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GLENN M. OKIMOTO
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PARSONS BRINCKERHOFF
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STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:
HWY-DD 2.4178

March 12, 2013

TO: THE HONORABLE GARY GILL, ACTING DIRECTOR
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

FROM: GLENN M. OKIMOTO, PH.D.
DIRECTOR OF TRANSPORTATION

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OFC. OF ENVIRONMENTAL QUALITY CONTROL

SUBJECT: FINAL ENVIRONMENTAL ASSESSMENT AND
FINDING OF NO SIGNIFICANT IMPACT
INTERSTATE ROUTE H-1 REHABILITATION
MIDDLE STREET TO VICINITY OF WARD AVENUE
HONOLULU, ISLAND OF OAHU, HAWAII
FEDERAL-AID INTERSTATE PROJECT NO. IM-H1-1(269)

With this letter, the State of Hawaii Department of Transportation transmits the Final Environmental Assessment and Finding of No Significant Impact (FEA-FONSI) for the Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue Project situated in Honolulu, on the island of Oahu, for publication in the next available edition of the Environmental Notice.

Enclosed is a completed Office of Environmental Quality Control (OEQC) Publication Form, one copy of the FEA-FONSI, an Adobe Acrobat PDF file of the same, and an electronic copy of the publication form in MS Word.

If there are any questions, please contact our project manager, Mr. Ross Hironaka at (808) 692-7575 or ross.hironaka@hawaii.gov., Design Section, Design Branch, Highways Division and reference letter number HWY-DD 2.4178 as noted above.

Enclosures:
- OEQC Publication Form (hard copy)
- FEA-FONSI (hard copy)
- CD with FEA-FONSI in PDF format and OEQC Publication Form in Word format

c: Jim Hayes, Parsons Brinckerhoff

AGENCY ACTIONS
SECTION 343-5(B), HRS
PUBLICATION FORM (JULY 2012 REVISION)

Project Name:	Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue; Federal Aid Project No. IM-H1-1(269)
Island:	Oahu
District:	Honolulu
TMK:	Interstate Route H-1 right-of-way, 1-6-021:005, 1-6-024:001, and 1-6-024:003
Permits:	CZM, NPDES, Noise Permit, and Noise Variance
Proposing/ Determination Agency:	State of Hawaii Department of Transportation, Highways Division 869 Punchbowl Street Honolulu, Hawaii 96813 Contact: Mr. Ross Hironaka Phone: (808) 768-7575
Consultant:	Parsons Brinckerhoff 1001 Bishop St., American Savings Bank Tower, Suite 2400 Honolulu, Hawaii 96813 Contact: Mr. James Hayes Phone: (808) 566-2239

Status (check one only):

____	DEA-AFNSI	Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of DEA, a completed OEQC publication form, along with an electronic word processing summary and a PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov); a 30-day comment period ensues upon publication in the periodic bulletin.
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____		

_____	Act 172-12 EISPN	Submit the proposing agency notice of determination on agency letterhead, an OEQC publication form, and an electronic word processing summary (you may send the summary to oeqchawaii@doh.hawaii.gov). NO environmental assessment is required and a 30-day consultation period upon publication in the periodic bulletin.
_____	DEIS	The proposing agency simultaneously transmits to both the OEQC and the accepting authority, a hard copy of the DEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the DEIS (you may send both the summary and PDF to oeqchawaii@doh.hawaii.gov); a 45-day comment period ensues upon publication in the periodic bulletin.
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_____	Section 11-200-23 Determination	The accepting authority simultaneously transmits its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS to both OEQC and the proposing agency. No comment period ensues upon publication in the periodic bulletin.
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_____	Withdrawal (explain)	

Summary (Provide proposed action and purpose/need in less than 200 words. Please keep the summary brief and on this one page):

The State of Hawaii Department of Transportation, Highways Division (HDOT) and the Federal Highway Administration (FHWA) propose to rehabilitate Interstate Route H-1 between Middle Street and the vicinity of Ward Avenue. The work will include pavement rehabilitation or resurfacing, permanent restriping to accommodate four (10-foot wide) through lanes, replace highway lighting, and the addition of a concrete glare screen. In addition, Nu‘uanu Stream Bridge will be widened along with other minor modifications to allow for the four through lanes.

The proposed project is consistent with the Oahu Regional Transportation Plan 2035 and has been developed to prolong the interstate’s surface life; address congestion in the Interstate Route H-1 corridor; and improve safety.

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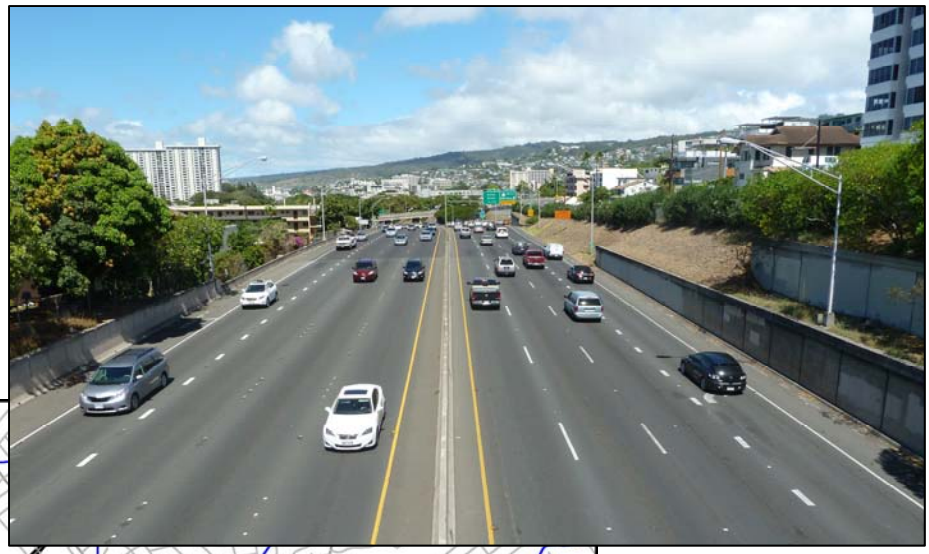
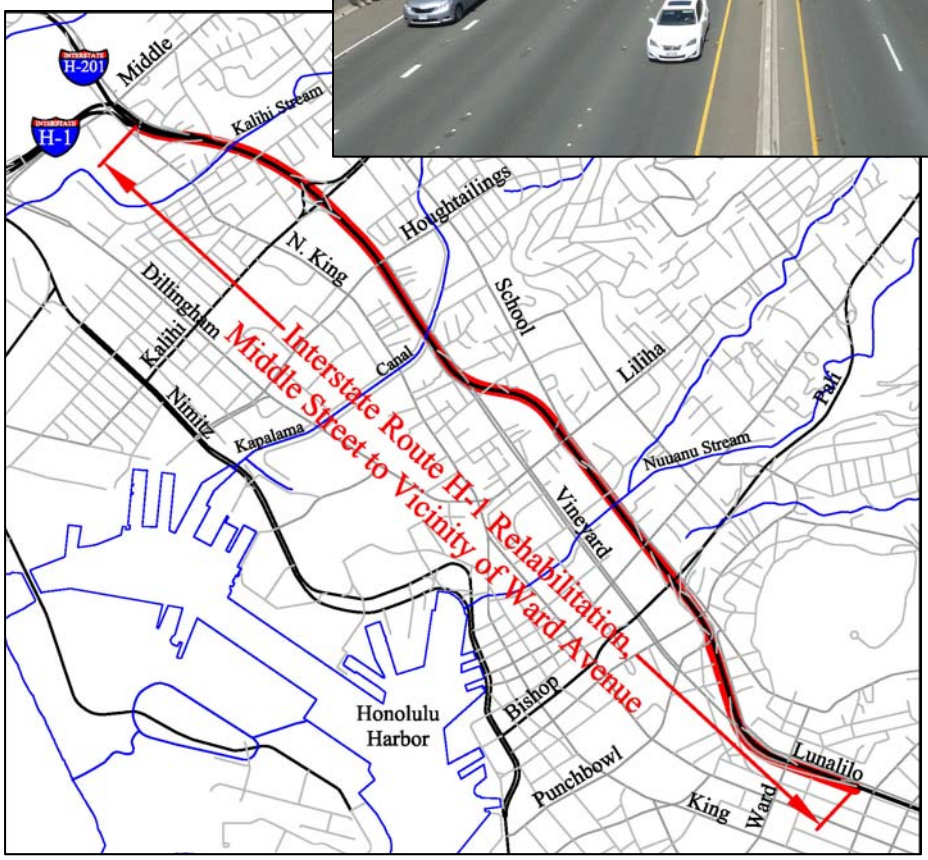
FINAL ENVIRONMENTAL ASSESSMENT

INTERSTATE ROUTE H-1 REHABILITATION, MIDDLE STREET TO VICINITY OF WARD AVENUE

HONOLULU, ISLAND OF O'AHU, HAWAI'I





March 23, 2013

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FINAL ENVIRONMENTAL ASSESSMENT
Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue Honolulu, Island of O‘ahu, Hawai‘i

Submitted Pursuant to the

Hawai‘i Environmental Policy Act,
Chapter 343, Hawai‘i Revised Statutes, and
Title 11, Chapter 200, Hawai‘i Department of Health Administrative Rules

by the

Department of Transportation, Highways Division
State of Hawai‘i

The following person may be contacted for additional information concerning this document:

Ross Hironaka, Project Manager
Department of Transportation
Highways Division, Design Branch
601 Kamokila Boulevard
Kapolei, HI 96707
(808) 768-7575

This Final Environmental Assessment documents a provisional finding that there will be no significant environmental impacts if Interstate Route H-1 were rehabilitated, including restriping to provide four through lanes, from Middle Street to the vicinity of Ward Avenue. The project will increase highway capacity and decrease congestion.

March 23, 2013

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1.0 DESCRIPTION OF THE PROPOSED ACTION

1.1 Introduction

The State of Hawai‘i Department of Transportation, Highways Division (HDOT) and the Federal Highway Administration (FHWA) are proposing to rehabilitate Interstate Route H-1 from Middle Street to the vicinity of Ward Avenue on the island of O‘ahu (see Figure 1-1). The proposed project is referred to as “Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue” and is Federal Aid Interstate Project No. IM-H1-1(269). Rehabilitation activities are proposed to include:

- Pavement rehabilitation using one of two levels of treatment – rehabilitation or resurfacing – as necessary, from roughly Likelike Highway to Miller Street, including on and off ramps.
- Replacing the highway lighting system from roughly Middle Street to Vineyard Boulevard on-ramp.
- Restriping the interstate to generate four through lanes in both directions to the extent possible throughout the project area.
- Installing a concrete glare screen on the median barrier from Likelike Highway to Miller Street.
- Widening the Nu‘uanu Stream Bridge roughly 5 feet on the makai (downstream) side in order to accommodate four through lanes and one auxiliary (exit) lane in the Diamond Head-bound (east-bound) direction.
- Making minor modifications to support the fourth through lane, including storm drain, grade, and structural component modifications at select and discrete locations throughout the project area.

HDOT completed the “Interstate Route H-1, Lane Reconfiguration Demonstration Project, Pali Highway to Punahou Street” in August 2012 (the demonstration project). That demonstration project restriped an adjacent stretch of Interstate Route H-1 between the Pali Highway and Punahou Street (see Figure 1-2) to produce four through lanes. The demonstration project is separate from the proposed project discussed in this Final Environmental Assessment (Final EA).

