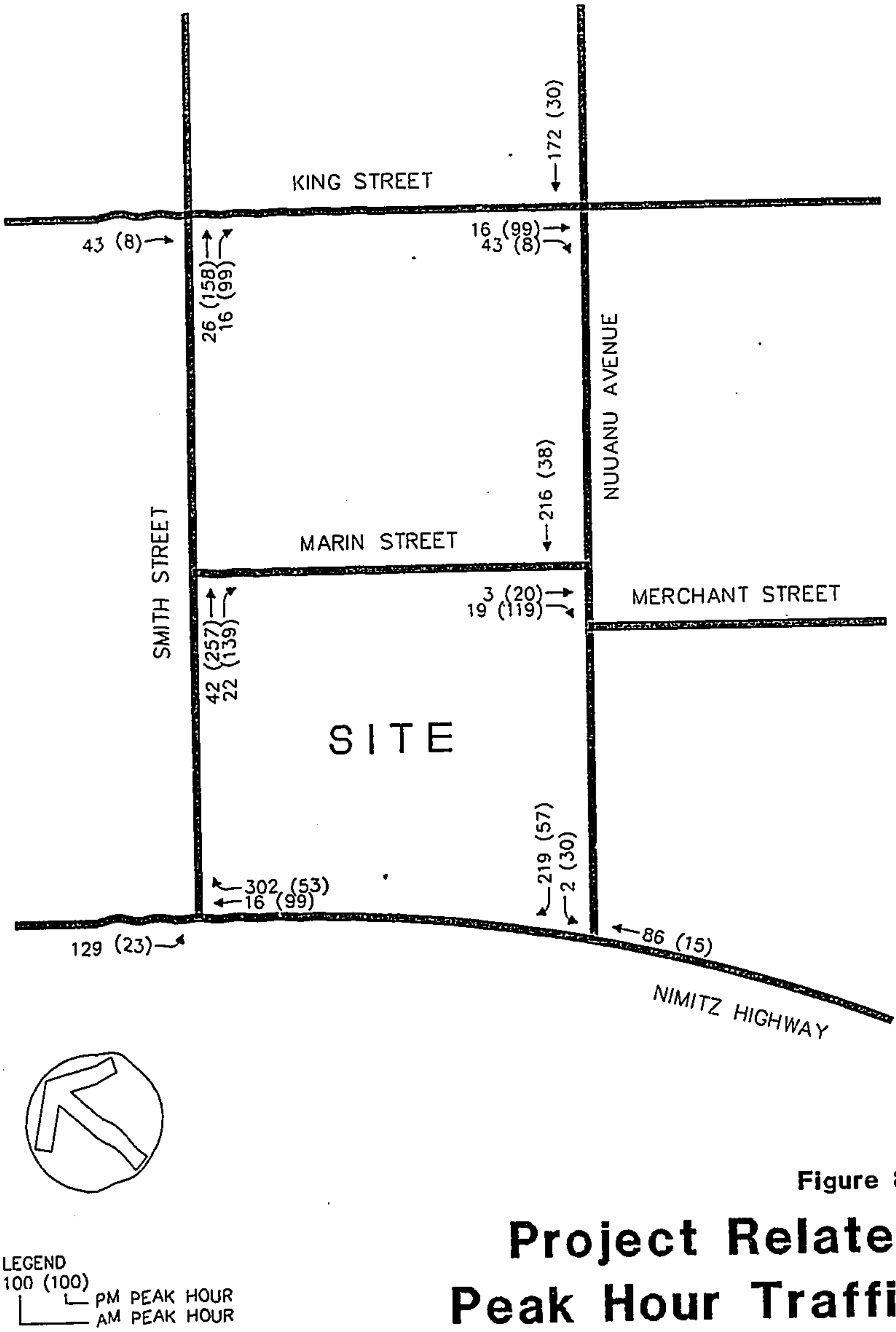

Figure 8

Project Related Peak Hour Traffic

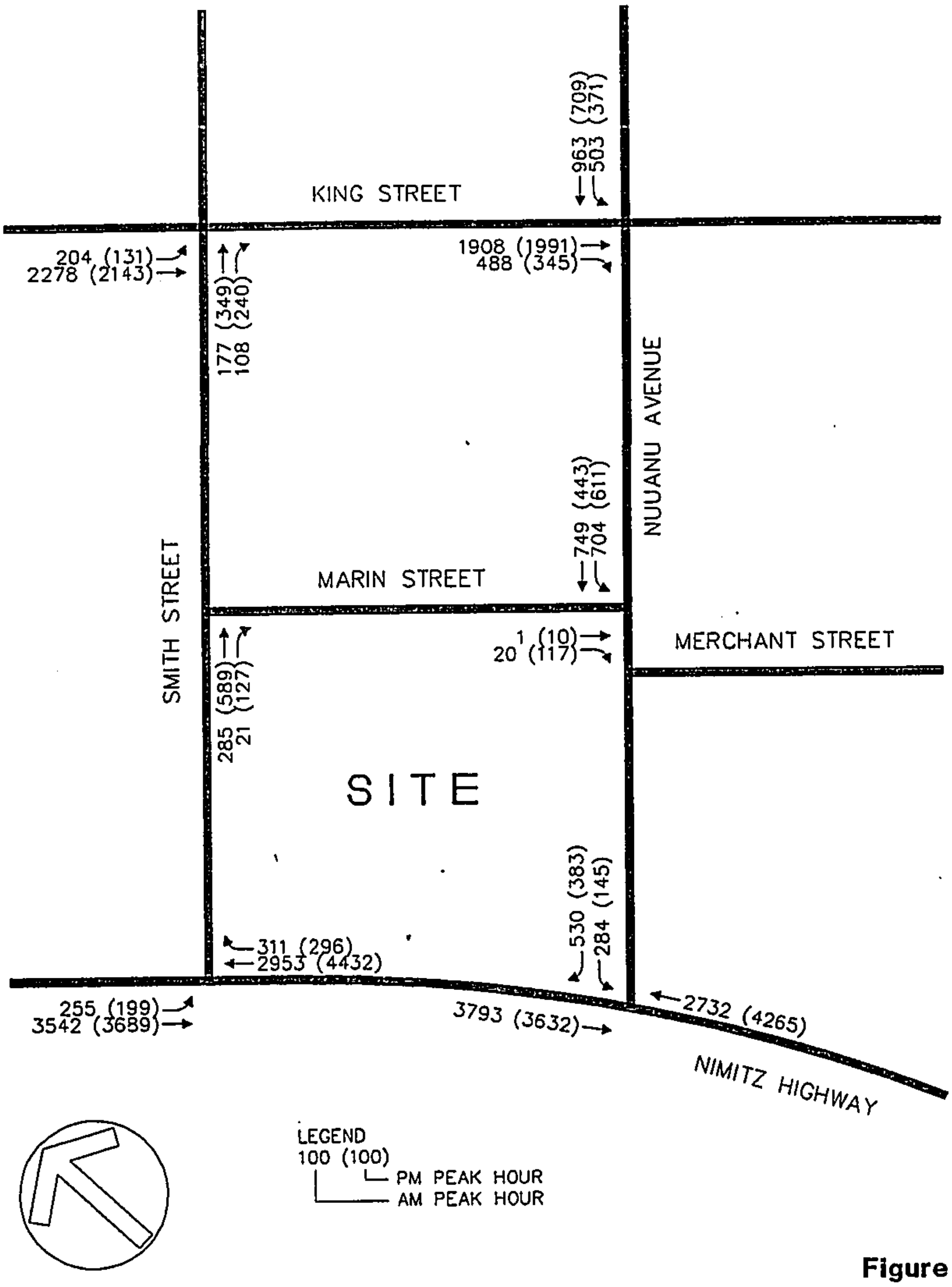

Figure 9

1999 Cumulative Plus Project Peak Hour Traffic

5. CONCLUSIONS AND RECOMMENDATIONS

The purpose of this chapter is to present the results of the level-of-service analysis, which identifies the project-related impacts. In addition, any mitigation measures necessary and feasible are identified and other access, egress and circulation issues are discussed.

Definition of Significant Impacts

Criteria for determining if a project has a significant traffic impact for which mitigation measures must be investigated have been established based on traffic impact study guidelines used in various other cities. Generally, the criteria are as follows: if the level-of-service (LOS) without the project is E or F and the volume/capacity (V/C) ratio changes less than 0.030, the project's traffic impacts are considered insignificant. However, if the V/C ratio change is greater than 0.030, then mitigation measures which will reduce the V/C ratio change to less than 0.030 must be identified. If the LOS with the project is D or better, then no mitigation measures need to be identified.

The above criteria has been used on several traffic impact studies reviewed and accepted by City and County of Honolulu Department of Transportation Services over the past three years, and therefore has been used for this study.

Project Related Traffic Impacts and Mitigation Measures

The anticipated level-of-service analysis for 1999 and anticipated traffic impacts are summarized in Table 8.