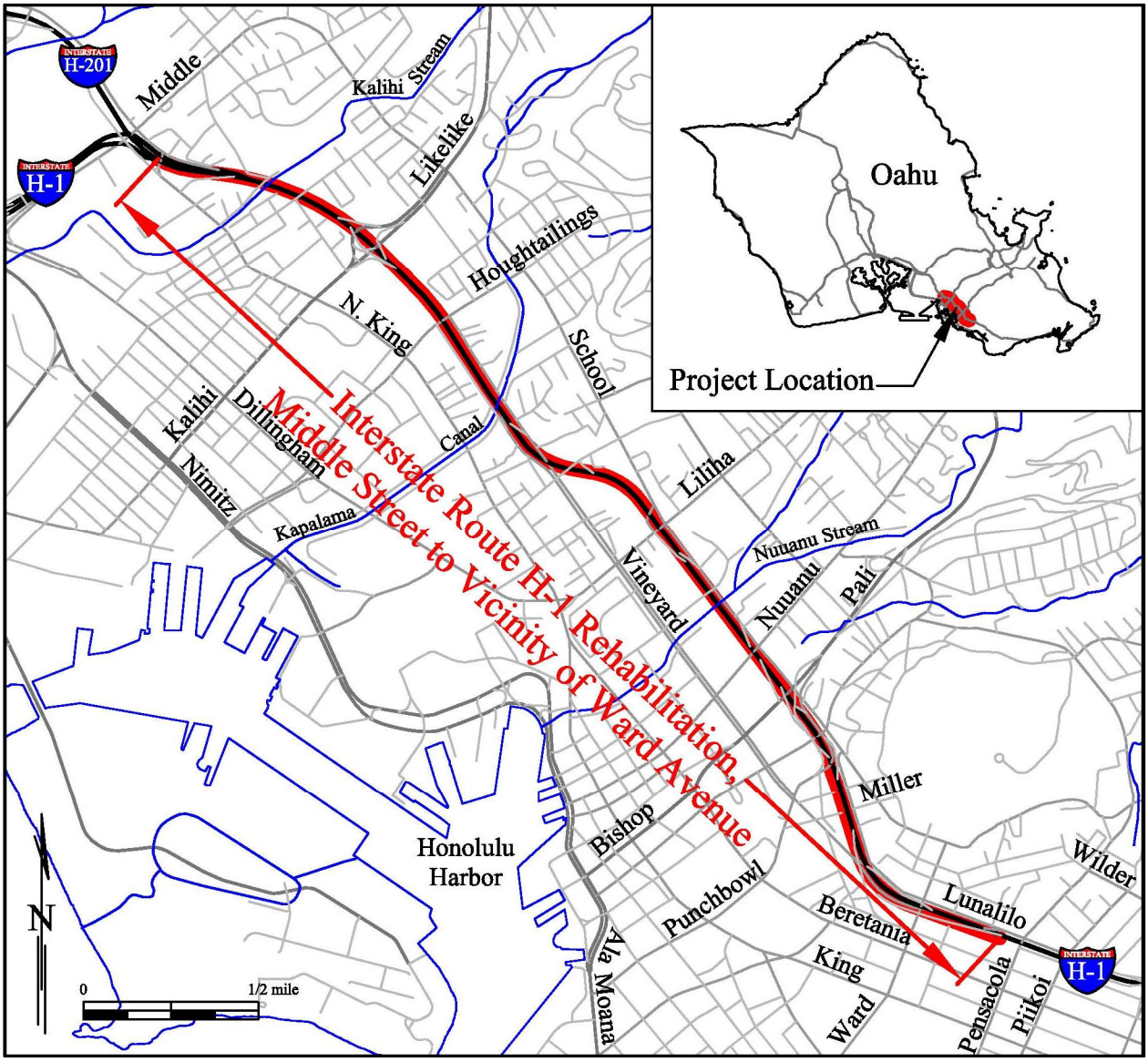


Figure 1-1: Proposed Project Location

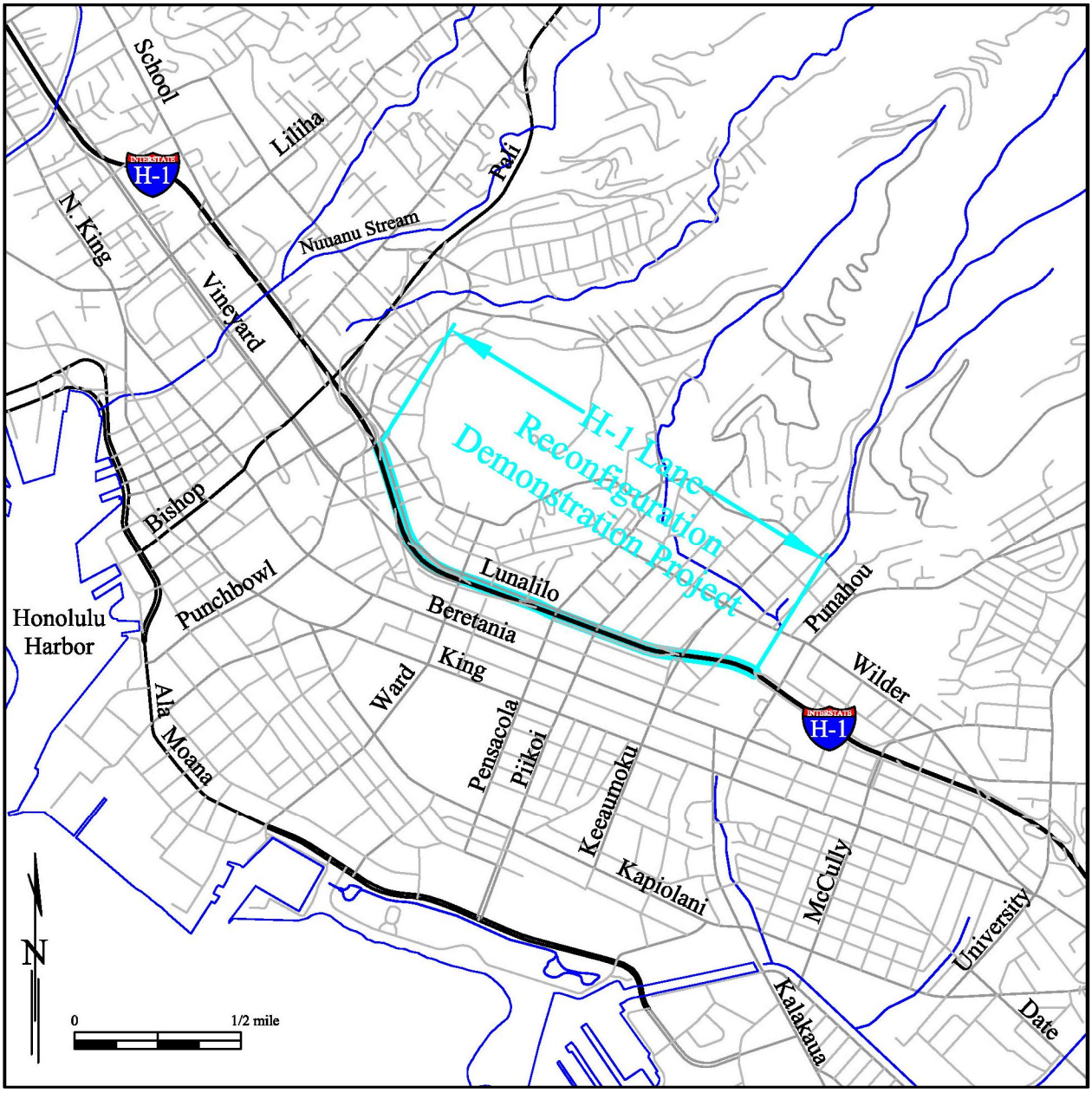


Figure 1-2: Interstate Route H-1, Lane Reconfiguration Demonstration Project, Pali Highway to Punahou Street

1.1.1 Purpose of this Document

The proposed project requires environmental review in accordance with Hawai‘i Revised Statutes (HRS) Chapter 343 due to the use of State funds and land for its construction. Therefore, the environmental review must comply with Hawai‘i Administrative Rules (HAR) Title 11, Chapter 200.

This Final EA discloses the foreseeable environmental impacts that could result from the proposed project’s implementation and commits to the employment of specific measures to avoid, minimize, or mitigate adverse impacts to the environment. Additionally, this Final EA

contains a record of consultation activities that have been conducted to date as part of project planning.

HDOT has determined that the proposed project will not have a "significant" impact in accordance with HRS Chapter 343. Therefore, HDOT has issued a "Finding of No Significant Impact" (FONSI) in Chapter 4.0.

Federal laws such as the National Environmental Policy Act (NEPA), Section 7 of the Endangered Species Act, and Section 106 of the National Historic Preservation Act apply to the proposed project because federal funds will be used. Compliance with these federal environmental regulations is either ongoing or has been completed, and is documented in this Final EA. Pursuant to NEPA, a Categorical Exclusion (CatEx) is anticipated for the proposed project.

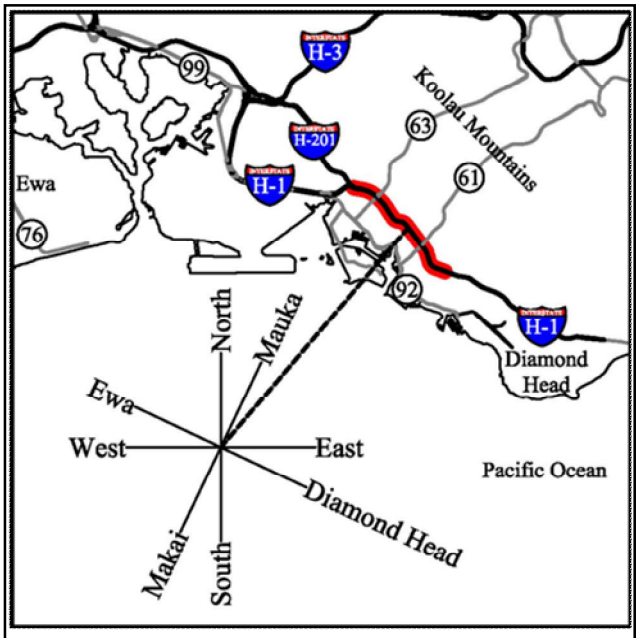
1.1.2 Organization of this Document

Section 1.0 discusses the purpose and need for the proposed project. It introduces the alternatives that were considered and the proposed project's anticipated schedule and cost. It also lists permits and approvals that may be required. Section 2.0 describes existing environmental conditions, potential environmental impacts, and the mitigation measures that are proposed to reduce the level of adverse impact. Section 3.0 documents agency and public coordination conducted to date related to the proposed project. Section 4.0 provides the Anticipated Finding of No Significant Impact (FONSI) statement, pursuant to HRS Chapter 343. Section 5.0 consists of a list of references used in the preparation of this Final EA. Appendix A contains records of coordination conducted for the proposed project. Appendix B through Appendix G provide various technical reports and permit applications prepared for the proposed project.

Items that have been added to the document between the Draft EA and Final EA have been highlighted like this. Items that have been deleted from the document between the Draft EA and Final EA have been highlighted like ~~this~~.

1.1.3 Naming Conventions in this Document

This document generally uses the directional terms north, south, east, and west. However, the terms "mauka" and "makai" (towards the mountains and towards the ocean, respectively), and "ewa" and "diamond head" are also used, especially where these terms may be the most convenient to describe a direction or location. Mauka generally corresponds to a northern direction, makai is a southern direction, while 'Ewa is a westerly



Direction terms

direction and Diamond Head corresponds to an easterly direction.

1.2 Project Purpose and Need

Based on an analysis of current and likely future conditions, the following project purposes and needs have been established:

- Prolonging the interstate's surface life;
- Addressing congestion in the corridor; and
- Improving vehicular safety in the corridor.

The proposed project is included in the current Statewide Transportation Improvement Program (STIP) and the need for congestion-relief within the Interstate Route H-1 corridor was discussed in the O'ahu Regional Transportation Plan 2035 (ORTP 2035) (April 2011).

1.2.1 Prolong Interstate Surface Life

The portion of Interstate Route H-1 that is proposed for rehabilitation (see Figure 1-3), was constructed between 1958 and 1966 in a series of six construction contracts. Like many other aging interstate routes, while it has been re-surfaced many times since initial construction, the existing condition exhibits moderate to severe signs of pavement distress due to its heavy use (See Section 2.1).

Moderate distress, patch and alligator cracking.

Severe distress, pothole with patch.

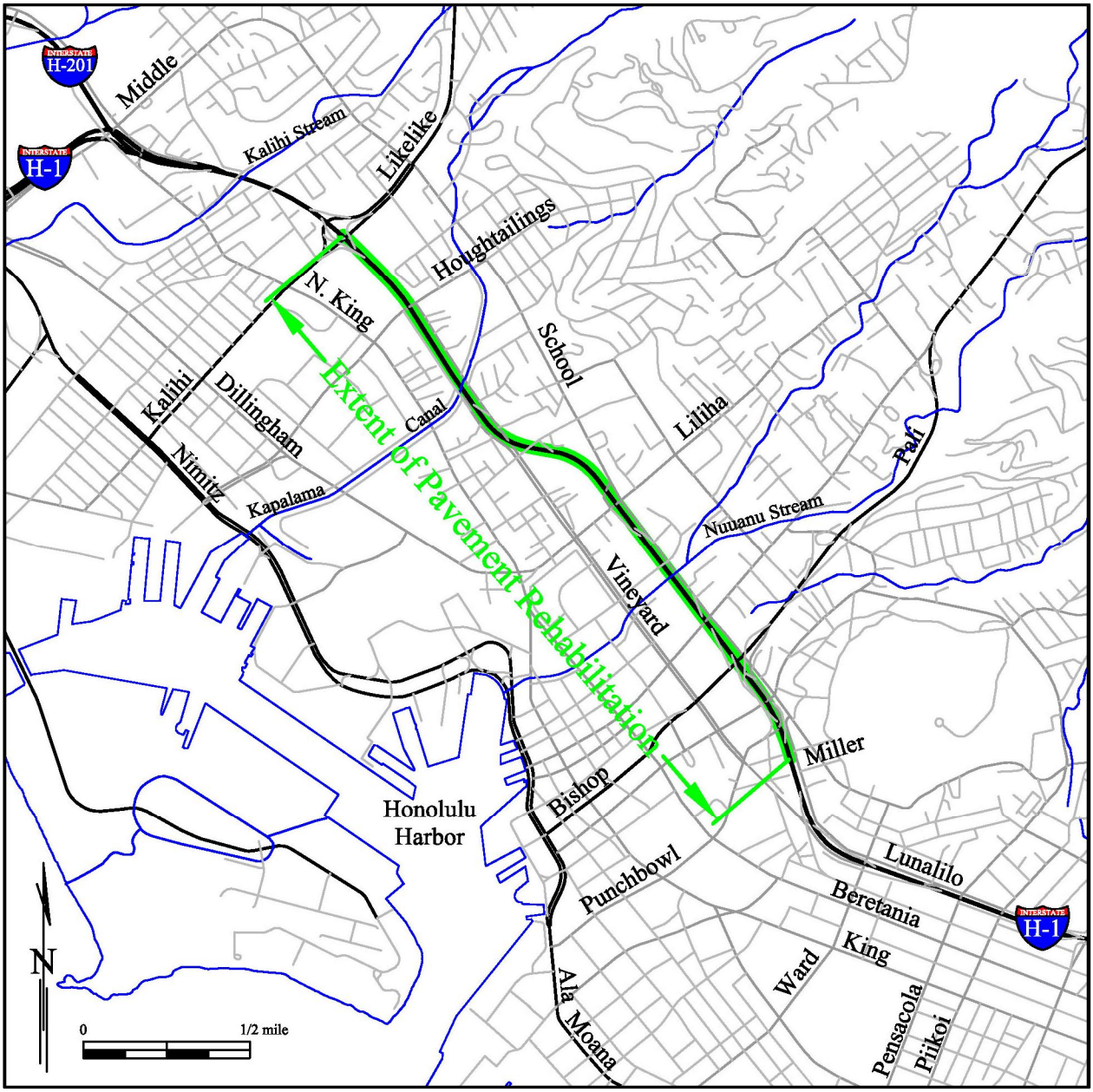


Figure 1-3: Extent of Pavement Rehabilitation and Glare Screen

A windshield survey of pavement conditions was conducted in October 2011 observed about 42,230 square feet and 88,315 square feet of pavement distress in the ‘Ewa (west) and Diamond Head (east) -bound directions, respectively. Common pavement failures that were identified included alligator cracking, pothole patching, and rutting (see photographs). Generally, these types of pavement failures can be associated with poor drainage, fatigue from repetitious heavy truck loads, or inadequacies of the pavement base. Although most of the failures were localized to a single lane, a few of the distressed areas spanned several adjacent lanes.

These observations indicate a clear need to improve pavement condition to prolong surface life. Pavement rehabilitation is proposed to address this need and prevent further deterioration.

Maintenance of the pavement surface is needed for the interstate to continue to meet user-performance expectations, as well as to avoid future costs to both consumers and the State. In 2009, the American Association of State Highway and Transportation Officials (AASHTO) released a report on the cost of deteriorating roads, called "Rough Roads Ahead". The study indicates that the average driver spends an additional $335 a year to repair and fuel their vehicle as a result of driving on poor roads. In urban areas, such as the Interstate Route H-1 corridor, vehicle operating costs can reach as high as $746 in additional costs. Furthermore, the study indicates that it is more cost-effective to maintain a road in good condition than to sustain a deteriorating road that will need to be re-constructed. Every $1 spent on keeping a road in good condition precludes spending $6-$14 in reconstruction. Over a span of 25-years, the cost per lane mile to reconstruct a road can be as high as 3-times the cost to simply maintain the road over the same period of time. Preventing further deterioration of the roadway surface will maintain the overall functional condition of the system, and keep both highway user and future operating costs down.