Table 8 Level-of-Service Analysis for 1999 Conditions

	AM Peak Hour				PM Peak Hour			
	w/o Project		w/ Project		w/o Project		w/ Project	
Intersection	V/C[1]	LoS[2]	V/C[1]	LoS[2]	V/C[1]	LoS[2]	V/C[1]	LoS[2]
Nimitz Hwy. at Smith St	0.580	A	0.672	B	0.720	C	0.863	D
Nimitz Hwy. at Nuuanu Av.	0.793	C	0.858	D	0.841	D	0.858	D
Marin St. at Smith St.	NA	NA	NA	NA	NA	NA	NA	NA
Marin St. at Nuuanu Av.	NA	NA	NA	NA	NA	NA	NA	NA
King St. at Smith St.	0.438	A	0.449	A	0.462	A	0.490	A
King St. at Smith St.	0.738	C	0.775	C	0.646	B	0.660	B

NOTES:
(1) V/C = Volume-to-Capacity Ratio
(2) LoS = Level-of-Service

Traffic Demand Management

The management should designate a Transportation Coordinator whose responsibilities may include the operation of the parking facilities and implementation of ridesharing programs. These programs include: rideshare matching, commuter information networks, employee surveys, transit and carpool/vanpool subsidy management, and city bus service coordination. Enhancement of these transportation systems management (TSM) programs will reduce the peak hour trips generated, especially employees.

Construction Traffic

Construction activities will have impacts on the surrounding roadway system. Heavy trucks, pile driving equipment, earth movers and various construction vehicles will need access to and from the site. These vehicles can be difficult to maneuver and are often slow-moving. Consequently, it may be necessary to temporarily close part of the curb lane of the adjacent streets under certain conditions. However, this is expected to be a rare occurrence.

Due to the capacity constraints of Nimitz Highway, it is recommended that the construction vehicles described above minimize travel on this roadway and limit turns into and out of the site to between 7 AM and 7 PM on weekdays. The temporary closure of a lane(s) should not occur within the same time frame, in order to avoid impacting traffic flow on Nimitz Highway.

Summary

In summary, traffic generated by the project will have impacts on the surrounding roadway system. However, in no case does the level-of-service fall below 'D', which is generally accepted an a minimum level-of-service for peak hour conditions in urban areas. Therefore, no mitigation measures are required.

Even though no mitigation measures are required to accommodate project-related traffic, it is recommended that TSM measures previously described in this chapter be implemented. This will reduce the demand for on-site parking by employees thereby enhancing the parking supply for visitors to the project.

APPENDIX A

TRAFFIC PROJECTION WORKSHEETS

TRIP ASSIGNMENT WORKSHEET
Bank of Hawaii Annex Tower TIAR (Alternate 2)
August 1994

INTERSECTION NO 1
INTERSECTION OF Nimitz Highway at Smith Street

NO	APPR & MVT	Existing AM	Existing PM	Trip Distribution % In	Trip Distribution % Out	Project Trips AM	Project Trips PM	Adjustment for Existing AM	Adjustment for Existing PM	Cumulative Plu Project AM	Cumulative Plu Project PM
1	N-RT					0	0			0	0
2	TH					0	0			0	0
3	LT					0	0			0	0
4	E-RT	117	222	70%	0%	302	53	-131	-23	311	296
5	TH	2429	3352		25%	16	99	-2	-10	2963	4432
6	LT					0	0			0	0
7	S-RT					0	0			0	0
8	TH					0	0			0	0
9	LT					0	0			0	0
10	W RT					0	0			0	0
11	TH	2931	2978			0	0			3542	3689
12	LT	142	154	30%		129	23	-44	-8	255	199
TOTAL		5619	6706			447	174			7071	8615

TRIP ASSIGNMENT WORKSHEET
Bank of Hawaii Annex Tower TIAR (Alternate 2)
August 1994

INTERSECTION NO 2
INTERSECTION OF Nimitz Highway at Nuuanu Avenue

NO	APPR & MVT	Existing AM	Existing PM	Trip Distribution % In	Trip Distribution % Out	Project Trips AM	Project Trips PM	Adjustment for Existing AM	Adjustment for Existing PM	Cumulative Plu Project AM	Cumulative Plu Project PM
1	N-RT	321	243	50%	25%	232	137	-89	-25	543	463
2	TH					0	0			0	0
3	LT	215	109		5%	3	20	-2	-10	284	145
4	E-RT					0	0			0	0
5	TH	2225	3331	20%		86	15	-44	-8	2732	4265
6	LT					0	0			0	0
7	S-RT					0	0			0	0
8	TH					0	0			0	0
9	LT					0	0			0	0
10	W RT					0	0			0	0
11	TH	3140	2931			0	0			3793	3632
12	LT					0	0			0	0
TOTAL		5901	6614			321	171			7352	8504

TRIP ASSIGNMENT WORKSHEET
Bank of Hawaii Annex Tower TIAR (Alternate 2)
August 1994

INTERSECTION NO 3
INTERSECTION OF Marin Street at Smith Street

		Existing		Trip Distribution		Project Trips		Adjustment for Existing		Cumulative Plu Project	
NO	APPR & MVT	AM	PM	% In	% Out	AM	PM	AM	PM	AM	PM
1	N-RT					0	0			0	0
2	TH					0	0			0	0
3	LT					0	0			0	0
4	E-RT					0	0			0	0
5	TH					0	0			0	0
6	LT					0	0			0	0
7	S-RT	8	0	0%	35%	22	139	-11	-12	21	127
8	TH	221	387	0%	65%	42	257	-22	-132	285	589
9	LT					0	0			0	0
10	W RT					0	0			0	0
11	TH					0	0			0	0
12	LT					0	0			0	0
TOTAL		229	387			64	396			306	716

TRIP ASSIGNMENT WORKSHEET
Bank of Hawaii Annex Tower TIAR (Alternate 2)
August 1994

INTERSECTION NO 4
INTERSECTION OF Marin Street at Nuuanu Avenue

NO	APPR & MVT	Existing AM	Existing PM	Trip Distribution % In	Trip Distribution % Out	Project Trips AM	Project Trips PM	Adjustment for Existing AM	Adjustment for Existing PM	Cumulative Plu Project AM	Cumulative Plu Project PM
1	N-RT					0	0			0	0
2	TH	528	352	50%		216	38	-100	-17	749	443
3	LT	554	457			0	0			704	611
4	E-RT					0	0			0	0
5	TH					0	0			0	0
6	LT					0	0			0	0
7	S-RT					0	0			0	0
8	TH					0	0			0	0
9	LT					0	0			0	0
10	W RT	8	0	0%	30%	19	119	-9	-2	20	117
11	TH	0	0		5%	3	20	-2	-10	1	10
12	LT					0	0			0	0
TOTAL		1090	809			238	176			1474	1180

TRIP ASSIGNMENT WORKSHEET
Bank of Hawaii Annex Tower TIAR (Alternate 2)
August 1994

INTERSECTION NO 5
INTERSECTION OF King Street at Smith Street

NO	APPR & MVT	Existing AM	Existing PM	Trip Distribution % In	Trip Distribution % Out	Project Trips AM	Project Trips PM	Adjustment for Existing AM	Adjustment for Existing PM	Cumulative Plu Project AM	Cumulative Plu Project PM
1	N-RT					0	0			0	0
2	TH					0	0			0	0
3	LT					0	0			0	0
4	E-RT					0	0			0	0
5	TH					0	0			0	0
6	LT					0	0			0	0
7	S-RT	84	160	0%	25%	16	99	-9	-51	108	240
8	TH	137	227		40%	26	158	-13	-81	177	349
9	LT					0	0			0	0
10	WRT					0	0			0	0
11	TH	1866	1782	10%		43	8			2278	2143
12	LT	170	109			0	0			204	131
TOTAL		2257	2278			85	265			2767	2863

TRIP ASSIGNMENT WORKSHEET
Bank of Hawaii Annex Tower TIAR (Alternate 2)
August 1994

INTERSECTION NO 6
INTERSECTION OF King Street at Nuuanu Avenue

NO	APPR & MVT	Existing AM	Existing PM	Trip Distribution % In	Trip Distribution % Out	Project Trips AM	Project Trips PM	Adjustment for Existing AM	Adjustment for Existing PM	Cumulative Plu Project AM	Cumulative Plu Project PM
1	N-RT					0	0			0	0
2	TH	719	529	40%		172	30	-100	-17	963	709
3	LT	420	310			0	0			503	371
4	E-RT					0	0			0	0
5	TH					0	0			0	0
6	LT					0	0			0	0
7	S-RT					0	0			0	0
8	TH					0	0			0	0
9	LT					0	0			0	0
10	W RT	363	280	10%		43	8			488	345
11	TH	1587	1622		25%	16	99	-9	-51	1908	1991
12	LT					0	0			0	0
TOTAL		3089	2741			232	137			3863	3416

APPENDIX B

LEVEL-OF-SERVICE CALCULATIONS

PROJECT: Bank of Hawaii Annex Tower TIAR (Alternate 2)
INTERSECTION: Nimitz Highway at Smith Street
INTERSECTION N 1
DATE: August 1994
NOTE 1:
NOTE 2:

CAPACITY INPUTS	
THRU Lane Capacity (v	1600
LEFT Lane Capacity (vp	1600
DBL LT PENALTY (%):	0.2
CYCLE LENGTH (secs):	150
AMBER (% of cycle):	0
NORTH RTOR (%):	10
EAST RTOR (%):	10
SOUTH RTOR (%):	10
WEST RTOR (%):	10