1.2.2 Addressing Congestion

As O‘ahu's principal east-west thoroughfare, stretching from Kalaeloa (west) to Kāhala (east), Interstate Route H-1 connects communities across the island (Figure 1-4). The portion of Interstate Route H-1 between Middle Street and Ward Avenue provides direct access to downtown Honolulu and serves as a critical link to areas within and beyond O‘ahu's primary urban center.

Congestion of Interstate Route H-1

Numerous private schools, one community college, the University of Hawai‘i's main campus, three major hospitals, the Hawai‘i State Capitol, the City and County of Honolulu's Municipal Building, and countless commercial and business centers are directly served by this section of Interstate Route H-1.

An estimated 73% of O‘ahu's primary employment (or 225,443 jobs) is located within Urban Honolulu (2010 U.S. Census Bureau's Designated Place), while only 42% or 94,618 of these employees actually live within the area, indicating that a large portion of O‘ahu's residents rely on Interstate Route H-1 for their daily commute (2010 U.S. Census Bureau).

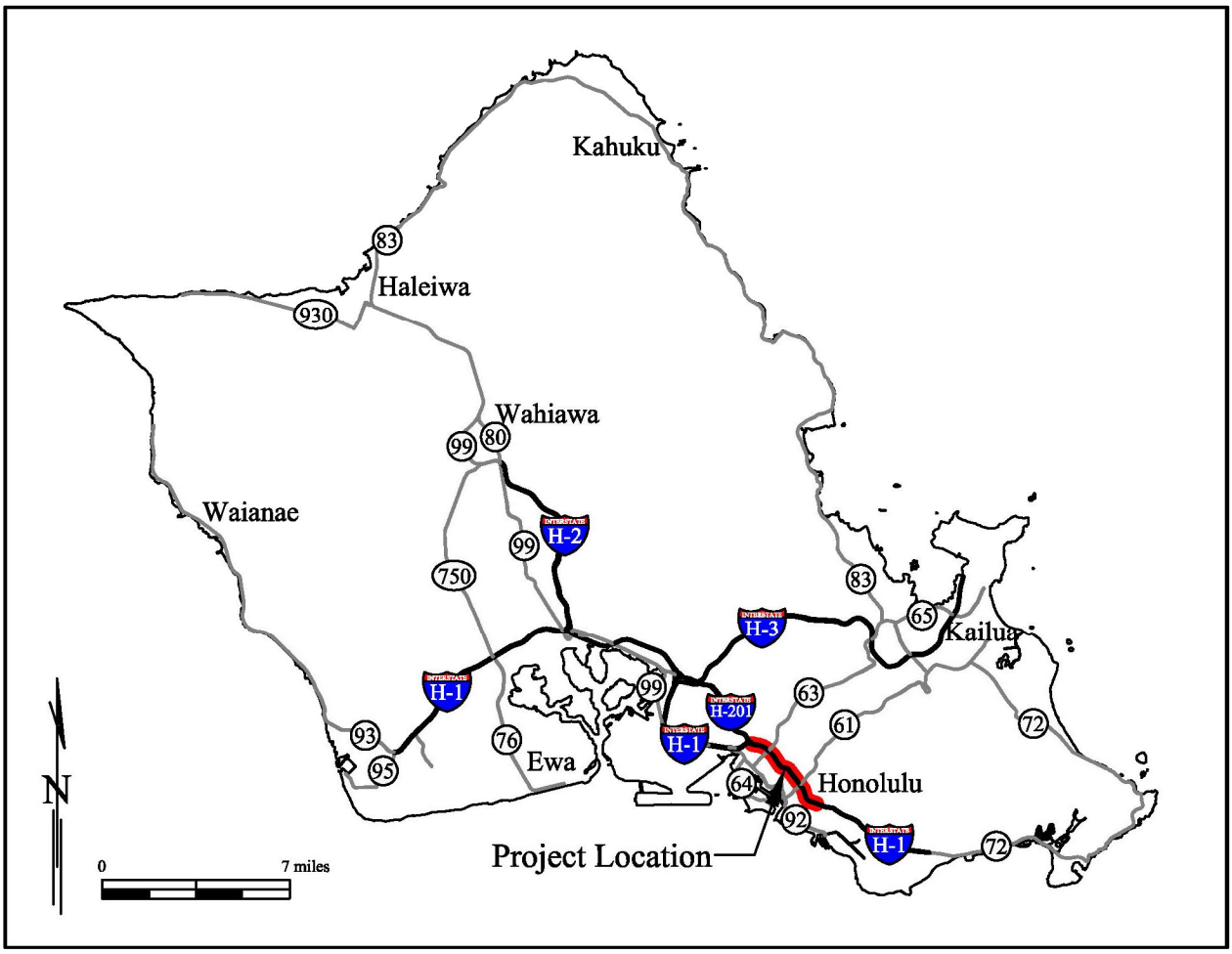


Figure 1-4: State Highway Routes on O‘ahu

There are 11 on- and off-ramps within the proposed project limits to accommodate access to these areas. Congestion within the proposed project limits is the worst near the on- and off-ramps as the outermost lane in each direction becomes a merge/weave lane and the number of through traffic lanes is essentially reduced to two. There is a need for additional through lanes in order to increase vehicle throughput.

The proposed project addresses existing and forecasted traffic congestion for this section of Interstate Route H-1. Congestion can be measured using various performance indicators. A commonly used indicator is the Level of Service (LOS). LOS uses six levels or grades, with letter designations from A through F, to grade the flow of traffic. LOS A represents the best operating conditions, when traffic is free-flowing (low volumes of vehicles moving at speed limit), while LOS F occurs when the vehicle flow is slow, and traffic is backed up. During the traffic capacity evaluation to support the proposed project and this Final EA (Section 2.1 and Appendix F), a number of “hot spots” were studied. The hot spots were generally interstate on- and off-ramps and areas where vehicles “weave” as they position to exit or enter the interstate. The analysis showed that most of these hot spots currently receive grades of E or F. With the ever increasing volume of vehicles moving through the proposed project corridor, the congestion and LOS grades will gradually get worse.

ORTP 2035 indicates that although the future Honolulu Rail Transit Project (HRTP, or rail project) will relieve some congestion, by itself, the HRTP will not be able to keep the traffic conditions in this area from worsening. Additional measures are necessary to address congestion on Interstate Route H-1 between the Middle Street merge and University Avenue (OMPO, April 2011).

1.2.3 Improve Vehicular Safety

The proposed project also improves safety for those travelling on the interstate. Safety improvements will be accomplished by (a) correcting pavement deficiencies, (b) installing a glare screen on the median divider, (c) installing new pavement markings, and (d) addressing congestion.

Pavement roughness can affect a vehicle's handling, reduce the driver's ability to steer, as well as compromise braking force or stopping distance. In both dry and wet conditions, an unpredictable surface can become hazardous. When visibility is low, such as at night or when it is rainy, drivers cannot always see the roadway deficiencies in order to make the best driving decisions, which can lead to accidents. Research by the FHWA indicates that up to 70% of wet-weather crashes could be prevented with better road surface texture and friction.

The glare screen will improve safety by shielding drivers from the headlights of on-coming traffic. Drivers can be distracted or their visibility reduced by the headlights of on-coming traffic. The glare screen will eliminate this for standard height vehicles. New pavement markings, installed after repaving is complete, will be more visible than the existing pavement markings. These two factors will improve visibility when headlights are in use.

The proposed project is also intended to improve safety by addressing congestion. As part of the Highway Safety Improvement Program, HDOT's Traffic Branch has conducted numerous traffic accident analyses for this portion of interstate. One analysis conducted in 2010 (HWY-TS 2.5230) studied three of the most recent years of accident data from Likelike Interchange to Punchbowl Street. The study found that the majority of the accidents were rear-end collisions, involving vehicles in the same travel lane in the middle of the day. Another study, conducted from Middle Street to the Vicinity of Ward (HWY-TS 12-2.0325) looked at accident data from 2007 to 2009 and also found that the majority (57%) of the accidents within the project limits were rear-end collisions. These types of accidents are typically related to congestion. By improving the LOS or traffic conditions within the proposed project limits, the number of these types of accidents may be reduced.

1.3 Basic Transportation Assumptions

Although congestion and pavement condition are considered operational issues that are experienced in real-time and often addressed with short-term strategies, transportation planning requires that remediation be considered within the context of long-range goals and objectives for the region. The O'ahu Regional Transportation Plan (ORTP) is the long-range transportation plan for O'ahu; it identifies transportation projects for the next 25 years. The current ORTP, which was adopted in April 2011, has a planning horizon of 2035. For consistency, the environmental analyses within this document use the same planning horizon to identify potential proposed project impacts. The transportation network assumptions within this document are

consistent with the Statewide Transportation Improvement Program (STIP) and ORTP 2035. When discussing the No Build Alternative, it is assumed that all projects in the STIP and ORTP 2035 are implemented with the exception of the proposed project and a highway widening project[1]. Projects that would be implemented in the vicinity of the proposed project are discussed Section 1.4.1.

In addition to the improvements identified within the STIP and ORTP 2035, the analyses within this document assume that the various strategies that HDOT, together with the City and County of Honolulu, have implemented to reduce congestion and maintain roadway reliability within the project limits will continue. These strategies include:

- Incident Management – Freeway Service Patrol (FSP) is a free program to assist motorists whose vehicles have stopped on the interstate. Interstate back ups are avoided by providing quick emergency road-side service and removing traffic impediments.

Freeway Safety Patrol

- Work Zone Management – Construction on Interstate Route H-1 typically occurs at night or on weekends when traffic volumes are at their lowest. Lane closures and construction zones are also posted on the HDOT's website for public notice so that highway users can plan accordingly or take alternate routes.
- Traveler Information – Live traffic video is available via internet, providing motorists with images of traffic conditions within the project limits. Motorists are able to monitor conditions at five locations along Interstate Route H-1: H-1 & Middle Street; H-1 & Vineyard Off-Ramp; H-1 & Liliha Street; Pali Highway & H-1 Off-Ramp; and H-1 & Ward Avenue. Motorists are also able to monitor conditions on parallel routes in the area. Providing travelers with real-time information helps them to make informed route choices.

1.4 Alternatives Addressed in this EA

Two main alternatives are analyzed in this EA, the No Build and Build Alternative. The proposed project is the Build Alternative. Other alternatives that were considered but rejected are discussed in Section 1.5.

[1] ORTP 2035 identifies Project No. 32 – Interstate Route H-1 Widening, Ola Lane to Vineyard Boulevard. This concept is discussed in the Section 1.5 and is excluded from the No Build Alternative.

1.4.1 No Build Alternative

The No Build Alternative assumes that the projects listed within the STIP and ORTP 2035 would be built by 2035, with the exception of the proposed project and related Interstate Route H-1 widening. Transportation improvements in the vicinity of the project limits include:

- Interstate Route H-1, Diamond Head–bound (east-bound) between Ward Avenue on-ramp to the University Avenue Interchange -- this project would provide operational improvements to improve traffic flow.
- Interstate Route H-1, ‘Ewa-bound (west-bound) between Lunalilo Street on-ramp and Vineyard Boulevard off-ramp -- this project would modify weaving movements to improve operations and capacity.
- Honolulu Rail Transit Project (HRTP) -- this project would construct a fixed-guideway system between East Kapolei and Ala Moana Shopping Center.

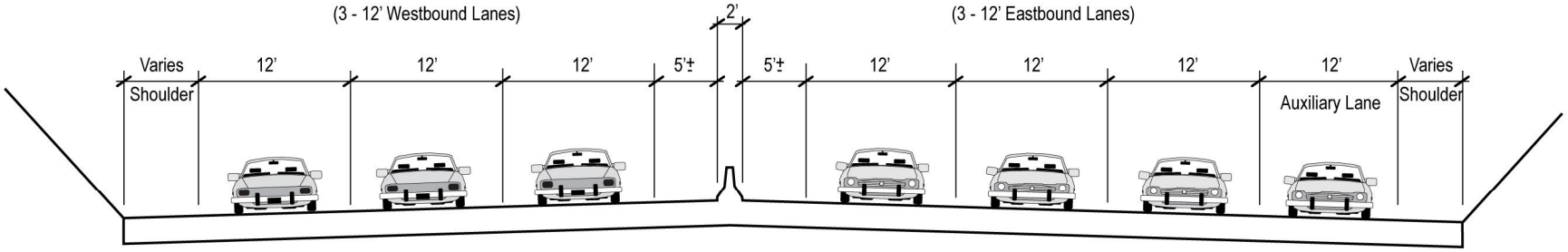
The No Build Alternative assumes that the existing three-lane cross-section would remain in the bulk of the project area as shown in Figure 1-5.

1.4.2 Build Alternative

The Build Alternative consists of the following activities:

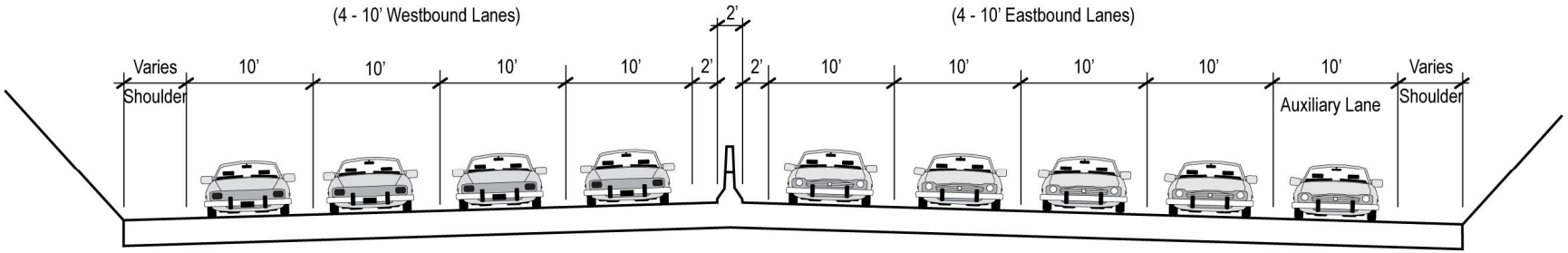
- Rehabilitating pavement, and resurfacing, as necessary, from Likelike Highway to Miller Street (see Figure 1-3), including on and off ramps;
- Replacing the Highway lighting system from roughly Middle Street to Vineyard Boulevard on-ramp;
- Restriping to create an additional lane in both the Diamond Head-bound (east-bound) and ‘Ewa-bound (west-bound) direction throughout the project area (Figure 1-1);
- Installing a concrete glare screen on the median barrier from Likelike Highway to Miller Street.
- Widening the Nu‘uanu Stream Bridge roughly 5 feet on the makai (downstream) side in order to accommodate four through lanes and one exit lane in the diamond head-bound (east-bound) direction.
- Making minor modifications to support the fourth through lane, including storm drain, grade, and structural component modifications at select and discrete locations throughout the project area.