	EXISTING						CUMULATIVE PLUS PROJECT					
			VOLUMES		V/C RATIOS				VOLUMES		V/C RATIOS	
APPRCH & MVT	APPR LANES	CAPACIT	AM	PM	AM	PM	APPR LANES	CAPACIT	AM	PM	AM	PM
N- RT	0	0	. 0	0	0	0	0	0	0	0	0	0
TH	0	0	0	0	0	0	0	0	0	0	0	0
LT	0	0	0	0	0	0	0	0	0	0	0	0
E- RT	0	0	117	222	0	0	1	1600	311	296	0.175	0.166
TH	4	6400	2429	3352	0.398	0.558	4	6400	2963	4432	0.463	0.693
LT	0	0	0	0	0	0	0	0	0	0	0	0
S- RT	0	0	0	0	0	0	0	0	0	0	0	0
TH	0	0	0	0	0	0	0	0	0	0	0	0
LT	1	1600	0	0	0	0	0	0	0	0	0	0
W- RT	0	0	0	0	0	0	0	0	0	0	0	0
TH	4	6400	2931	2978	0.48	0.489	4	6400	3542	3689	0.553	0.576
LT	0	0	142	154	0	0	2	3200	255	199	0.08	0.062
N-S(1):					0	0					0	0
N-S(2):					0	0					0	0
E-W(1):					0.398	0.558					0.543	0.755
E-W(2):					0.48	0.489					0.553	0.576
V/C:					0.48	0.558					0.553	0.755
AMBER:					0	0					0	0
ICU:					0.48	0.558					0.553	0.755
LOS:					A	A					A	C

PROJECT: Bank of Hawaii Annex Tower TIAR (Alternate 2)
INTERSECTION: Nimitz Highway at Nuuanu Avenue
INTERSECTION N 2
DATE: August 1994
NOTE 1:
NOTE 2:

CAPACITY INPUTS	
THRU Lane Capacity (v	1600
LEFT Lane Capacity (vp	1600
DBL LT PENALTY (%):	0.2
CYCLE LENGTH (secs):	150
AMBER (% of cycle):	0
NORTH RTOR (%):	20
EAST RTOR (%):	10
SOUTH RTOR (%):	10
WEST RTOR (%):	10

APPRCH & MVT	EXISTING APPR LANES	EXISTING CAPACIT	EXISTING VOLUMES AM	EXISTING VOLUMES PM	EXISTING V/C RATIOS AM	EXISTING V/C RATIOS PM	CUMULATIVE PLUS PROJECT APPR LANES	CUMULATIVE PLUS PROJECT CAPACIT	CUMULATIVE PLUS PROJECT VOLUMES AM	CUMULATIVE PLUS PROJECT VOLUMES PM	CUMULATIVE PLUS PROJECT V/C RATIOS AM	CUMULATIVE PLUS PROJECT V/C RATIOS PM
N- RT	1	1600	321	243	0.161	0.122	2	3200	543	463	0.136	0.116
TH	0	0	0	0	0	0	0	0	0	0	0	0
LT	2	3197	215	109	0.067	0.034	1	1600	284	145	0.178	0.091
E- RT	0	0	0	0	0	0	0	0	0	0	0	0
TH	4	6400	2225	3331	0.348	0.52	4	6400	2732	4265	0.427	0.666
LT	0	0	0	0	0	0	0	0	0	0	0	0
S- RT	0	0	0	0	0	0	1	1600	0	0	0	0
TH	0	0	0	0	0	0	0	0	0	0	0	0
LT	0	0	0	0	0	0	1	1600	0	0	0	0
W- RT	2	3200	0	0	0	0	1	1600	0	0	0	0
TH	4	6400	3140	2931	0.491	0.458	4	6400	3793	3632	0.593	0.568
LT	0	0	0	0	0	0	0	0	0	0	0	0
N-S(1):					0.161	0.122					0.136	0.116
N-S(2):					0.067	0.034					0.178	0.091
E-W(1):					0.348	0.52					0.427	0.666
E-W(2):					0.491	0.458					0.593	0.568
V/C:					0.652	0.642					0.771	0.782
AMBER:					0	0					0	0
ICU:					0.652	0.642					0.771	0.782
LOS:					B	B					C	C

PROJECT: Bank of Hawaii Annex Tower TIAR (Alternate 2)
INTERSECTION: King Street at Smith Street
INTERSECTION N 5
DATE: August 1994
NOTE 1:
NOTE 2:

CAPACITY INPUTS	
THRU Lane Capacity (v	1600
LEFT Lane Capacity (vp	1600
DBL LT PENALTY (%):	0.2
CYCLE LENGTH (secs):	150
AMBER (% of cycle):	0
NORTH RTOR (%):	10
EAST RTOR (%):	10
SOUTH RTOR (%):	10
WEST RTOR (%):	10

	EXISTING						CUMULATIVE PLUS PROJECT					
			VOLUMES		V/C RATIOS				VOLUMES		V/C RATIOS	
APPRCH & MVT	APPR LANES	CAPACIT	AM	PM	AM	PM	APPR LANES	CAPACIT	AM	PM	AM	PM
N- RT	0	0	0	0	0	0	0	0	0	0	0	0
TH	0	0	0	0	0	0	0	0	0	0	0	0
LT	0	0	0	0	0	0	0	0	0	0	0	0
E- RT	0	0	0	0	0	0	0	0	0	0	0	0
TH	0	0	0	0	0	0	0	0	0	0	0	0
LT	0	0	0	0	0	0	0	0	0	0	0	0
S- RT	1	1600	84	160	0.047	0.09	1	1600	108	240	0.061	0.135
TH	2	3200	137	227	0.043	0.071	2	3200	177	349	0.055	0.109
LT	0	0	0	0	0	0	0	0	0	0	0	0
W- RT	0	0	0	0	0	0	0	0	0	0	0	0
TH	4	6400	1866	1782	0.318	0.295	4	6400	2278	2143	0.388	0.355
LT	0	0	170	109	0	0	0	0	204	131	0	0
N-S(1):					0	0					0	0
N-S(2):					0.047	0.09					0.061	0.135
E-W(1):					0	0					0	0
E-W(2):					0.318	0.295					0.388	0.355
V/C:					0.365	0.385					0.449	0.49
AMBER:					0	0					0	0
ICU:					0.365	0.385					0.449	0.49
LOS:					A	A					A	A

PROJECT: Bank of Hawaii Annex Tower TIAR (Alternate 2)
INTERSECTION: King Street at Nuuanu Avenue
INTERSECTION N 6
DATE: August 1994
NOTE 1:
NOTE 2:

CAPACITY INPUTS	
THRU Lane Capacity (v	1600
LEFT Lane Capacity (vp	1600
DBL LT PENALTY (%):	0.2
CYCLE LENGTH (secs):	150
AMBER (% of cycle):	0
NORTH RTOR (%):	10
EAST RTOR (%):	10
SOUTH RTOR (%):	10
WEST RTOR (%):	10

APPRCH & MVT	EXISTING APPR LANES	EXISTING CAPACIT	EXISTING VOLUMES AM	EXISTING VOLUMES PM	EXISTING V/C RATIOS AM	EXISTING V/C RATIOS PM	CUMULATIVE PLUS PROJECT APPR LANES	CUMULATIVE PLUS PROJECT CAPACIT	CUMULATIVE PLUS PROJECT VOLUMES AM	CUMULATIVE PLUS PROJECT VOLUMES PM	CUMULATIVE PLUS PROJECT V/C RATIOS AM	CUMULATIVE PLUS PROJECT V/C RATIOS PM
N- RT	0	0	0	0	0	0	0	0	0	0	0	0
TH	1.5	2400	719	529	0.3	0.22	1.5	2400	963	709	0.401	0.295
LT	1.5	2398	420	310	0.175	0.129	1.5	2400	503	371	0.21	0.155
E- RT	0	0	0	0	0	0	0	0	0	0	0	0
TH	0	0	0	0	0	0	0	0	0	0	0	0
LT	0	0-	0	0	0	0	0	0	0	0	0	0
S- RT	0	0	0	0	0	0	0	0	0	0	0	0
TH	0	0	0	0	0	0	0	0	0	0	0	0
LT	0	0	0	0	0	0	0	0	0	0	0	0
W- RT	0	0	363	280	0	0	0	0	488	345	0	0
TH	4	6400	1587	1622	0.305	0.297	4	6400	1908	1991	0.374	0.365
LT	0	0	0	0	0	0	0	0	0	0	0	0
N-S(1):					0.3	0.22					0.401	0.295
N-S(2):					0.175	0.129					0.21	0.155
E-W(1):					0	0					0	0
E-W(2):					0.305	0.297					0.374	0.365
V/C:					0.605	0.517					0.775	0.66
AMBER:					0	0					0	0
ICU:					0.605	0.517					0.775	0.66
LOS:					B	A					C	B

PARSONS ENGINEERING SCIENCE, INC.

1357 Kapiolani Boulevard, Suite 1120 • Honolulu, Hawaii 96814 • (808) 944-8009 • Fax: (808) 944-1618

October 20, 1995

Mr. Philip Russell
Graham Murata Russell
345 Queen Street
Suite 400
Honolulu, Hawaii 96813

Re: Traffic Impact Study for Bank Of Hawaii Annex Tower
Addendum to TIAR

Dear Phil:

We have performed an analysis of the impact of the above project considering conversion of Smith Street from one-way to two-way operation between King Street and Nimitz Highway. We are presenting the results of our analysis as an addendum rather than preparing a revised report. The calculations performed considered comments received from the Department of Transportation Services (DTS) on the Traffic Impact Analysis Report (TIAR) prepared in October 1994.

This addendum was prepared considering Smith Street as two-way between King Street and Nimitz highway. With the conversion to two-way operation, the access and egress for Marin Tower would be modified so that all traffic would enter from Maunakea Street and exit onto Smith Street. The traffic signal at the intersection of Smith Street at Nimitz Highway would be modified to allow left or right turns per our discussions with DTS. These conditions represent 1999 cumulative conditions, which are background conditions for which the Bank of Hawaii project is compared to determine the project's traffic-related impacts.

Attached are Figures 7 and 9 from the TIAR, modified to reflected revised cumulative and cumulative plus project conditions considering Smith Street as described above. Also is attached the *Summary of Level-of-Service Analysis*, which summarizes the levels-of-service (LoS) at the subject intersections. The conclusions of the analysis is as follows:

1. All intersections operate at LoS C or better during the morning peak hour.

2. All intersections except the ones along Nimitz Highway operate at LoS C or better during the afternoon peak hour.

3. The LoS at the intersection of Nimitz Highway at Smith Street is expected to decrease from C to D during the afternoon peak hour. However, the change in the volume-to-capacity ratio is 0.017, which is less than the 0.020 used to define an impact as significant. Therefore, no mitigation is recommended.

4. The LoS at the intersection of Nimitz Highway at Nuuanu Avenue does not change with the addition of the project related traffic. The volume-to-capacity ratio is 0.988 without and with the project indicating that the project has no impact on the LoS at this intersection. This is because the redistribution of employee traffic balances the addition of project traffic.

Mr. Philip Russell
October 20, 1995
Page 2

The impact of the conversion of Smith Street from one-way to two-way has a positive impact on the intersection of Nimitz Highway at Nuuanu Avenue. With Smith Street as one-way, traffic from the Ewa and Mauka directions had to circulate down Nuuanu Avenue, along Nimitz Highway and then Mauka along Smith Street. This route is now eliminated in favor of a more direct route down Smith Street. With this alternative, we do not have to address the issue of mitigation measures at the Nuuanu/Nimitz intersection.

Left turn from Smith Street into the Bank of Hawaii parking garage will have to yield to mauka bound traffic along Smith Street. Since the number of turns is relatively small, delays would be minimal and there should not be any queues backing up and blocking the exit from Marin Tower for a noticeable length of time.

Traffic exiting the Bank of Hawaii parking garage will have to yield to Smith Street traffic. Left turns will have a slightly longer delay with Smith Street as two-way versus one-way. Prohibiting left turns from the Bank of Hawaii garage would force traffic to circulate around the block impacting Marin Street and the Nuuanu Avenue/Nimitz Highway intersection, requiring mitigation.

I trust the above discussion addresses your concerns. If you have any questions or require any additional information, please do not hesitate to call.

Very truly yours,
PARSONS ENGINEERING SCIENCE, INC.

Phillip J. Rowell, P.E.
Principal Traffic Engineer

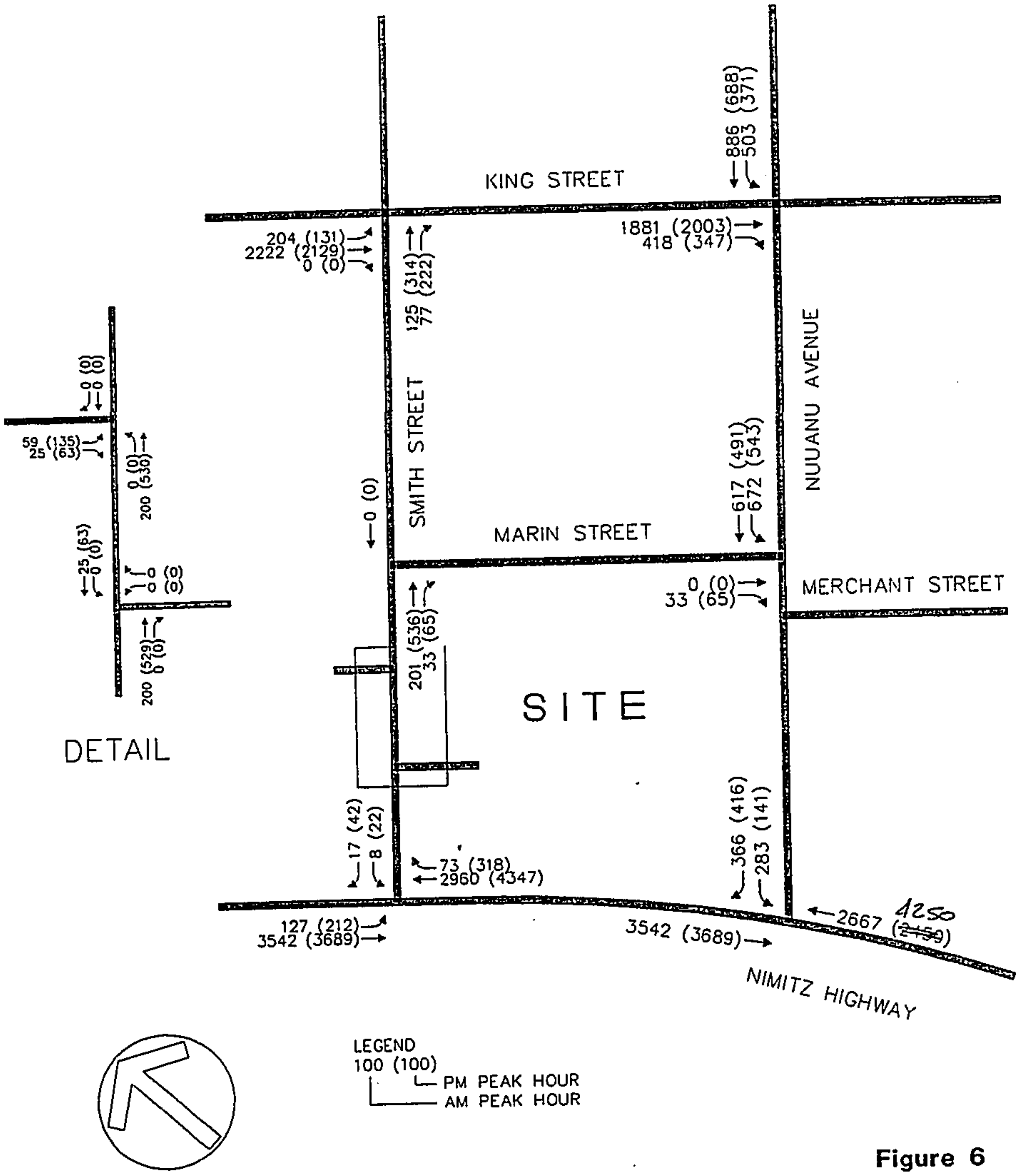

Figure 6

Cumulative Peak Hour Traffic Volumes Without Traffic

Barton–Aschman Associates, Inc.

Revised 9–25–95

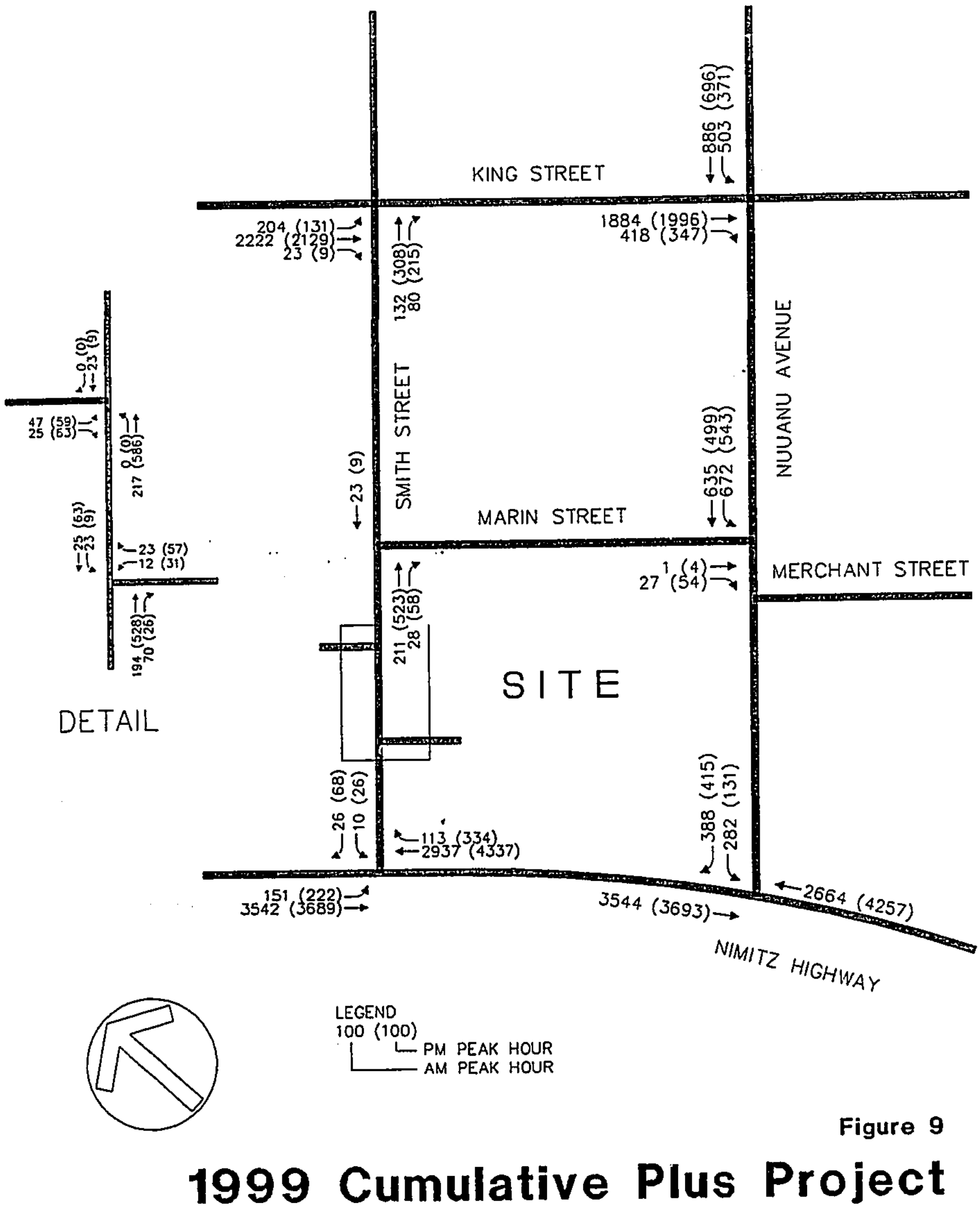

Figure 9

1999 Cumulative Plus Project Peak Hour Traffic

Barton-Aschman Associates, Inc.