The following sections describe the attributes of the Build Alternative in more detail. The information provided is based on preliminary engineering work. As HDOT consults with project stakeholders and advances the design, modifications or additions to the Build Alternative are possible. Any additional features will be kept within the existing Interstate Route H-1 right-of-way.



Typical Section - Current Condition

Not to Scale



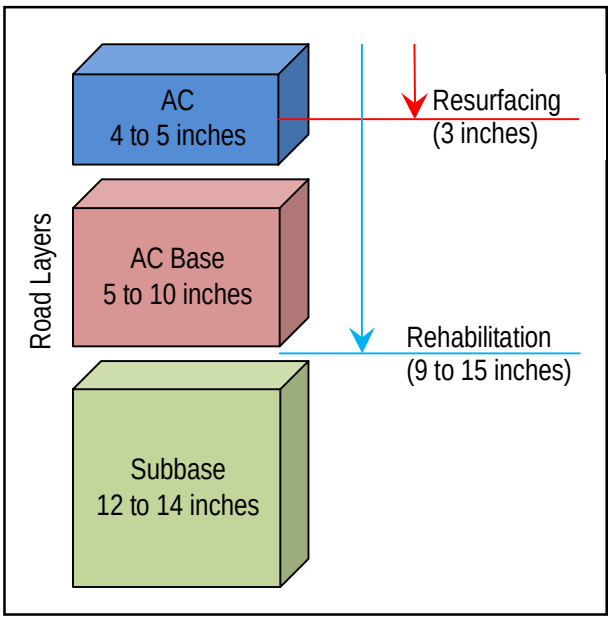
Typical Section - Proposed Condition

Not to Scale

Figure 1-5: Cross Section of Interstate Route H-1 (Existing and Proposed)

Pavement Rehabilitation

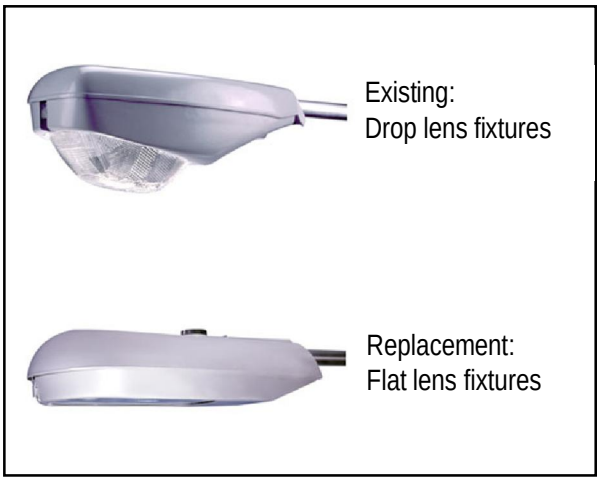
Some level of rehabilitation will occur throughout the area identified in Figure 1-3. All lanes of Interstate Route H-1 and portions of the on and off ramps in the project area will be rehabilitated. Two levels of rehabilitation will be employed, as deemed appropriate for each area. The two levels are illustrated to the right and are:



1. Resurfacing, which involves removing the top three inches of asphaltic concrete (AC) and replacing it with a fresh layer of AC. This will be done in areas with what is considered normal wear and tear.
2. Rehabilitation, which involves removing and replacing all the AC and portions of the AC base. The thickness of the AC and AC base layers vary, together they range between 9 and 15 inches. This will be done in areas with what is considered moderate to severe distress.

Highway Lighting Replacement

The Build Alternative will replace existing highway lighting. The replacement will involve removing the current drop lens fixtures and replacing them with new flat lens fixtures. The location and spacing of the light standards will also be adjusted as necessary to provide sufficient lighting according to AASHTO's Roadway Lighting Design Guide (2005). The new lighting will be installed within the existing Interstate Route H-1 right-of-way, but a construction easement will be required to install some of the replacement lighting in the vicinity of Farrington High School, the Kalihi-Pālama Library, and Bishop Museum. The general area of the construction easements are illustrated on Figure 1-6. The construction easements will be roughly 15 feet wide parallel with and along the existing Interstate Route H-1 right-of-way.



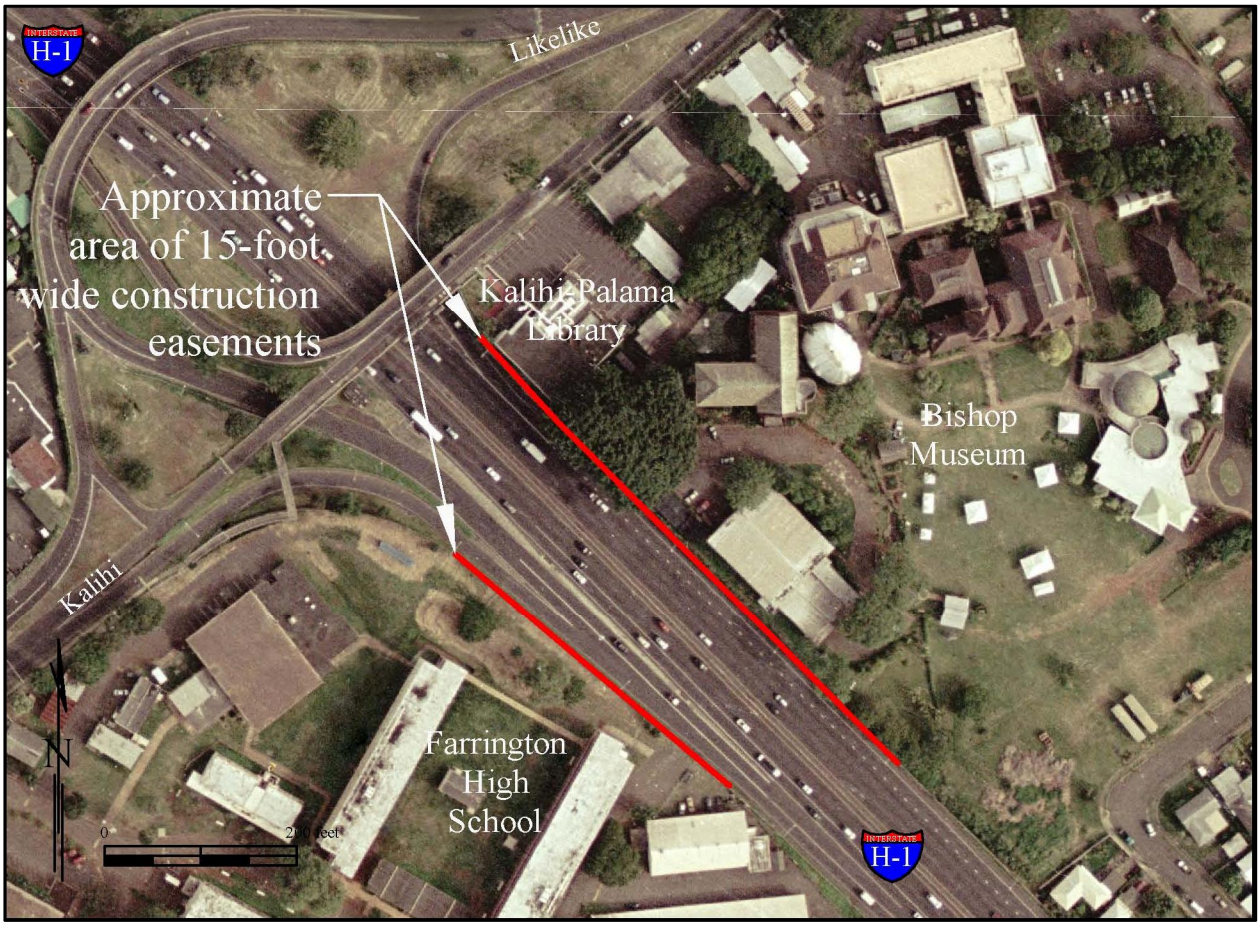
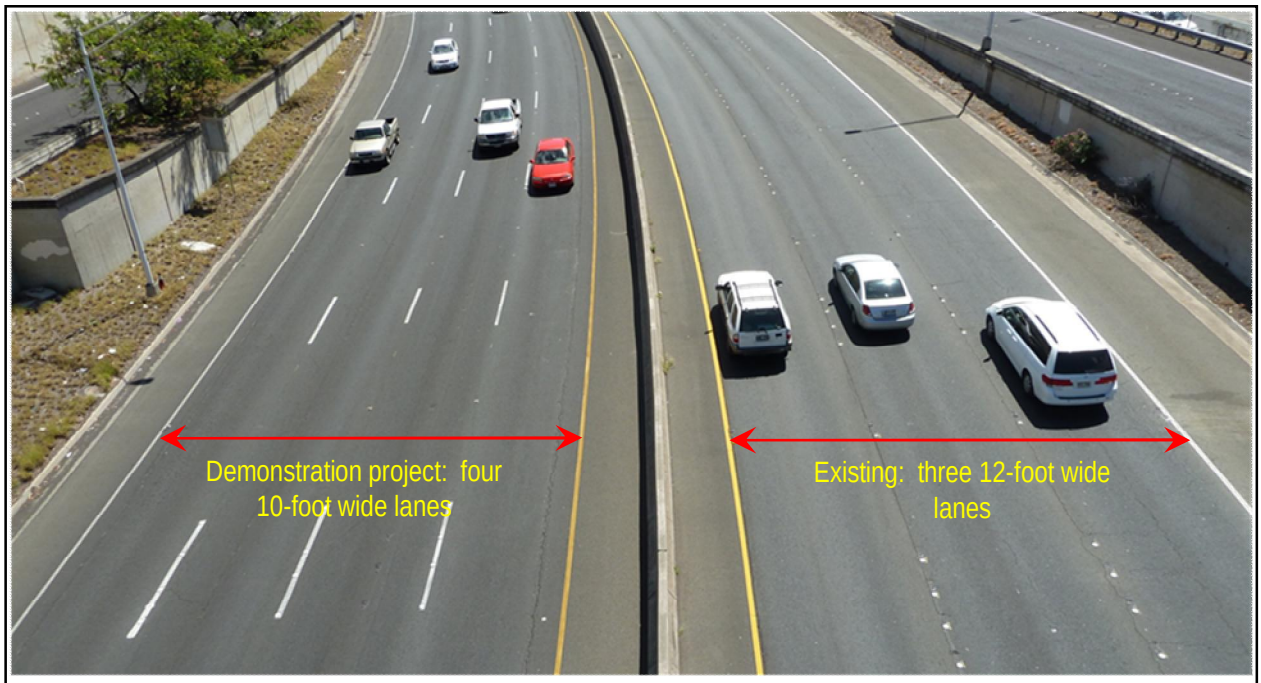


Figure 1-6: Construction Easements for Lighting Replacement

The replacement will comply with the Hawaii Night Sky Protection Act (HRS Chapter 201). HRS Chapter 201 requires that new and replacement outdoor fixtures in counties with populations of at least 100,000 be fully shielded and have a correlated color temperature of 4,000 Kelvin or less beginning July 1, 2014. The new lenses limit the way light is emitted, directing light downward, such that it is not as visible from overhead and the sides. Seabirds passing overhead have been known to be confused by the light emitted from the drop lens style fixtures. The new fixtures with flat lenses will help to prevent the seabirds from becoming confused. The lighting system will be replaced from roughly Middle Street to the Vineyard Boulevard on-ramp.

Restriping

After Interstate Route H-1 is rehabilitated, it will be permanently restriped. Temporary striping may be necessary during the proposed project's construction. Proposed permanent restriping will begin in the Diamond Head-bound (east-bound) direction near the Middle Street merge and terminate in the vicinity of Ward Avenue (see Figure 1-1) where the "Interstate Route H-1, Lane Reconfiguration Demonstration Project, Pali Highway to Punahou Street" began; this is a distance of roughly 3.5 miles. In the west-bound direction, restriping will begin near the Pali Highway Off-ramp where the "Interstate Route H-1, Lane Reconfiguration Demonstration Project, Pali Highway to Punahou Street" ends and terminate near the Interstate Route H-1 Airport Viaduct off-ramp, a distance of roughly 2.8 miles.



Demonstration project 4 lanes 'Ewa (west) –bound and existing 3 through lanes Diamond Head (east) –bound, at Miller Street

Restriping the interstate with narrower travel lanes, median, and shoulder widths to create an additional fourth through lane is a lower cost alternative to widening the interstate. Figure 1-5 provides a typical section that will result from the proposed restriping. No new right-of-way will be necessary. Space for the additional lane will be achieved by reducing the existing 12-foot wide travel lanes to 10 feet wide, the 3.5-foot to 5-foot wide median will be reduced to 1.5 feet to 4 feet wide, and shoulder widths will be narrowed from 2 to 10 feet to 1.5 to 8 feet. Auxiliary or merging lanes will range in width from 10 to 11 feet.

The proposed 10-foot wide travel lanes are a departure from the American Association of State Highway and Transportation Officials (AASHTO) design guidelines which advise 12-foot interstate lane widths, therefore an exception to the design guidelines will be obtained from the FHWA for the narrower lane widths. FHWA approved a variance for the narrow lanes on the "Interstate Route H-1, Lane Reconfiguration Demonstration Project, Pali Highway to Punahou Street".