Revised 9-25-95

SUMMARY OF LEVEL-OF-SERVICE ANALYSIS
Bank of Hawaii Annex Tower TIAR (Alternate 2A)
August 1994

		AM Peak Hour					PM Peak Hour				
		Without Project		With Project			Without Project		With Project		
No	Intersection	V/C	LoS	V/C	LoS	Change	V/C	LoS	V/C	LoS	Change
1	Nimitz Highway at Smith Street	0.563	A	0.586	A	0.023	1.075	F	1.093	F	0.018
2	Nimitz Highway at Nuuanu Avenue	0.702	C	0.712	C	0.010	0.833	D	0.833	D	0.000
3	Marin Street at Smith Street	0.073	A	0.075	A	0.002	0.188	A	0.182	A	-0.006
4	Marin Street at Nuuanu Avenue	0.269	A	0.006	A	-0.263	0.215	A	0.012	A	-0.203
5	King Street at Smith Street	0.422	A	0.428	A	0.006	0.478	A	0.475	A	-0.003
6	King Street at Nuuanu Avenue	0.721	C	0.729	C	0.008	0.654	B	0.656	B	0.002
7	Smith Street at Bank of Hawaii Dri	0.063	A	0.015	A	-0.048	0.165	A	0.081	A	-0.084
8	Smith Street at Marin Tower Drive	0.178	A	0.18	A	0.002	0.455	A	0.442	A	-0.013

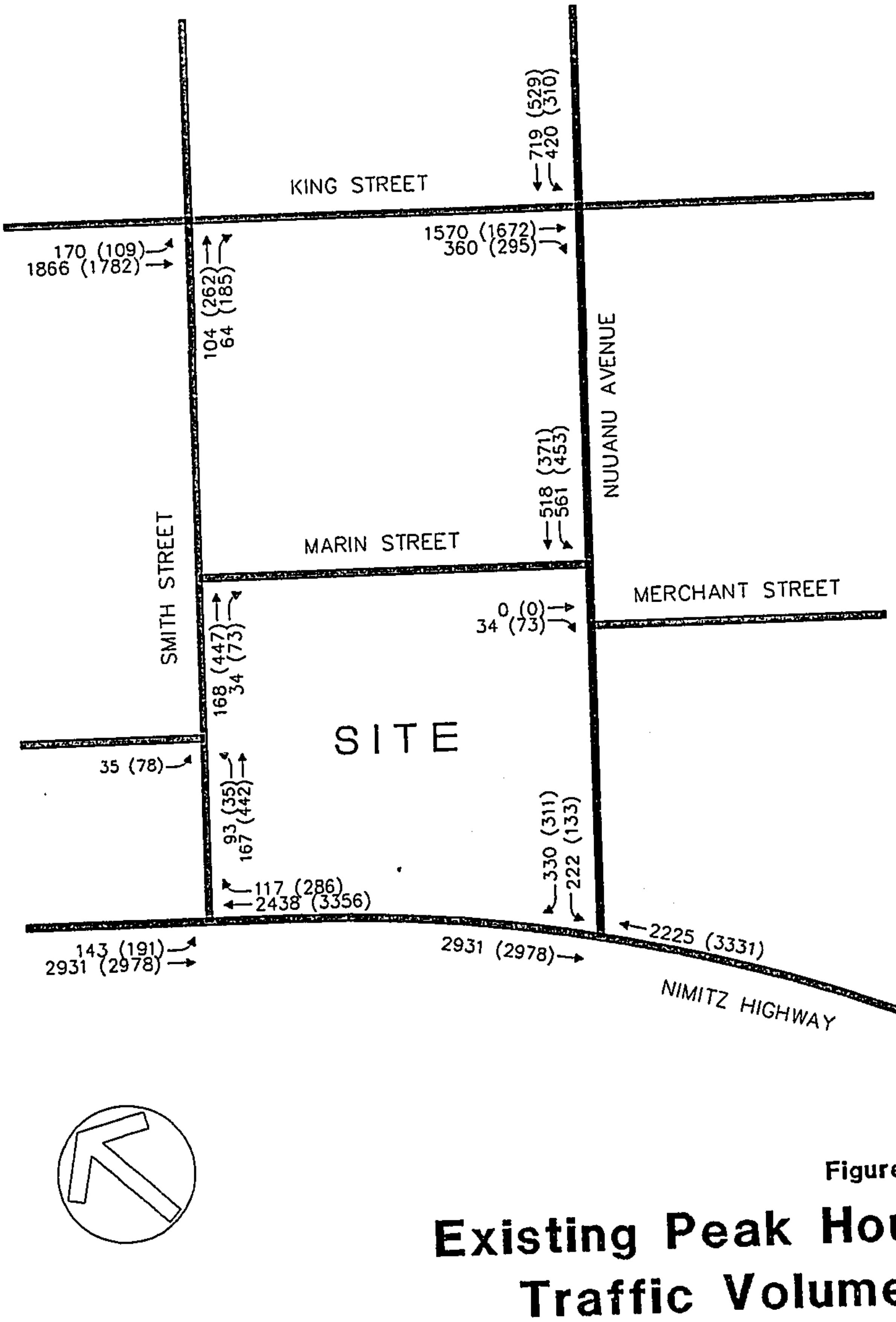

Figure 3

Existing Peak Hour Traffic Volumes

Revised 9-25-95

Barton-Aschman Associates, Inc.

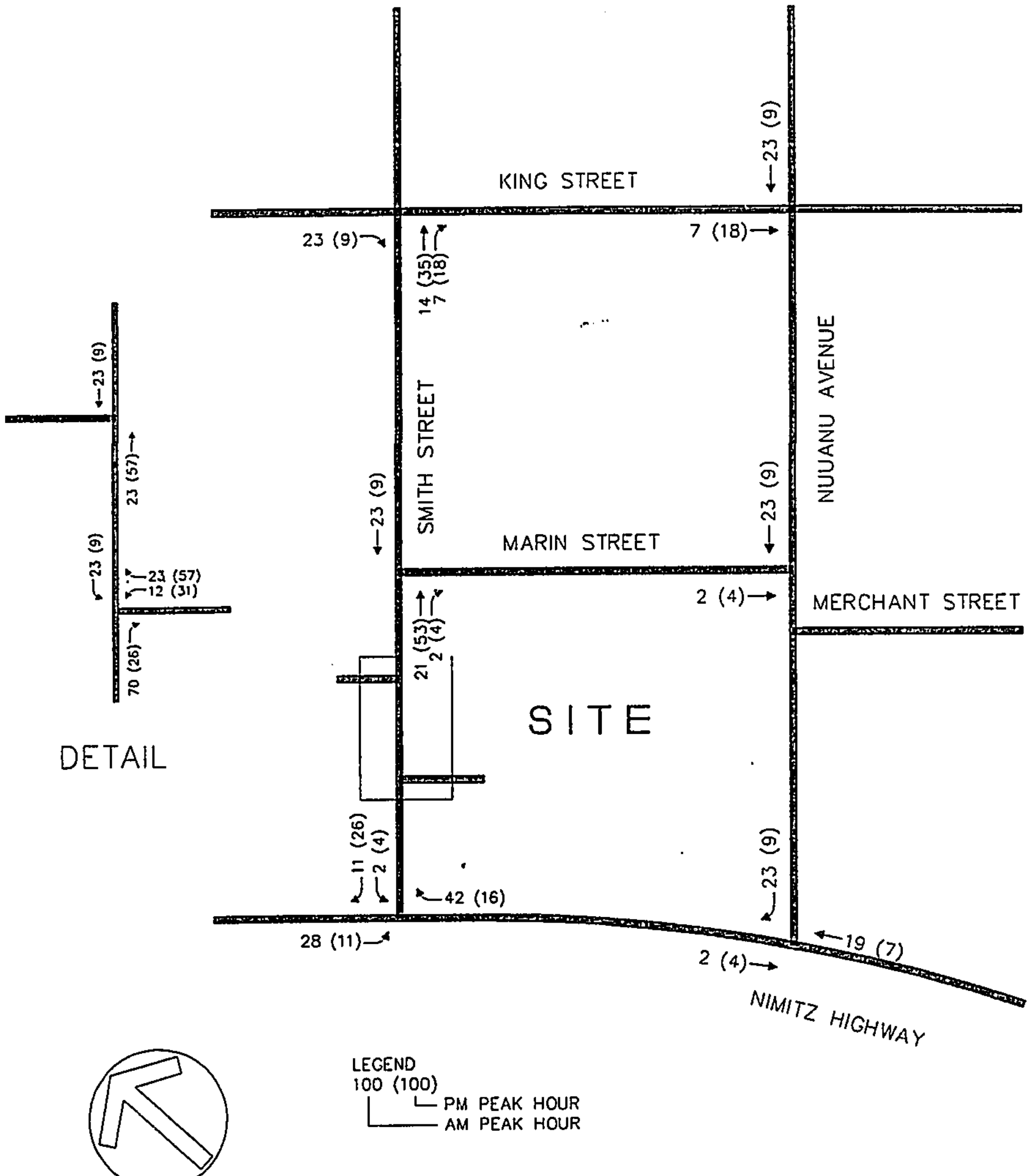

Figure 8

Project Related Peak Hour Traffic

Barton-Aschman Associates, Inc.