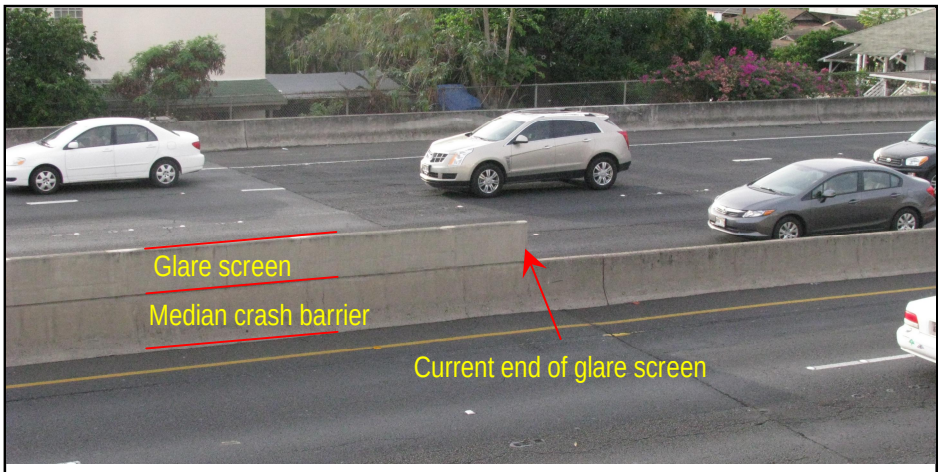
In coordination with the narrower lanes, the speed limit within the proposed project area will be reduced to 45 miles per hour (mph) from the current 50 mph. Advisory signs of 35 and 40 mph will be placed in select locations, such as around the horizontal curves or in vertical sags, due to the limited sight distance at these locations. Signs advising motorists of the narrow lane conditions will also be posted.

Median Glare Screen

A concrete glare screen will be placed atop the existing concrete median barrier. Similar glare screens have been built on adjacent portions of Interstate Route H-1. Glare screens are installed

to block the headlights of vehicles travelling the opposite direction from creating glare and distracting drivers.

The glare screen will increase the height of the current median barrier by roughly 2 feet. The glare screen will be constructed using concrete.



Glare screen

Widening Nu‘uanu Stream Bridge

Interstate Route H-1 crosses Nu‘uanu Stream between the A‘ala Street and Nu‘uanu Street overpasses (Figure 1-7). The existing bridge was built in 1964 and originally accommodated three 12-foot wide lanes in each direction but HDOT modified the Diamond Head-bound (east-bound) lanes in 2006 to accommodate four 11-foot wide lanes – three through lanes and one auxiliary lane. The modification in 2006 was done to allow for weaving between the Liliha Street on-ramp and the Pali Highway off-ramp and was found to improve interstate operation. The bridge will be widened roughly 5 feet on the makai side in order to provide sufficient room for five 10-foot wide lanes – four through lanes and one auxiliary lane.

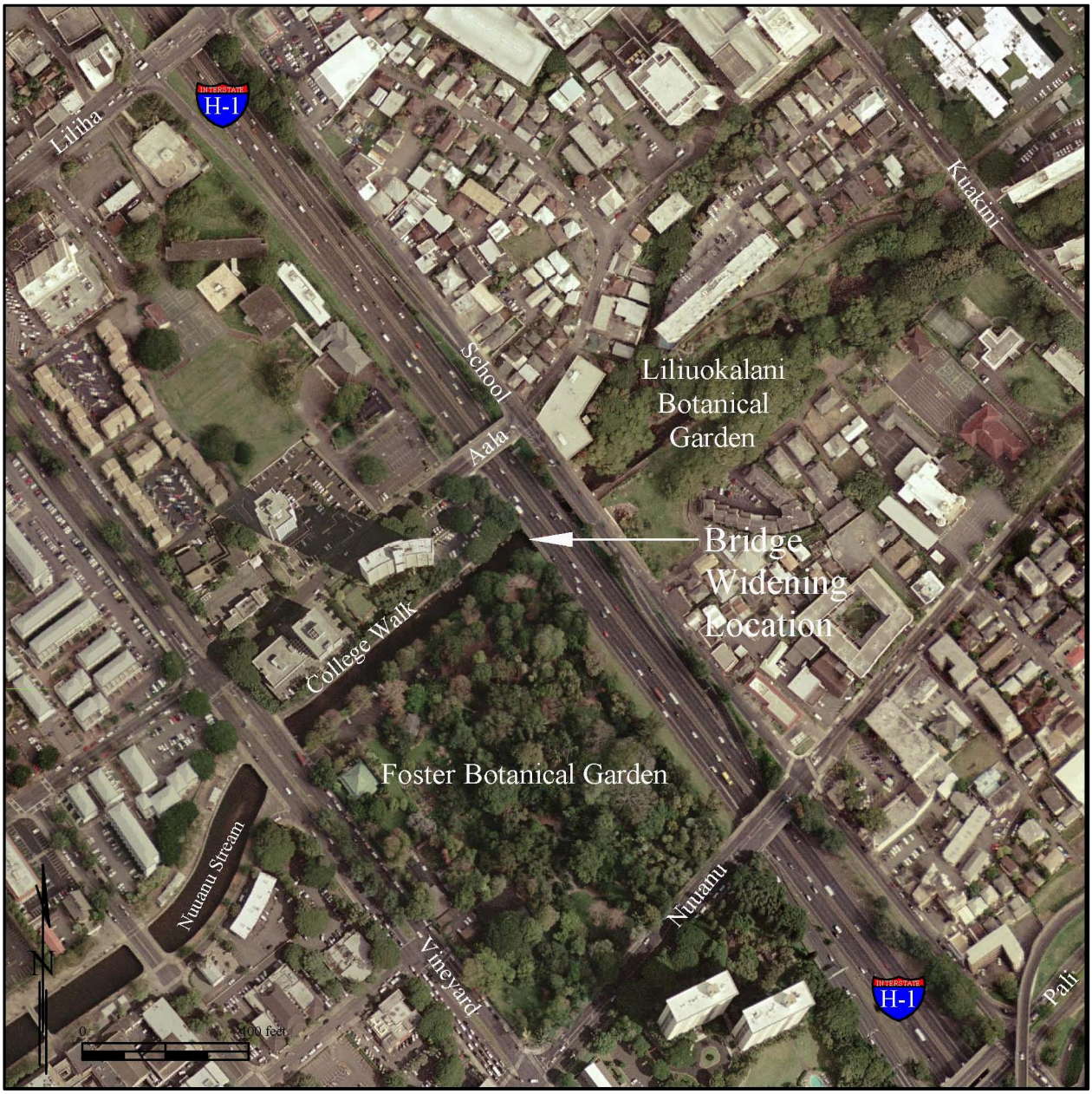
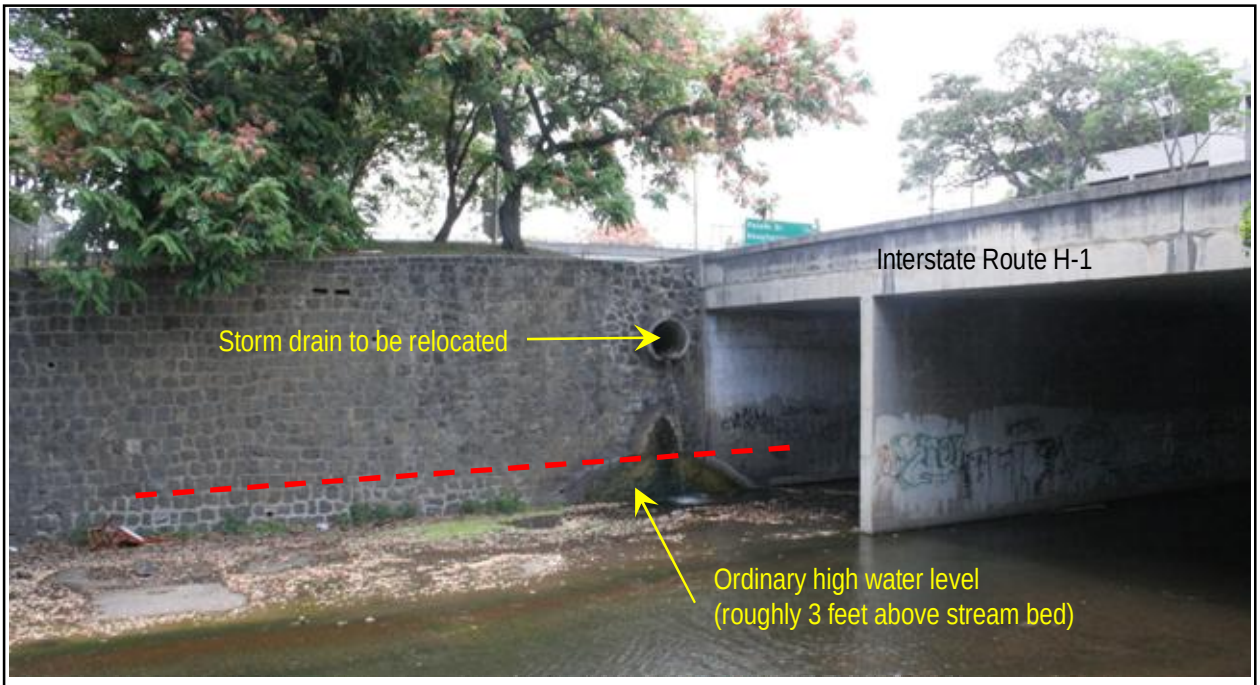


Figure 1-7: Nu‘uanu Stream Bridge Location

The photograph of the Nu‘uanu Stream Bridge below illustrates current conditions in the area where the bridge will be widened. The photograph shows a storm drain pipe currently located in the area of the bridge widening. The storm drain pipe will be moved further makai, roughly five feet, to make room for the widened bridge.



Nu'uanu Stream Bridge, makai-'Ewa side

HDOT is committed to avoiding dredging materials from the channel or placing fill within the stream channel during the widening of Nu'uanu Stream Bridge and relocation of the storm drain pipe. To achieve this, HDOT will require, in the bid documents, that the contractor perform all work above the ordinary high water level in the stream. One possible method to conduct the work above the ordinary high water level includes the following:

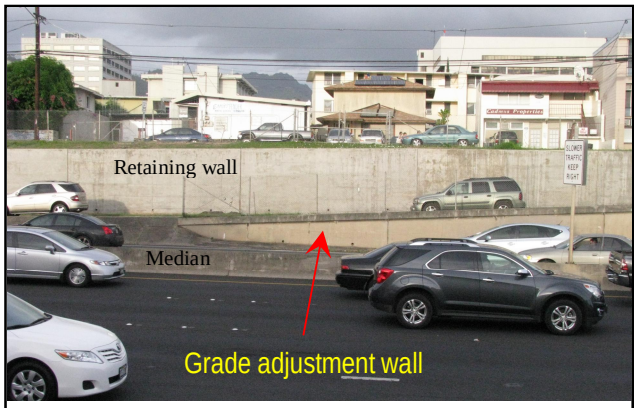
- Dredging is not considered to be needed due to the channelized nature of the stream.
- Designing the improvements so that no permanent structural components will be placed below the ordinary high water level.
- Lowering materials into the channel from the deck of the interstate without the need for heavy equipment in the stream.
- Mounting temporary horizontal beams on the sidewalls and vertical walls of the existing bridge above the water level.
- Building a temporary solid scaffold on those horizontal beams as a work platform and to capture any falling materials to prevent discharges to the stream.
- Removing the temporary scaffold materials using equipment on the deck of the interstate without the need for heavy equipment in the stream.

Minor Modifications and Improvements

In order to accommodate and support the fourth through lane, minor modifications to existing ancillary facilities will be necessary. These include the following:

- Minor modifications to the storm drain system, primarily inlet modifications. Currently the storm drain inlets are at-grade grate inlets on both the median and shoulder. The inlets are adjacent to or beyond the marked travel lanes. The restriping of the interstate to four through lanes will bring the marked travel lanes much closer to the existing grate inlets, or, in some cases, the new travel lane may be on a portion of the grate. Portions of the storm drain inlets that fall within the travel lane will be reconstructed to prevent them from becoming obstructions.

- Grade adjustment walls or curbing, similar to the one shown, will be constructed or existing walls extended at on- and off-ramp locations where the slopes will become less gradual due to minor pavement widening within the right-of-way. New walls or curbing will be necessary at the following locations:
  - Likelike Highway on-ramp, Diamond Head-bound (east-bound);
  - Liliha Avenue on-ramp, Diamond Head-bound (east-bound);
  - Pali Highway on-ramp, Diamond Head-bound (east-bound);
  - Vineyard Boulevard on-ramp, Diamond Head-bound (east-bound);
  - Punchbowl Street on-ramp, ‘Ewa-bound (west-bound);
  - Hālona Street on-ramp, ‘Ewa-bound (west-bound); and
  - School Street on-ramp, ‘Ewa-bound (west-bound).



Grade adjustment wall (between interstate through lanes and entrance ramp)

  For locations that require retaining walls, the walls will be relatively short compared to most existing retaining walls and overpass abutments in the project area.

- Some existing retaining walls will be shifted slightly. One example is that the existing retaining wall near the Pali Highway off-ramp, Diamond Head-bound (east-bound) will be reconstructed at the new roadway width associated with Nu‘uanu Stream Bridge widening.

- Overhead directional and destination signs will be modified and several new warning signs will be installed. New 45 mph speed limit signs will replace the existing 50 mph signs. Advisory signs of 35 mph and 40 mph will be placed in select locations, such as around the horizontal curves or in verticals sags, due to the limited sight distance at these locations. Signs advising motorists of the narrow lane conditions will also be posted.

- The curb and guardrail on the Pālama Separation Structure (between Vineyard Boulevard and School Street Diamond Head-bound (east-bound) overpass) will be removed and the bridge rail reconstructed.
- Some safety barriers (i.e. crash attenuators) and guardrails will also be relocated.

1.5 Alternatives Considered But Rejected

This section consists of brief descriptions of alternatives (or components of alternatives) that were considered, and the reason(s) for rejecting them. Responses received during the EA scoping or pre-assessment consultation period are also included. For a description of comments received, see Section 3.0 and Appendix A of this Final EA.

The following alternatives were considered for this project:

- Widening of Interstate Route H-1 at Middle Street
- Ramp Metering at on-ramps

1.5.1 Interstate Widening

As the name indicates, the Interstate Widening Alternative would provide congestion-relief and operational improvements by physically widening the interstate in the project area to add additional lanes rather than re-striping within the existing right-of-way, as proposed by the Build Alternative (Section 1.4.2). The widening would require reconstruction of a number of bridges and underpasses and additional large retaining walls. The widening would also require significantly expanding the interstate right-of-way; the additional right-of-way needs would require acquisition of private property along the existing interstate and relocation of businesses and residences. The right-of-way acquisition would result in significant land use impacts due to the relocation of a large number of businesses and residences.

This alternative was rejected from further consideration because the construction costs and right-of-way acquisition plus relocation costs would be prohibitive.

1.5.2 Ramp Metering

Ramp metering uses traffic signals at interstate on-ramps to regulate the number of vehicles entering the interstate. The system works by allowing one vehicle to utilize the interstate entrance at a time. Each vehicle is given a 5 to 15 second delay before the next vehicle is given the green light to enter the interstate, thereby slowing or delaying the number of cars entering the interstate at any given time.