Revised 9-25-95

TRIP ASSIGNMENT WORKSHEET
Bank of Hawaii Annex Tower TIAR (Alternate 2A)
August 1994

INTERSECTION NO 1
INTERSECTION OF Nimitz Highway at Smith Street

NO	APPR & MVT	Existing		Background Growth		Related Projects		Marin Tower Adjustment		1999 Cumulative		Trip Distribution		Project Trips		Adjustment for Existing		Cumulative Plu Project	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	% In	% Out	AM	PM	AM	PM	AM	PM
1	N-RT	0	0	0	0			17	42	17	42		30%	11	26			28	68
2	TH	0	0	0	0			0	0	0	0			0	0			0	0
3	LT	0	0	0	0			8	22	8	22		5%	2	4			10	26
4	E-RT	117	286	23	57			-67	-25	73	318	45%	0%	42	16	-2	0	113	334
5	TH	2438	3356	483	664	39	327	0	0	2960	4347		0%	0	0	-23	-10	2937	4337
6	LT	0	0	0	0			0	0	0	0			0	0			0	0
7	S-RT	0	0	0	0			0	0	0	0			0	0			0	0
8	TH	0	0	0	0			0	0	0	0			0	0			0	0
9	LT	0	0	0	0			0	0	0	0			0	0			0	0
10	W RT	0	0	0	0			0	0	0	0			0	0			0	0
11	TH	2931	2978	580	590	31	121	0	0	3542	3689			0	0			3542	3689
12	LT	143	191	28	38			-44	-17	127	212	30%		28	11	-4	-1	151	222
TOTAL		5629	6811	1114	1349	70	448	-86	22	6727	8630			82	57			6780	8676

TRIP ASSIGNMENT WORKSHEET
Bank of Hawaii Annex Tower TIAR (Alternate 2A)
August 1994

INTERSECTION NO 2
INTERSECTION OF Nimitz Highway at Nuuanu Avenue

		Existing		Background Growth		Related Projects		Marin Tower Adjustment		1999 Cumulative		Trip Distribution		Project Trips		Adjustment for Existing		Cumulative Plu Project	
NO	APPR & MVT	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	% In	% Out	AM	PM	AM	PM	AM	PM
1	N-RT	330	311	65	62	15	60	-44	-17	366	416	25%	0%	23	9	-1	-10	388	415
2	TH	0	0	0	0			0	0	0	0			0	0			0	0
3	LT	222	133	44	26	25	4	-8	-22	283	141		0%	0	0	-1	-10	282	131
4	E-RT	0	0	0	0			0	0	0	0			0	0			0	0
5	TH	2225	3331	441	660	24	267	-23	-8	2667	4250	20%		19	7	-22	0	2664	4257
6	LT	0	0	0	0			0	0	0	0			0	0			0	0
7	S-RT	0	0	0	0			0	0	0	0			0	0			0	0
8	TH	0	0	0	0			0	0	0	0			0	0			0	0
9	LT	0	0	0	0			0	0	0	0			0	0			0	0
10	WRT	0	0	0	0			0	0	0	0			0	0			0	0
11	TH	2931	2978	580	590	31	121	0	0	3542	3689		5%	2	4			3544	3693
12	LT	0	0	0	0			0	0	0	0			0	0			0	0
TOTAL		5708	6753	1130	1338	95	452	-75	-47	6858	8496			44	20			6878	8496

TRIP ASSIGNMENT WORKSHEET
Bank of Hawaii Annex Tower TIAR (Alternate 2A)
August 1994

INTERSECTION NO 3
INTERSECTION OF Marin Street at Smith Street

NO	APPR & MVT	Existing		Background Growth		Related Projects		Marin Tower Adjustment		1999 Cumulative		Trip Distribution		Project Trips		Adjustment for Existing		Cumulative Plu Project	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	% In	% Out	AM	PM	AM	PM	AM	PM
1	N-RT	0	0	0	0			0	0	0	0	25%		0	0			0	0
2	TH	0	0	0	0			0	0	0	0			23	9			23	9
3	LT	0	0	0	0			0	0	0	0			0	0			0	0
4	E-RT	0	0	0	0			0	0	0	0			0	0			0	0
5	TH	0	0	0	0			0	0	0	0			0	0			0	0
6	LT	0	0	0	0			-8	-22	33	65	0%	5%	0	0	-7	-11	0	0
7	S-RT	34	73	7	14			0	0	201	536	0%	60%	2	4	-11	-66	28	58
8	TH	168	447	33	89			0	0	0	0			21	53			211	523
9	LT	0	0	0	0			0	0	0	0			0	0			0	0
10	WRT	0	0	0	0			0	0	0	0			0	0			0	0
11	TH	0	0	0	0			0	0	0	0			0	0			0	0
12	LT	0	0	0	0			0	0	0	0			0	0			0	0
TOTAL		202	520	40	103	0	0	-8	-22	234	601			46	66			262	590

TRIP ASSIGNMENT WORKSHEET
Bank of Hawaii Annex Tower TIAR (Alternate 2A)
August 1994

INTERSECTION NO 4
INTERSECTION OF Marin Street at Nuuanu Avenue

NO	APPR & MVT	Existing AM	Existing PM	Background Growth AM	Background Growth PM	Related Projects AM	Related Projects PM	Marin Tower Adjustment AM	Marin Tower Adjustment PM	1999 Cumulative AM	1999 Cumulative PM	Trip Distribution % In	Trip Distribution % Out	Project Trips AM	Project Trips PM	Adjustment for Existing AM	Adjustment for Existing PM	Cumulative Plu Project AM	Cumulative Plu Project PM
1	N-RT	0	0	0	0			0	0	0	0			0	0			0	0
2	TH	518	371	103	73	40	64	-44	-17	617	491	25%		23	9	-5	-1	635	499
3	LT	561	453	111	90			0	0	672	543			0	0			672	543
4	E-RT	0	0	0	0			0	0	0	0			0	0			0	0
5	TH	0	0	0	0			0	0	0	0			0	0			0	0
6	LT	0	0	0	0			0	0	0	0			0	0			0	0
7	S-RT	0	0	0	0			0	0	0	0			0	0			0	0
8	TH	0	0	0	0			0	0	0	0			0	0			0	0
9	LT	0	0	0	0			0	0	0	0			0	0			0	0
10	WRT	34	73	7	14			-8	-22	33	65	0%	0%	0	0	-6	-11	27	54
11	TH	0	0	0	0			0	0	0	0		5%	2	4	-1	0	1	4
12	LT	0	0	0	0			0	0	0	0			0	0			0	0
TOTAL		1113	897	221	177	40	64	-52	-39	1322	1099			25	13			1335	1100

TRIP ASSIGNMENT WORKSHEET
Bank of Hawaii Annex Tower TIAR (Alternate 2A)
August 1994

INTERSECTION NO 5
INTERSECTION OF King Street at Smith Street

NO	APPR & MVT	Existing AM	Existing PM	Background Growth AM	Background Growth PM	Related Projects AM	Related Projects PM	Marin Tower Adjustment AM	Marin Tower Adjustment PM	1999 Cumulative AM	1999 Cumulative PM	Trip Distribution % In	Trip Distribution % Out	Project Trips AM	Project Trips PM	Adjustment for Existing AM	Adjustment for Existing PM	Cumulative Plu Project AM	Cumulative Plu Project PM
1	N-RT	0	0	0	0			0	0	0	0			0	0			0	0
2	TH	0	0	0	0			0	0	0	0			0	0			0	0
3	LT	0	0	0	0			0	0	0	0			0	0			0	0
4	E-RT	0	0	0	0			0	0	0	0			0	0			0	0
5	TH	0	0	0	0			0	0	0	0			0	0			0	0
6	LT	0	0	0	0			0	0	0	0			0	0			0	0
7	S-RT	64	185	13	37			0	0	77	222	0%	20%	7	18	-4	-25	80	215
8	TH	104	262	21	52			0	0	125	314		40%	14	35	-7	-41	132	308
9	LT	0	0	0	0			0	0	0	0			0	0			0	0
10	W RT	0	0	0	0			0	0	0	0	25%		23	9			23	9
11	TH	1866	1782	369	353	10	2	-23	-8	2222	2129	0%		0	0			2222	2129
12	LT	170	109	34	22			0	0	204	131			0	0			204	131
TOTAL		2204	2338	437	464	10	2	-23	-8	2628	2796			44	62			2661	2792

TRIP ASSIGNMENT WORKSHEET
Bank of Hawaii Annex Tower TIAR (Alternate 2A)
August 1994

INTERSECTION NO 6
INTERSECTION OF King Street at Nuuanu Avenue

NO	APPR & MVT	Existing AM	Existing PM	Background Growth AM	Background Growth PM	Related Projects AM	Related Projects PM	Marin Tower Adjustment AM	Marin Tower Adjustment PM	1999 Cumulative AM	1999 Cumulative PM	Trip Distribution % In	Trip Distribution % Out	Project Trips AM	Project Trips PM	Adjustment for Existing AM	Adjustment for Existing PM	Cumulative Plu Project AM	Cumulative Plu Project PM
1	N-RT	0	0	0	0			0	0	0	0			0	0			0	0
2	TH	719	529	142	105	30	62	-23	-8	868	688	25%		23	9	-5	-1	886	696
3	LT	420	310	83	61			0	0	503	371			0	0			503	371
4	E-RT	0	0	0	0			0	0	0	0			0	0			0	0
5	TH	0	0	0	0			0	0	0	0			0	0			0	0
6	LT	0	0	0	0			0	0	0	0			0	0			0	0
7	S-RT	0	0	0	0			0	0	0	0			0	0			0	0
8	TH	0	0	0	0			0	0	0	0			0	0			0	0
9	LT	0	0	0	0			0	0	0	0			0	0			0	0
10	W RT	360	295	71	58	10	2	-23	-8	418	347	0%		0	0			418	347
11	TH	1570	1672	311	331			0	0	1881	2003		20%	7	18	-4	-25	1884	1996
12	LT	0	0	0	0			0	0	0	0			0	0			0	0
TOTAL		3069	2806	607	555	40	64	-46	-16	3670	3409			30	26			3691	3409

TRIP ASSIGNMENT WORKSHEET
Bank of Hawaii Annex Tower TIAR (Alternate 2A)
August 1994

INTERSECTION NO 7
INTERSECTION OF Smith Street at Bank of Hawaii Driveway

NO	APPR & MVT	Existing AM	Existing PM	Background Growth AM	Background Growth PM	Related Projects AM	Related Projects PM	Marin Tower Adjustment AM	Marin Tower Adjustment PM	1999 Cumulative AM	1999 Cumulative PM	Trip Distribution % In	Trip Distribution % Out	Project Trips AM	Project Trips PM	Adjustment for Existing AM	Adjustment for Existing PM	Cumulative Plu Project AM	Cumulative Plu Project PM
1	N-RT	0	0	0	0			0	0	0	0			0	0			0	0
2	TH	0	0	0	0			25	63	25	63			0	0			25	63
3	LT	0	0	0	0			0	0	0	0	25%		23	9			23	9
4	E-RT	0	0	0	0			0	0	0	0		65%	23	57			23	57
5	TH	0	0	0	0			0	0	0	0			0	0			0	0
6	LT	0	0	0	0			0	0	0	0		35%	12	31			12	31
7	S-RT	0	0	0	0			0	0	0	0	75%		70	26			70	26
8	TH	260	477	51	94			-111	-42	200	529	0%		0	0	-6	-1	194	528
9	LT	0	0	0	0			0	0	0	0			0	0			0	0
10	WRT	0	0	0	0			0	0	0	0			0	0			0	0
11	TH	0	0	0	0			0	0	0	0			0	0			0	0
12	LT	0	0	0	0			0	0	0	0			0	0			0	0
TOTAL		260	477	51	94	0	0	-86	21	225	592			128	123			347	714

TRIP ASSIGNMENT WORKSHEET
Bank of Hawaii Annex Tower TIAR (Alternate 2A)
August 1994

INTERSECTION NO 8
INTERSECTION OF Smith Street at Marin Tower Driveway

NO	APPR & MVT	Existing AM	Existing PM	Background Growth AM	Background Growth PM	Related Projects AM	Related Projects PM	Marin Tower Adjustment AM	Marin Tower Adjustment PM	1999 Cumulative AM	1999 Cumulative PM	Trip Distribution % In	Trip Distribution % Out	Project Trips AM	Project Trips PM	Adjustment for Existing AM	Adjustment for Existing PM	Cumulative Plu Project AM	Cumulative Plu Project PM
1	N-RT	0	0	0	0			0	0	0	0			0	0			0	0
2	TH	0	0	0	0			0	0	0	0	25%		23	9			23	9
3	LT	0	0	0	0			0	0	0	0			0	0			0	0
4	E-RT	0	0	0	0			0	0	0	0			0	0			0	0
5	TH	0	0	0	0			0	0	0	0			0	0			0	0
6	LT	0	0	0	0			0	0	0	0			0	0			0	0
7	S-RT	0	0	0	0			0	0	0	0			0	0			0	0
8	TH	167	442	33	88			0	0	200	530		65%	23	57	-6	-1	217	586
9	LT	93	35	18	7			-111	-42	0	0			0	0	0	0	0	0
10	W RT	0	0	0	0			25	63	25	63			0	0			25	63
11	TH	0	0	0	0			0	0	0	0			0	0			0	0
12	LT	35	78	7	15			17	42	59	135			0	0	-12	-76	47	59
TOTAL		295	555	58	110	0	0	-69	63	284	728			46	66			312	717

PROJECT: Bank of Hawaii Annex Tower TIAR (Alternate 2A)
INTERSECTION: Nimitz Highway at Smith Street
INTERSECTION N 1
DATE: August 1994
NOTE 1:
NOTE 2:

CAPACITY INPUTS	
THRU Lane Capacity (vp	1600
LEFT Lane Capacity (vph	1600
DBL LT PENALTY (%):	0.2
CYCLE LENGTH (secs):	150
AMBER (% of cycle):	0
NORTH RTOR (%):	10
EAST RTOR (%):	10
SOUTH RTOR (%):	10
WEST RTOR (%):	10

	EXISTING						CUMULATIVE						CUMULATIVE PLUS PROJECT					
			VOLUMES		V/C RATIOS				VOLUMES		V/C RATIOS				VOLUMES		V/C RATIOS	
APPRCH & MVT	APPR LANES	CAPACIT	AM	PM	AM	PM	APPR LANES	CAPACIT	AM	PM	AM	PM	APPR LANES	CAPACIT	AM	PM	AM	PM
N- RT	0	0	0	0	0	0	1	1600	17	42	0.01	0.024	1	1600	28	68	0.015	0.038
TH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LT	0	0	0	0	0	0	1	1600	8	22	0.005	0.213	1	1600	10	26	0.006	0.225
E- RT	0	0	117	286	0	0	0	0	73	318	0	0	0	0	113	334	0	0
TH	4	6400	2438	3356	0.399	0.569	4	6400	2960	4347	0.474	0.729	4	6400	2937	4337	0.477	0.73
LT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S- RT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LT	1	1600	0	0	0	0	1	1600	0	0	0	0	0	0	0	0	0	0
W- RT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH	4	6400	2931	2978	0.458	0.465	4	6400	3542	3689	0.553	0.576	4	6400	3542	3689	0.553	0.576
LT	1	1600	143	191	0.089	0.119	1	1600	127	212	0.079	0.133	1	1600	151	222	0.094	0.138
N-S(1):					0	0					0.01	0.024					0.015	0.038
N-S(2):					0	0					0.005	0.213					0.006	0.225
E-W(1):					0.488	0.688					0.553	0.862					0.571	0.868
E-W(2):					0.458	0.465					0.553	0.576					0.553	0.576
V/C:					0.488	0.688					0.563	1.075					0.586	1.093
AMBER:					0	0					0	0					0	0
ICU:					.0.488	0.688					0.563	1.075					0.586	1.093
LOS:					A	B					A	F					A	F

PROJECT: Bank of Hawaii Annex Tower TIAR (Alternate 2A)
INTERSECTION: Nimitz Highway at Nuuanu Avenue
INTERSECTION N 2
DATE: August 1994
NOTE 1:
NOTE 2:

CAPACITY INPUTS		APPRCH & MVT	EXISTING APPR LANES	EXISTING CAPACIT	EXISTING VOLUMES AM	EXISTING VOLUMES PM	EXISTING V/C RATIOS AM	EXISTING V/C RATIOS PM	CUMULATIVE APPR LANES	CUMULATIVE CAPACIT	CUMULATIVE VOLUMES AM	CUMULATIVE VOLUMES PM	CUMULATIVE V/C RATIOS AM	CUMULATIVE V/C RATIOS PM	CUMULATIVE PLUS PROJECT APPR LANES	CUMULATIVE PLUS PROJECT CAPACIT	CUMULATIVE PLUS PROJECT VOLUMES AM	CUMULATIVE PLUS PROJECT VOLUMES PM	CUMULATIVE PLUS PROJECT V/C RATIOS AM	CUMULATIVE PLUS PROJECT V/C RATIOS PM
THRU Lane Capacity (vp	1600	N- RT	1	1600	330	311	0.134	0.126	1	1600	366	416	0.149	0.169	1	1600	388	415	0.158	0.168
LEFT Lane Capacity (vph	1600	TH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DBL LT PENALTY (%):	0	LT	2	3197	222	133	0.069	0.042	2	3200	283	141	0.088	0.044	2	3200	282	131	0.088	0.041
CYCLE LENGTH (secs):	150	E- RT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AMBER (% of cycle):	0	TH	4	6400	2225	3331	0.348	0.52	4	6400	2667	4250	0.417	0.664	4	6400	2664	4257	0.416	0.665
NORTH RTOR (%):	35	LT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EAST RTOR (%):	10	S- RT	0	0	0	0	0	0	0	0	0	0	0	0	1	1600	0	0	0	0
SOUTH RTOR (%):	10	TH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WEST RTOR (%):	10	LT	0	0	0	0	0	0	0	0	0	0	0	0	1	1600	0	0	0	0
		W- RT	2	3200	0	0	0	0	2	3200	0	0	0	0	1	1600	0	0	0	0
		TH	4	6400	2931	2978	0.458	0.465	4	6400	3542	3689	0.553	0.576	4	6400	3544	3693	0.554	0.577
		LT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		N-S(1):					0.134	0.126					0.149	0.169					0.158	0.168
		N-S(2):					0.069	0.042					0.088	0.044					0.088	0.041
		E-W(1):					0.348	0.52					0.417	0.664					0.416	0.665
		E-W(2):					0.458	0.465					0.553	0.576					0.554	0.577
		V/C:					0.592	0.646					0.702	0.833					0.712	0.833
		AMBER:					0	0					0	0					0	0
		ICU:					0.592	0.646					0.702	0.833					0.712	0.833
		LOS:					A	B					C	D					C	D