Example of ramp metering

While ramp meters have been shown to be effective in decreasing congestion and reducing the number of accidents caused by merging traffic on the mainland, this alternative was dismissed from further

consideration because of the congestion that would be created by back-ups on surface streets, specifically near interstate entrances. There are 11 on-ramps between the Middle Street merge and the vicinity of Ward Avenue. These on-ramps are too short to accommodate the queue of vehicles that would be waiting to enter the interstate; therefore, the queue would extend onto surface streets. This would result in pushing congestion and backups onto local streets, creating gridlock conditions on those streets.

1.6 Project Cost and Schedule

Based on conceptual engineering, the estimated construction cost of the proposed project (the Build Alternative discussed in Section 1.4.2) is $30 million (2012 dollars). Based on customary cost sharing formulas, the State of Hawai‘i will be responsible for 20 percent of the costs, and FHWA will contribute 80 percent.

The estimated project schedule is as follows:

- Completion of environmental review, planning, and final design: Spring 2013
- Advertise/Award Construction Contract: Spring 2013
- Start Construction: Summer 2013
- End Construction: Fall 2014

1.7 Permits and Approvals

Table 1-1 lists approvals and permits that may be required for the Build Alternative. As noted below, activities to obtain some approvals are complete and others are ongoing and will be finalized prior to completion of the environmental review process. Other permits and approvals will be obtained during final design or prior to construction.

~~It is anticipated that~~ Through consultation with the US Army Corps of Engineers (USACE), it has been established that a Clean Water Act Section 404 Department of the Army permit will not be needed. Although the proposed project crosses three streams (Kalihi Stream, Kapālama Canal Stream, and Nu‘uanu Stream) and will widen the Nu‘uanu Stream Bridge, as discussed in Section 1.4.2, no dredging or fill of regulatory “Waters of the U.S.” at Nu‘uanu Stream is anticipated. Coordination with the USACE ~~is ongoing and~~ is documented in Appendix A of this Final EA.

Table 1-1: Permits and Approvals

Agency	Permit or Approval	Current Status
~~Department of the Army (DA); (U.S. Army Corps of Engineers, Regulatory Branch)~~	~~Section 404 of the Clean Water Act, Department of the Army Permit~~	~~Coordination on-going (Appendix A); permit unlikely necessary.~~
FHWA	Section 106 of the National Historic Preservation Act	Coordination on-going with State Historic Preservation Officer (SHPO), Native Hawaiian Organizations (NHOs), and stakeholders. See Section 2.15 and Appendix A.
FHWA	Design exception	Coordinating with FHWA.
Department of Land and Natural Resources (DLNR), Historic Preservation Division (SHPD)	HRS Chapter 6E-8 Review	Coordination on-going in conjunction with Section 106.
U.S. Fish and Wildlife Service (USFWS)	Section 7 of the Endangered Species Act	~~Informal consultation on-going (Appendix A).~~ No effect. No species or habitat in project area.
Department of Business, Economic Development, and Tourism (DBEDT); Office of Planning	Hawai'i Coastal Zone Management Program Consistency concurrence	Application provided in Appendix C.
Department of Health (HDOH), Clean Water Branch (CWB)	National Pollutant Discharge Elimination System (NPDES) Permit for storm water discharges relating to construction activities	Notice of General Permit Coverage (NGPC) received from HDOH (Appendix G)
~~HDOH, CWB~~	~~Water Quality Certification (WQC), Section 401 of the Clean Water Act~~	~~Only required if Section 404 permit is required.~~
HDOH, Indoor Air and Radiological Branch	Noise Permit	Application provided in Appendix D.
HDOH, Indoor Air and Radiological Branch	Noise Variance	Application provided in Appendix E.
~~DLNR, Commission on Water Resource Management (CWRM)~~	~~Stream Channel Alteration Permit (SCAP)~~	~~Coordination on-going.~~

2.0 AFFECTED ENVIRONMENT, POTENTIAL IMPACTS, AND PROPOSED MITIGATION

This section describes existing conditions in the area potentially affected by the project. It also describes immediate and long-term environmental impacts of the proposed action, including construction-phase impacts. Where an impact is considered adverse, measures proposed to avoid, minimize, or mitigate the impact are specified.

2.1 Roadways and Traffic

Details regarding the Interstate Route H-1 traffic conditions and the analyses performed to support the proposed project are provided in the Traffic Capacity Evaluation report included in Appendix F. The following sections summarize that report.

2.1.1 Existing Conditions

Interstate Route H-1 is a divided freeway that begins in Kapolei and ends in Kāhala. It is the primary east-west thoroughfare for commuters traveling between west Oʻahu and downtown Honolulu and points further east. This corridor experiences extremely heavy traffic volumes during the morning, mid-day, and afternoon peak hours and is a vital transportation link. The section of Interstate Route H-1 that will be rehabilitated by the proposed project provides direct access to Kalihi, Nuʻuanu, and the downtown business district.

The "Middle Street merge" is at the ʻEwa (west) end of the proposed project. The Middle Street merge is where three lanes from Interstate Route H-201 (the Moanalua Freeway) and two lanes from Interstate Route H-1 (the Lunalilo Freeway) merge or diverge. The Diamond Head (east) end of the proposed project is roughly Ward Avenue where the proposed project will connect to the "Interstate Route H-1, Lane Reconfiguration Demonstration Project, Pali Highway to Punahou Street." The demonstration project restriped Interstate Route H-1 to make four through lanes from roughly Punahou Street to the Pali Highway off-ramp in the ʻEwa (west) bound direction and from roughly Ward Avenue to Punahou Street in the Diamond Head (east) bound direction.

Traffic Volumes

Interstate Route H-1 consists of three 12-foot wide through lanes (Figure 1-5) in both the Diamond Head (east) bound and the ʻEwa (west) bound directions throughout the project limits. Figure 2-1 and Table 2-1 summarize the peak hour traffic volumes on Interstate Route H-1 at four locations within the project area.

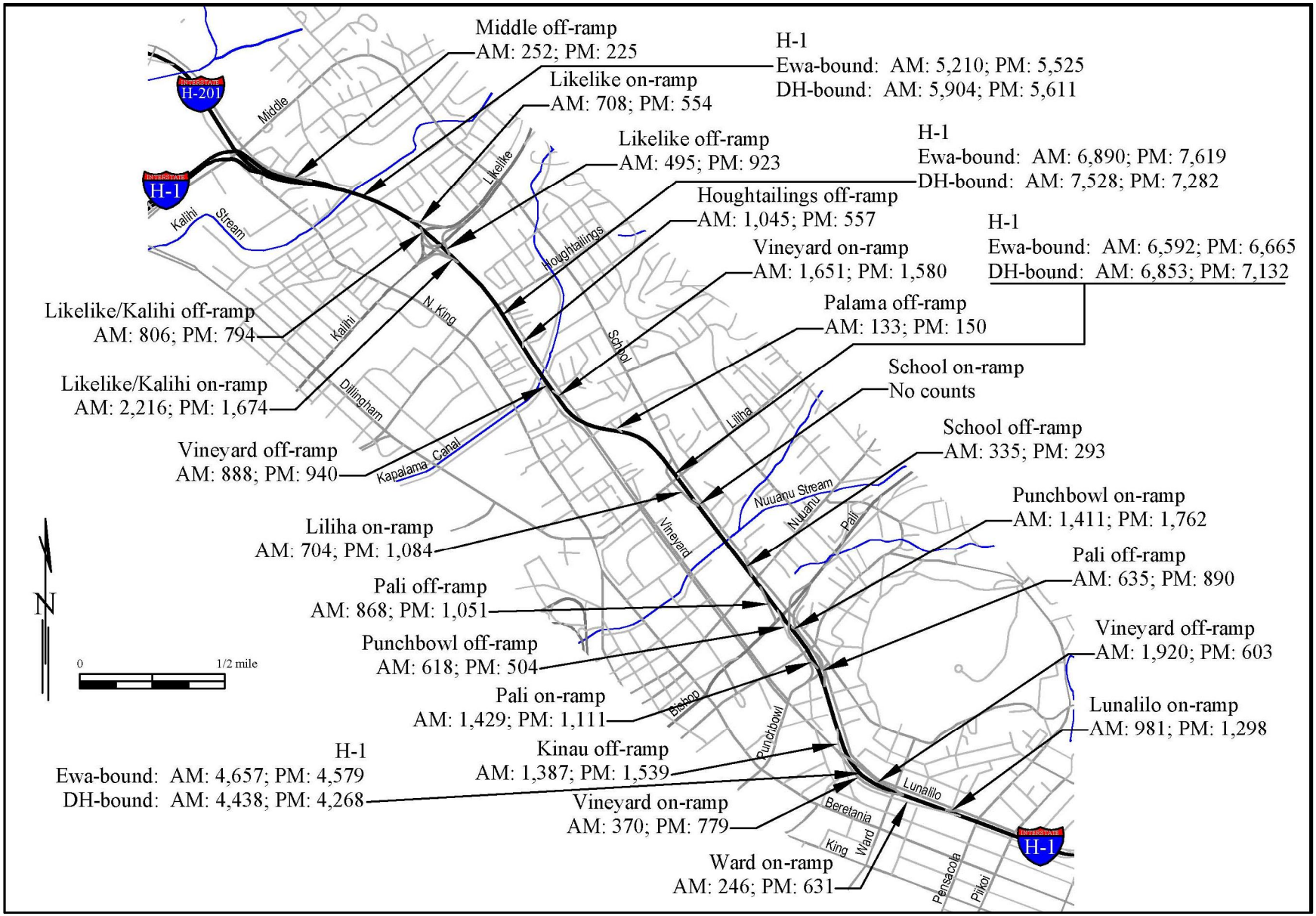


Figure 2-1: Peak Hour Traffic Volumes in Project Corridor (Interstate Route H-1 and Ramps)

Table 2-1: Peak Hour Traffic Volumes on Interstate Route H-1

Location	WB AM Peak	WB PM Peak	EB AM Peak	EB PM Peak
Gulick Street overpass	5,210	5,525	5,904	5,611
Houghtailings underpass	6,890	7,619	7,528	7,282
Liliha Street overpass	6,592	6,665	6,853	7,132
0.1 mile west of Ward Avenue	4,657	4,579	4,438	4,268
Notes: WB = west-bound ('Ewa-bound); EB = east-bound (Diamond Head-bound); AM = morning; PM = afternoon Traffic counts from Tuesday, March 12 and Thursday, April 23, 2009.				

There are also auxiliary lanes in this section of Interstate Route H-1; auxiliary lanes are those lanes that are not through lanes but extend from at least from an on-ramp to the next off-ramp and facilitate weaving movements between vehicles entering or exiting the interstate. The auxiliary lanes are listed in Table 2-2.

Table 2-2: Interstate Route H-1 Auxiliary Lanes in Project Limits

Diamond Head-bound (east-bound)	'Ewa-bound (west-bound)
• One outside lane between Middle Street merge and Likelike Highway, which is used as an exit only lane at Likelike Highway. • One outside lane between Likelike Highway on-ramp and Vineyard Avenue off-ramp. • One outside lane between Liliha Street on-ramp and Pali Highway off-ramp. • One outside lane between Pali Highway on-ramp and Kinau Street off-ramp.	• One outside lane between Lunalilo Street on-ramp and Vineyard Boulevard off-ramp. • One outside lane between Vineyard Avenue on-ramp and Likelike Highway off-ramp. • One outside lane between Likelike Highway on-ramp and the Middle Street off-ramp.

With 12 on/off-ramps in the ‘Ewa (west) bound direction and 10 on/off-ramps in the Diamond Head (east) bound direction (Table 2-3), the outermost (right) through lane in each direction acts as a merge/weave lane. The merging and weaving around the on/off-ramps effectively reduces the number of through lanes from three to two lanes. Figure 2-1 and Table 2-3 summarize the peak hour traffic volumes on the various on/off ramps within the project area.

Table 2-3: Peak Hour On/Off-Ramps Traffic Volumes, Interstate Route H-1

Ramp	Morning Peak	Afternoon Peak
‘Ewa (west) Bound		
Lunalilo Street on-ramp	981	1,298
Vineyard Boulevard off-ramp (exit 22)	1,920	603
Pali Highway off-ramp (exit 21B)	635	890
Punchbowl Street on-ramp	1,411	1,762
School Street off-ramp (exit 21A)	335	293
School Street on-ramp	No counts	No counts
Pālama Street off-ramp (exit 20C)	133	150
Vineyard Boulevard on-ramp	1,651	1,580
Houghtailings Street off-ramp (exit 20B)	1,045	557
Likelike Highway/Kalihi Street off-ramp (exit 20A)	495	923
Likelike Highway/Kalihi Street on-ramp	708	554
Middle Street off-ramp (exit 19A)	252	225
Diamond Head (east) Bound		
Likelike Highway/Kalihi Street off-ramp (exit 20A)	806	794
Likelike Highway/Kalihi Street on-ramp	2,216	1,674
Vineyard Boulevard off-ramp (exit 20B)	888	940
Liliha Street on-ramp	704	1,084
Pali Highway off-ramp (exit 21A)	868	1,051
Punchbowl Street off-ramp (21B)	618	504
Pali Highway on-ramp	1,429	1,111
Kinau Street off-ramp (exit 22)	1,387	1,539
Vineyard Boulevard on-ramp	370	779
Ward Avenue on-ramp	246	631
Notes: Counts collected on various weekdays 2009		

Other pertinent information gathered during the traffic study includes:

- In the Diamond Head (east) bound direction, the morning peak hour is 6:00 to 7:00 a.m. and the afternoon peak hour is 5:00-6:00 p.m.
- In the ‘Ewa (west) bound direction, the morning peak hour is 6:30-7:30 a.m. and the afternoon peak hour is 5:00-6:00 p.m.
- The percentage of trucks on Interstate Route H-1 ranges from 2.8% (west of Ward Avenue) to 3.4% (at the Kapālama Canal). The six-lane Route 92, Nimitz Highway, which is parallel to this section of Interstate Route H-1, is the major truck route due to its proximity to shipping ports and industrial areas. The percentage of trucks on Nimitz Highway is 5.5%.

Traffic Queuing

A queuing analysis was performed in order to document the existing conditions at two key locations: (a) the Middle Street merge in the Diamond Head (east) bound direction, and (b) Likelike Highway/Kalihi Street makai (south) bound on-ramp to Interstate Route H-1 ‘Ewa (west) bound.