PROJECT: Bank of Hawaii Annex Tower TIAR (Alternate 2A)
INTERSECTION: Marin Street at Smith Street
INTERSECTION N 3
DATE: August 1994
NOTE 1:
NOTE 2:

CAPACITY INPUTS	
THRU Lane Capacity (vp	1600
LEFT Lane Capacity (vph	1600
DBL LT PENALTY (%):	0.2
CYCLE LENGTH (secs):	150
AMBER (% of cycle):	0
NORTH RTOR (%):	10
EAST RTOR (%):	10
SOUTH RTOR (%):	10
WEST RTOR (%):	10

	EXISTING						CUMULATIVE						CUMULATIVE PLUS PROJECT					
			VOLUMES		V/C RATIOS				VOLUMES		V/C RATIOS				VOLUMES		V/C RATIOS	
APPRCH & MVT	APPR LANES	CAPACIT	AM	PM	AM	PM	APPR LANES	CAPACIT	AM	PM	AM	PM	APPR LANES	CAPACIT	AM	PM	AM	PM
N- RT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	9	0	0
LT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E- RT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH	0	0	0	0	0	0	0	0	0	0	0	0	3	4800	0	0	0	0
LT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S- RT	0	0	34	73	0	0	0	0	33	65	0	0	0	0	28	58	0	0
TH	2	3200	168	447	0.063	0.163	2	3200	201	536	0.073	0.188	2	3200	211	523	0.075	0.182
LT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W- RT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH	0	0	0	0	0	0	3	4800	0	0	0	0	3	4800	0	0	0	0
LT	0	0	0	0	0	0	2	3200	0	0	0	0	2	3200	0	0	0	0
N-S(1):					0	0					0	0					0	0
N-S(2):					0.063	0.163					0.073	0.188					0.075	0.182
E-W(1):					0	0					0	0					0	0
E-W(2):					0	0					0	0					0	0
V/C:					0.063	0.163					0.073	0.188					0.075	0.182
AMBER:					0	0					0	0					0	0
ICU:					0.063	0.163					0.073	0.188					0.075	0.182
LOS:					A	A					A	A					A	A

PROJECT: Bank of Hawaii Annex Tower TIAR (Alternate 2A)
INTERSECTION: Marin Street at Nuuanu Avenue
INTERSECTION N 4
DATE: August 1994
NOTE 1:
NOTE 2:

CAPACITY INPUTS	
THRU Lane Capacity (vp	1600
LEFT Lane Capacity (vph	1600
DBL LT PENALTY (%):	0.2
CYCLE LENGTH (secs):	150
AMBER (% of cycle):	0
NORTH RTOR (%):	10
EAST RTOR (%):	10
SOUTH RTOR (%):	10
WEST RTOR (%):	10

	EXISTING						CUMULATIVE						CUMULATIVE PLUS PROJECT					
			VOLUMES		V/C RATIOS				VOLUMES		V/C RATIOS				VOLUMES		V/C RATIOS	
APPRCH & MVT	APPR LANES	CAPACIT	AM	PM	AM	PM	APPR LANES	CAPACIT	AM	PM	AM	PM	APPR LANES	CAPACIT	AM	PM	AM	PM
N- RT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH	2	3200	518	371	0.337	0.258	3	4800	617	491	0.269	0.215	0	0	635	499	0	0
LT	0	0	561	453	0	0	0	0	672	543	0	0	0	0	672	543	0	0
E- RT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH	1	1600	0	0	0	0	1	1600	0	0	0	0	3	4800	0	0	0	0
LT	0	0	0	0	0	0	0	0	0	0	0	0	1	1600	0	0	0	0
S- RT	0	0	0	0	0	0	0	0	0	0	0	0	2	3200	0	0	0	0
TH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W- RT	0	0	34	73	0	0	0	0	33	65	0	0	0	0	27	54	0	0
TH	0	0	0	0	0	0	0	0	0	0	0	0	3	4800	1	4	0.006	0.012
LT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N-S(1):					0.337	0.258					0.269	0.215					0	0
N-S(2):					0	0					0	0					0	0
E-W(1):					0	0					0	0					0	0
E-W(2):					0	0					0	0					0.006	0.012
V/C:					0.337	0.258					0.269	0.215					0.006	0.012
AMBER:					0	0					0	0					0	0
ICU:					0.337	0.258					0.269	0.215					0.006	0.012
LOS:					A	A					A	A					A	A

PROJECT: Bank of Hawaii Annex Tower TIAR (Alternate 2A)
INTERSECTION: King Street at Smith Street
INTERSECTION N 5
DATE: August 1994
NOTE 1:
NOTE 2:

CAPACITY INPUTS	
THRU Lane Capacity (vp	1600
LEFT Lane Capacity (vph	1600
DBL LT PENALTY (%):	0.2
CYCLE LENGTH (secs):	150
AMBER (% of cycle):	0
NORTH RTOR (%):	10
EAST RTOR (%):	10
SOUTH RTOR (%):	10
WEST RTOR (%):	10

	EXISTING						CUMULATIVE						CUMULATIVE PLUS PROJECT					
			VOLUMES		V/C RATIOS				VOLUMES		V/C RATIOS				VOLUMES		V/C RATIOS	
APPRCH & MVT	APPR LANES	CAPACIT	AM	PM	AM	PM	APPR LANES	CAPACIT	AM	PM	AM	PM	APPR LANES	CAPACIT	AM	PM	AM	PM
N- RT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E- RT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S- RT	1	1600	64	185	0.036	0.104	1	1600	77	222	0.043	0.125	1	1600	80	215	0.045	0.121
TH	2	3200	104	262	0.033	0.082	2	3200	125	314	0.039	0.098	2	3200	132	308	0.041	0.095
LT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W- RT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23	9	0	0
TH	4	6400	1866	1782	0.318	0.295	4	6400	2222	2129	0.379	0.353	4	6400	2222	2129	0.383	0.354
LT	0	0	170	109	0	0	0	0	204	131	0	0	0	0	204	131	0	0
N-S(1):					0	0					0	0					0	0
N-S(2):					0.036	0.104					0.043	0.125					0.045	0.121
E-W(1):					0	0					0	0					0	0
E-W(2):					0.318	0.295					0.379	0.353					0.383	0.354
V/C:					0.354	0.399					0.422	0.478					0.428	0.475
AMBER:					0	0					0	0					0	0
ICU:					0.354	0.399					0.422	0.478					0.428	0.475
LOS:					A	A					A	A					A	A

PROJECT: Bank of Hawaii Annex Tower TIAR (Alternate 2A)
INTERSECTION: King Street at Nuuanu Avenue
INTERSECTION N 6
DATE: August 1994
NOTE 1:
NOTE 2:

CAPACITY INPUTS	
THRU Lane Capacity (vp	1600
LEFT Lane Capacity (vph	1600
DBL LT PENALTY (%):	0.2
CYCLE LENGTH (secs):	150
AMBER (% of cycle):	0
NORTH RTOR (%):	10
EAST RTOR (%):	10
SOUTH RTOR (%):	10
WEST RTOR (%):	10

	EXISTING						CUMULATIVE						CUMULATIVE PLUS PROJECT					
			VOLUMES		V/C RATIOS				VOLUMES		V/C RATIOS				VOLUMES		V/C RATIOS	
APPRCH & MVT	APPR LANES	CAPACIT	AM	PM	AM	PM	APPR LANES	CAPACIT	AM	PM	AM	PM	APPR LANES	CAPACIT	AM	PM	AM	PM
N- RT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH	1.5	2400	719	529	0.3	0.22	1.5	2400	868	688	0.362	0.287	1.5	2400	886	696	0.369	0.29
LT	1.5	2398	420	310	0.175	0.129	1.5	2400	503	371	0.21	0.155	1.5	2400	503	371	0.21	0.155
E- RT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S- RT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
W- RT	0	0	360	295	0	0	0	0	418	347	0	0	0	0	418	347	0	0
TH	4	6400	1570	1672	0.302	0.307	4	6400	1881	2003	0.359	0.367	4	6400	1884	1996	0.36	0.366
LT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
N-S(1):					0.3	0.22					0.362	0.287					0.369	0.29
N-S(2):					0.175	0.129					0.21	0.155					0.21	0.155
E-W(1):					0	0					0	0					0	0
E-W(2):					0.302	0.307					0.359	0.367					0.36	0.366
V/C:					0.602	0.527					0.721	0.654					0.729	0.656
AMBER:					0	0					0	0					0	0
ICU:					0.602	0.527					0.721	0.654					0.729	0.656
LOS:					B	A					C	B					C	B