At the Middle Street merge, the inside Interstate Route H-1 lane (left lane of two lanes) must merge into the outside Interstate Route H-201 lane (right lane of three lanes). The merge is further complicated by the fact that beyond that initial merge, the outside (right) fourth lane is an exit-only auxiliary lane for the Likelike Highway/Kalihi Street off-ramp. The combination of the two interstates at the Middle Street merge creates turbulence and a bottleneck that causes spillover onto both facilities in the up-stream direction. Queuing observations were made on both Interstate Routes H-1 and H-201 on Tuesday, October 23, and Thursday, October 25, 2012; measurements were taken with the gore point for the eastbound Middle Street merge as the starting point. The observations are summarized in Table 2-4.

Table 2-4: Diamond Head (east) Bound Queuing Summary at Middle Street Merge

Time Period	Average Back of Queue	Average Back of Queue Landmark	Maximum Back of Queue	Maximum Back of Queue Landmark
Interstate Route H-1, Airport Viaduct				
6:30 to 8:30 a.m.	7,050 feet; 1.3 miles	100 feet west of Lagoon Drive	10,650 feet; 2.0 miles	100 feet east of Camp Catlin Road
1:30 to 2:30 p.m.	No congestion or queuing observed			
4:30 to 6:00 p.m.	2,500 feet; 0.5 mile	Just past off-ramp to Nimitz Highway	4,650 feet; 0.9 mile	At exit to Nimitz Highway
Interstate Route H-201, Moanalua Freeway				
6:30 to 8:30 a.m.	3,800 feet; 0.7 mile	Between Kikowaena Street and Funston Road overpasses	5,000 feet; 0.9 mile	Off-ramp to North King Street
1:30 to 2:30 p.m.	No congestion or queuing observed			
4:30 to 6:00 p.m.	No congestion or queuing observed			

In the morning peak period there is typically no queuing at the Likelike Highway/Kalihi Street makai (south) bound on-ramp to Interstate Route H-1 ‘Ewa (west) bound. In the afternoon peak period there is a maximum queue length of roughly 130 feet. The lack of significant queuing is due to the fact that the on-ramp forms an auxiliary lane to Interstate Route H-1 ‘Ewa (west) bound toward the airport; therefore, vehicles entering Interstate Route H-1 at this location do not have to merge with other traffic to enter the freeway. The short afternoon queue is due to the fact that Interstate Route H-1 is operating at a level of service of F (Table 2-5); therefore, even though the on-ramp forms a new auxiliary lane, the congestion on the interstate immediately impacts the auxiliary lane.

Traffic Operations

Operating conditions are expressed as a qualitative measure known as Level of Service (LOS) with letter designations ranging from A through F, with LOS A representing free-flow conditions and LOS F representing over-capacity conditions. Various analytical tools and models were used to establish the existing LOS.

During the morning and afternoon peak hours especially, Interstate Route H-1 is a heavily utilized facility. Demand routinely surpasses capacity and congestion form at locations with heavy turbulence (caused by lane reductions or ramp and weaving movements). Any congestion quickly propagate up-stream resulting in queuing congestion beyond the specific trouble spots. As shown in Table 2-5, 11 of the 15 ramp and weaving segments of Interstate Route H-1 operate at LOS E or F in the morning peak hour, afternoon peak hour, or both.

Table 2-5: Existing Peak Hour Level of Service

Segment	Type	Morning (AM) Peak LOS	Afternoon (PM) Peak LOS
‘Ewa (west) Bound			
Lunalilo Street on-ramp to Vineyard Boulevard off-ramp	Weaving	F	D
Pali Highway off-ramp	Off-ramp	D	D
Punchbowl on-ramp	On-ramp	D	F
School Street off-ramp	Off-ramp	D	D
Pālama Street off-ramp	Off-ramp	F	F
Vineyard Boulevard on-ramp to Likelike Highway off-ramp	Weaving	F	F
Likelike Highway off-ramp	Off-ramp	F	F
Likellike Highway on-ramp to Middle Street off-ramp	Weaving	F	F
Middle Street off-ramp	Off-ramp	B	A
Diamond Head (east) Bound			
Middle Street on-ramp to Likelike Highway off-ramp	Weaving	F	E
Likelike Highway on-ramp to Vineyard Boulevard off-ramp	Weaving	F	F
Liliha Street on-ramp to Pali Highway off-ramp	Weaving	E	F
Punchbowl off-ramp	Off-ramp	F	F
Pali Highway on-ramp to Kinau off-ramp	Weaving	E	E
Vineyard Boulevard on-ramp	On-ramp	B	C
Notes: LOS = level of service (A through F)			

2.1.2 Potential Impacts

No Build Alternative

Under the No-Build Alternative, traffic conditions would remain unchanged and over time gradually worsen as demand for transportation through the corridor continues to increase.

Build Alternative

The proposed conditions generally involve restriping the Diamond Head (east) bound and ‘Ewa (west) bound lanes of Interstate Route H-1 to create four 10-foot wide through lanes (Figure 1-5). Lateral clearances will be about two feet. In most cases the existing auxiliary lanes (Table 2-2) will be retained and on/off-ramps will maintain their existing configuration as far as the length provided for merging and weaving. The only significant changes in auxiliary lanes and on/off-ramps will be as follows:

- The Pali Highway off-ramp in the ‘Ewa (west) bound direction will become a divergent off-ramp instead of the existing exit-only auxiliary lane. The proposed project will restore the condition that existing prior to the implementation of the demonstration project.
- The Likelike Highway/Kalihi Street off-ramp in the ‘Ewa (west) bound direction will become a divergent off-ramp instead of the existing exit-only auxiliary lane (Figure 2-2).
- The Likelike Highway/Kalihi Street on-ramp to Interstate Route H-1 ‘Ewa (west) bound will become a merge condition instead of the current condition where it forms a new auxiliary lane to Interstate Route H-1 to the airport (Figure 2-2). There will be a roughly 250-foot long tapered on-ramp, which will provide opportunity for vehicles entering the interstate to find sufficient gaps in traffic to merge.
- The Likelike Highway/Kalihi Street off-ramp in the Diamond Head (east) bound direction will become a divergent off-ramp instead of the existing exit-only auxiliary lane (Figure 2-2).

In assessing the effect the proposed project will have on traffic conditions, it was assumed that traffic volumes will be the same as in the existing condition. The comparison was made solely on the basis of the existing lane configurations versus the proposed lane configurations using various analytical tools and modeling software.

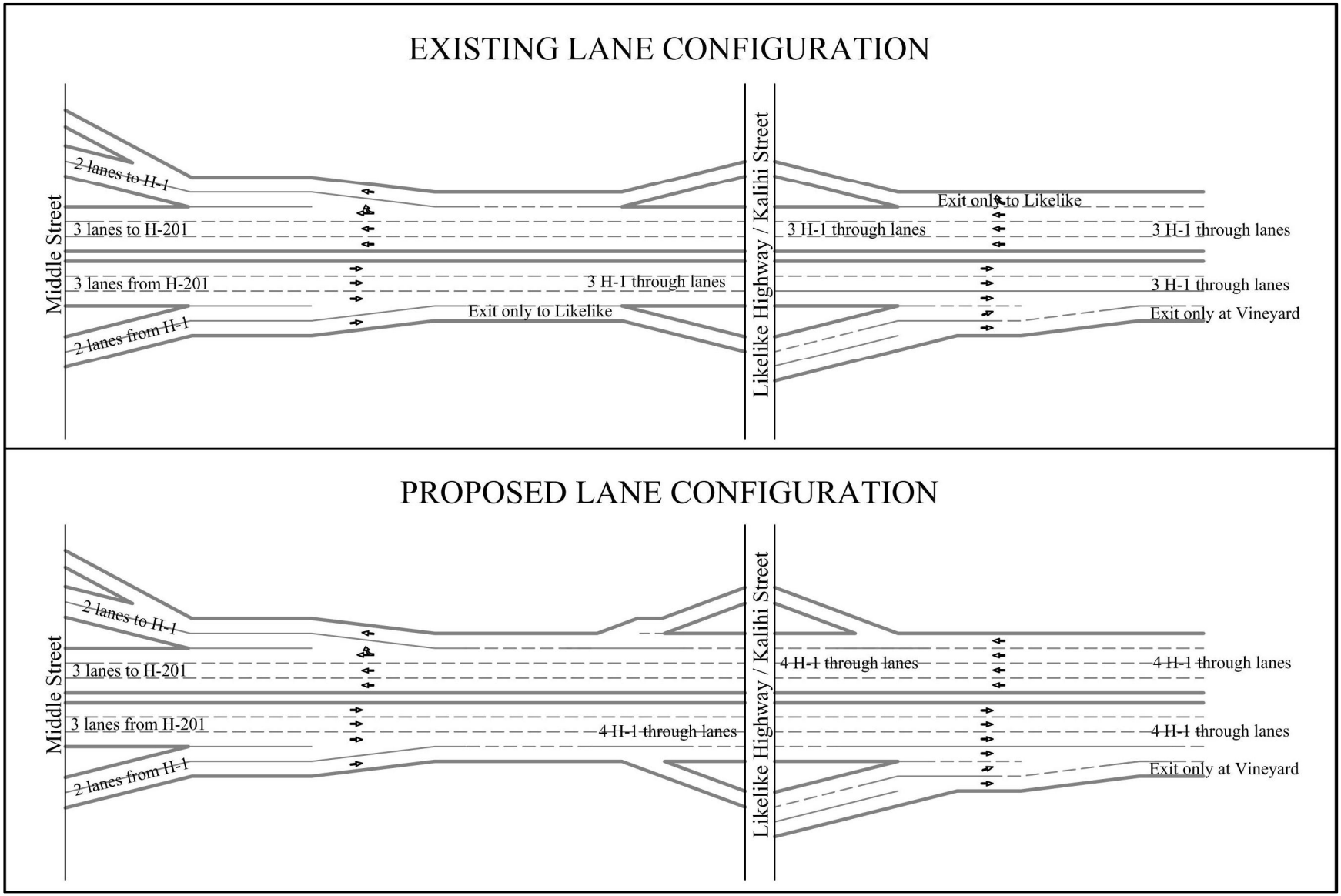


Figure 2-2: Proposed Lane Configuration, Middle Street Merge to Kalihi Interchange

Traffic Queuing

The presence of a fourth Interstate Route H-1 through lane under Likelike Highway/Kalihi Street (Figure 2-2) will have a beneficial impact on the traffic queuing on Interstate Routes H-1 and H-201 upstream of the Middle Street merge. The average queue length on Interstate Route H-1, beginning at the merge, is projected to decrease from roughly 7,000 feet currently (Table 2-4) to roughly 3,400 feet if the proposed project is implemented. The average queue length on Interstate Route H-201, beginning at the merge, is projected to decrease from roughly 3,800 feet currently (Table 2-4) to roughly 2,000 feet if the proposed project is implemented.

The afternoon queue on the Likelike Highway/Kalihi Street to Interstate Route H-1 ‘Ewa (west) bound on-ramp is anticipated to get a little longer, however, this queue is not anticipated to require mitigation. Modeling indicates that the maximum queue length on the on-ramp will be 270 feet in the afternoon peak hour, which has been identified as the critical peak period. By comparison, in the existing condition, the maximum queue length is roughly 130 feet. The on-ramp has a long, 1,500-foot “run up” lane that will prevent the anticipated maximum queue from causing major turbulence or spillover onto Likelike Highway/Kalihi Street upstream of the interstate.

Traffic Operations

The proposed Interstate Route H-1 rehabilitation will improve the public's mobility on this vital transportation link in O'ahu's primary urban center. The proposed project will enhance the motorist's driving experience and further the pavement's service life expectancy.

The added fourth through lane will increase Interstate Route H-1 capacity. This benefit outweighs the loss of capacity due to (a) decreasing the lane widths and lateral clearances, and (b) reducing the speed limit to 45 mph. In the existing condition, 11 of the 15 ramp segments analyzed and listed in Table 2-6 operate at LOS E or F during the morning peak hour, afternoon peak hour, or both. The proposed project will generally improve operations at 13 of 15 ramp segments during the morning peak hour, afternoon peak hour, or both (Table 2-6).

Table 2-6: Summary of Existing and Predicted Peak Hour Level of Service

Segment	Type	Morning (AM) Peak LOS		Afternoon (PM) Peak LOS	
		Exist.	Pro.	Exist.	Pro.
'Ewa (west) Bound					
Lunalilo Street on-ramp to Vineyard Boulevard off-ramp	Weaving	F	F	D	D
Pali Highway off-ramp	Off-ramp	D	C	D	C
Punchbowl on-ramp	On-ramp	D	D	F	D
School Street off-ramp	Off-ramp	D	C	D	C
Pālama Street off-ramp	Off-ramp	F	C	F	C
Vineyard Boulevard on-ramp to Likelike Highway off-ramp	Weaving	F	E	F	E
Likelike Highway off-ramp	Off-ramp	F	D	F	E
Likellike Highway on-ramp to Middle Street off-ramp	Weaving	F	F	F	F
Middle Street off-ramp	Off-ramp	B	A	A	A
Diamond Head (east) Bound					
Middle Street on-ramp to Likelike Highway off-ramp	Weaving	F	E	E	E
Likelike Highway on-ramp to Vineyard Boulevard off-ramp	Weaving	F	E	F	D
Liliha Street on-ramp to Pali Highway off-ramp	Weaving	E	D	F	E
Punchbowl off-ramp	Off-ramp	F	D	F	D
Pali Highway on-ramp to Kinau off-ramp	Weaving	E	C	E	C
Vineyard Boulevard on-ramp	On-ramp	B	A	C	B

Notes: LOS = level of service (A through F); Exist. = existing; Pro. = proposed.
= LOS improvement of at least one grade.

2.1.3 Mitigation Measures

The proposed project is itself a mitigation measure for the current traffic congestion in the area. Because the impacts are anticipated to be beneficial in nature, no mitigation is proposed.

2.2 Safety

2.2.1 Existing Conditions

Lane Width

Lane width may affect the number of accidents on a roadway. Standard lane width is 12 feet in order to provide a buffer to (a) absorb the small random deviations of vehicles from their intended path, and (b) allow for correction in near-accident circumstances.

Under federal law, trucks can measure up to 8.5 feet wide, not including such extensions as mirrors and footholds. City buses are roughly 8.5 feet wide, not including side mirrors, as well. Passenger vehicles are typically about 6 feet wide, and large trucks and SUVs are often about 7 feet wide. Side-view mirrors usually add between 6 and 12 inches to vehicle total width. Wider vehicles are currently required and will continue to be required to obtain permits from the HDOT prior to travelling.

Traffic Accident Analysis

A traffic accident analysis study was performed for the proposed project. Accident data from the three most recent years for which data is available (2007 through 2009) were studied. The study found:

- Accidents occur in both the eastbound and westbound directions almost equally, with eastbound (Diamond Head-bound) slightly higher.
- The most frequent type of human factor reported was inattention.
- Accidents occurred in all lanes of travel.
- The majority of collisions occurred during daylight hours.
- The majority of collisions were rear-end collisions (57%). The next most frequent type of collision was sideswipe in the same direction (9%).
- The location with the greatest number of major traffic accidents was eastbound near the Nu‘uanu Street Overpass and the Pali Highway Overpass.

2.2.2 Potential Impacts

No Build Alternative

Under the No-Build Alternative, no changes to safety conditions would occur.

Build Alternative

All vehicles that routinely travel on Interstate Route H-1 could be accommodated within 10 foot wide lanes. However, when lanes are made narrower than 12 feet, the chance of accidents may increase if other modifications are not made in concert with the lane width reduction. The accident type that becomes more likely when lanes are narrowed is primarily sideswipe collisions. When the shoulders become smaller, then the chance of motor vehicles hitting fixed objects on or just beyond the shoulder, such as signs and utility poles, also increases.

The National Cooperative Highway Research Program (NCHRP) Reports 330 and 369 have examined the use of narrow lanes. These publications point out that although many agencies that have implement narrower lanes reported no adverse traffic operational or safety problems, other agencies reported some specific problems including increases in sideswipe crashes and the straddling of lane lines by trucks and buses. The analyses concluded that shoulders and narrow lanes can be effectively used to increase capacity in congested urban corridors.

2.2.3 Mitigation Measures

Research indicates that, when travel lanes are narrowed, the speed limit should be adjusted to mitigate safety concerns. The speed limit in the proposed project area is currently 50 miles per hour (mph). The speed limit will be reduced to 45 mph to reduce the likelihood of accidents occurring due to the narrower lanes.

The traffic accident analysis recommends considering the installation of milled centerline and shoulder rumble strips as safety measures to reduce the frequency and severity of accidents. However, this measure would do little or nothing to reduce the number of the majority of collisions that occurred from 2007 to 2009, which were rear-end collisions. In addition, the median and shoulder width will be insufficient to install milled rumble strips without the rumble strips becoming safety hazards themselves. Therefore, milled rumble strips will not be installed.

It has been HDOT's policy that Nimitz Highway be the primary truck corridor in the vicinity of downtown Honolulu. This is generally feasible due to Nimitz Highway's proximity to Port of Honolulu facilities. ~~Should the proposed project move forward,~~ HDOT will contact freight haulers and reinforce the policy of Nimitz Highway being the main truck corridor.

2.3 Emergency Response

Improved traffic flow during peak hours as a result of implementing the proposed project will allow vehicles to move over to more effectively accommodate passage of emergency vehicles. HDOT is collaborating closely with Honolulu Police, Fire, and Emergency Medical Services to ensure that all access concerns are fully addressed.

2.4 Noise

A traffic noise study was performed for this project and documented in the Noise Technical Report in Appendix B. The following sections summarize study methods and findings. The study was performed per the Highway Noise Policy and Abatement Guidelines prepared by HDOT and FHWA and dated April 25, 2011 (http://hawaii.gov/dot/highways/hwy-l/110425_FINAL_Hwy%20Noise%20and%20Abatement%20Guidelines.pdf).

2.4.1 Characteristics and Measurement of Sound

Several characteristics of sound affect the impact it has. These include the sound level (loudness), frequencies involved, period of exposure to the sound, and changes or fluctuations in the sound levels during exposure. Noise is defined as any sound that is undesirable or interferes with normal human activities.

Loudness is measured in decibels (dB). Because sound pressure levels vary widely within the range of human hearing, the dB scale is logarithmic. Since the human ear does not perceive all pitches or frequencies equally, noise levels are adjusted, or weighted, to correspond to human hearing. This adjusted unit is known as the A-weighted decibel, or dBA.

Since dBA describes a noise level at just one moment, and very few noises are constant, ways of describing noise over extended periods are needed. One way is to describe fluctuating noise observed over a period as if it were a steady, unchanging sound. This type of an average is called the equivalent sound level, Leq. Leq is the constant sound level that, for a given situation and time period (e.g., 1-hour, Leq(1); hourly, Leq(h); or 24 hours, Leq(24)), conveys the same sound energy as the actual time varying sound.

Generally, changes in sound levels of less than 3 dBA are barely perceptible to most listeners, but an increase of 10 dBA is perceived as a doubling (or halving for a decrease) of noise levels.

2.4.2 Noise Abatement Criteria

The Federal Highway Administration (FHWA) has developed Noise Abatement Criteria (NAC), which were adopted by the State of Hawai‘i (Table 2-7). According to the HDOT’s Noise Analysis and Abatement Policy (Noise Policy), a noise impact would occur when predicted traffic noise levels approach or exceed the NAC, or when predicted traffic noise levels substantially exceed the existing noise levels.

In terms of the one-hour Leq(h) noise descriptor, a noise impact could potentially require mitigation if either of the following conditions is predicted to occur:

- Future year traffic noise approaches (is within 1 dBA of) or exceeds the FHWA NAC; or
- Future year traffic noise substantially exceeds (15 dBA or more) the existing ambient noise level.

Table 2-7: FHWA Noise Abatement Criteria

Activity Category	Activity Leq(h) dBA[1]	Criteria[2] L10(h)	Evaluation Location	Description of Activity
A	57	60	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B[3]	67	70	Exterior	Residential.
C[3]	67	70	Exterior	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas Section 4(f) sites, schools, televisions studios, trails, and trail crossings.
D	52	55	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E[3]	72	75	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	----	----	----	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities, (water resources, water treatment, electrical), and warehousing.
G	----	----	----	Undeveloped lands that are not permitted.

Notes: [1] Either Leq(h) or L10(h) (but not both) may be used on a project.
[2] The Leq(h) and the L10(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.
[3] Includes undeveloped lands permitted for this activity category.
Source: Federal Highway Administration

2.4.3 Existing Conditions

Existing and future noise sensitive land uses and activities adjacent to the proposed corridor and nearby major roadways were identified from site inspections and existing mapping. These land use activities include residences, recreation and park areas, and institutions such as schools and churches. All residences along the H-1 project area are Category B and all recreation areas, parks, schools, and similar uses are Category C. Category B and Category C activities have an exterior NAC of Leq(h) 67 dBA (Table 2-7).

In September 2012, 21 short-term (15-minute) measurements were taken at noise sensitive sites located along the project corridor. The measurement sites are illustrated on Figure 2-3. The results of the noise monitoring are summarized in Table 2-8.

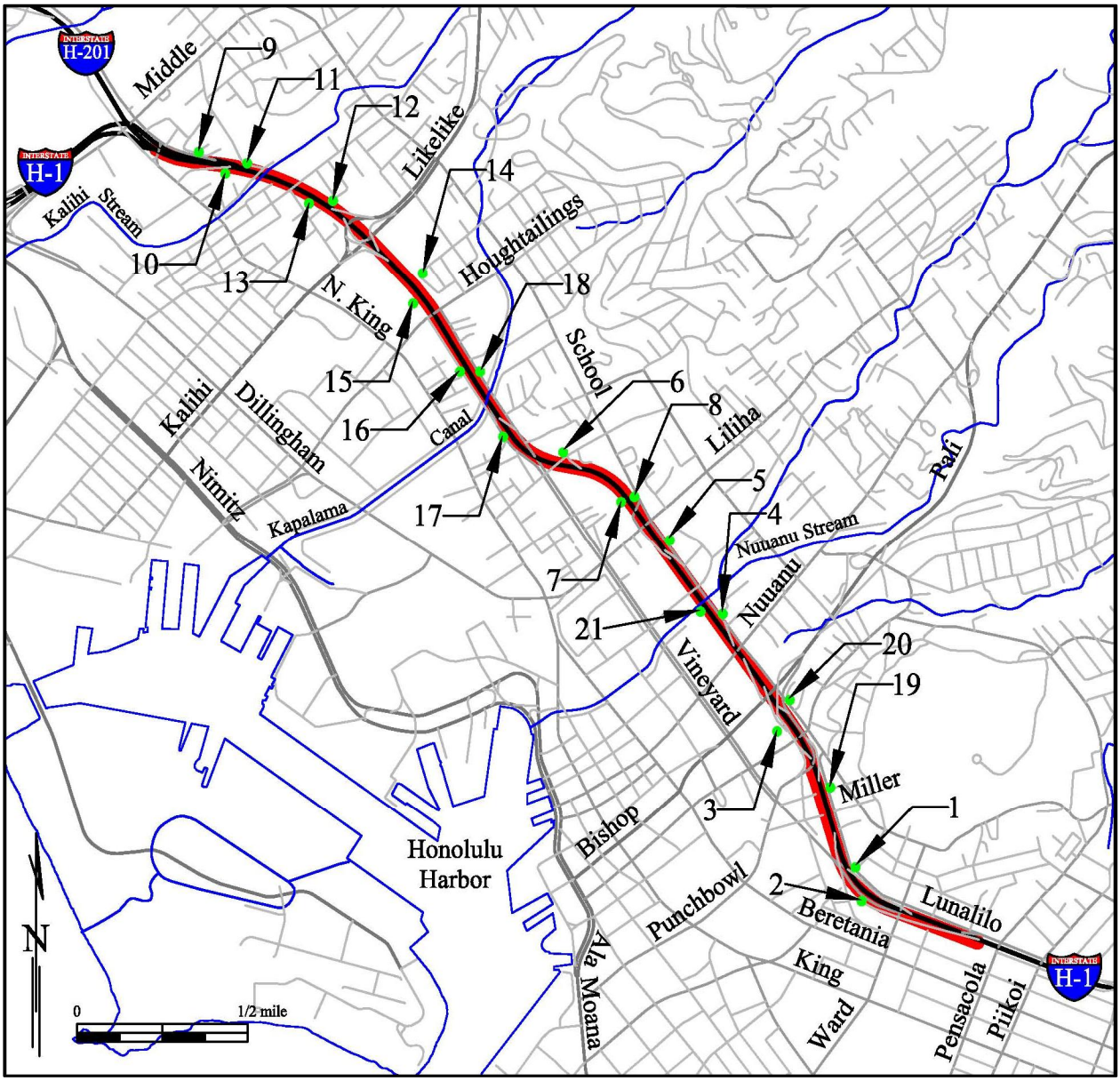


Figure 2-3: Noise Monitoring Locations

Table 2-8: Noise Measurement Data and TNM Model Validation

Site ID	Site Location	Land Use	Date of Measurement and Start Time	Measured Leq(h), dBA	Modeled Noise Level for Calibration Leq(h), dBA	Difference between Modeled and Measured Noise Level Leq(h), dBA
1	1401 Alapai St	Residential	9/18/12; 10:42 a.m.	68	68	0
2	745 Kinalau Pl	Residential	9/18/12; 11:17 a.m.	70	71	1
3	Matsuyama Field	Park	9/18/12; 12:05 p.m.	62	64	2
4	50 N School St	Residential	9/18/12; 1:47 p.m.	70	71	1
5	Puuhue Pl / N School St	Residential	9/18/12; 2:31 p.m.	66	67	1
6	Likelike Elem. School	School	9/18/12; 3:02 p.m.	65	67	2
7	521 Kiapu Pl	Residential	9/18/12; 3:44 p.m.	66	66	0
8	N School St / Kiapu Pl	Residential	9/18/12; 4:05 p.m.	71	72	1
9	Kamehameha IV Rd, #8	Residential	9/18/12; 5:18 p.m.	66	66	0
10	Kalihi Union School	School	9/19/12; 9:44 a.m.	67	69	2
11	1212 Richards Lane	Residential	9/19/12; 10:15 a.m.	71	74	3
12	1242 Nakuina St	Residential	9/19/12; 10:46 a.m.	74	74	0
13	Park at Nakuina St / Beckley St	Park	9/19/12; 11:15 a.m.	67	67	0
14	1269 Kapalama	Residential	9/19/12; 11:50 a.m.	60	62	2
15	Farrington High School	School	9/19/12; 2:01 p.m.	65	64	-1
16	1179 Olomea St	Residential	9/19/12; 2:38 p.m.	72	72	0
17	1081 Olomea St	Residential	9/19/12; 3:03 p.m.	71	69	2
18	1116 Halona St	Residential	9/19/12; 3:44 p.m.	71	72	1
19	326 Magellan Ave	Residential	9/20/12; 9:10 a.m.	71	70	-1
20	112 S School St	Residential	9/21/12; 9:45 a.m.	69	70	1
21	Foster Botanical Garden	Park	9/21/12; 10:30 a.m.	71	71	0

Note : All measurements were taken at outdoor use areas for 15 minutes
Modeled Noise Levels Leq(h) are within 3 dBA of measured values indicating the model is correctly calibrated.

As the noise measurements were taken, traffic volumes were simultaneously counted for all of the measurement sites. The traffic counts used five vehicle classifications: automobiles, medium trucks, heavy trucks, motorcycles, and buses. Vehicle speeds were observed during all measurements and the corridor was driven daily to estimate vehicle speeds during measurement periods. Noise measurements were not taken unless traffic conditions were free-flowing.

Because traffic conditions are typically congested along this section of Interstate Route H-1, with weaving, geometry, and other non-volume factors affecting flow and speed, the free-flow traffic conditions are at times below the posted speed limit. All measurements were started after the morning peak hour which often results in congestion that slows traffic below the H-1 speed limit.

FHWA Traffic Noise Model (TNM) version 2.5 was used to model existing traffic noise levels at the measurement sites. The model estimates the traffic noise level at a receptor location based on the traffic counts made during the measurements. TNM also considers effects of intervening barriers, topography, trees, and atmospheric absorption. By intent and design, noise from sources other than traffic is not included. Therefore, when non-traffic noise, such as aircraft, is considerable in an area, the TNM results can be less than the measured noise levels.

As shown in Table 2-8, there is reasonable agreement between measured and modeled noise levels (within 3.0 dBA) for all the measured sites near Route H-1. This is important because the TNM was used to predict noise levels in both the No Build alternative and the Build alternative at these and other receptors throughout the project corridor and evaluate the effectiveness of potential noise barriers.

2.4.4 Potential Impacts

No Build Alternative

FHWA Traffic Noise Model (TNM) was used to model the noise levels at 64 sites (the 21 measurement sites and 43 selected sites) for the No Build alternative. The No-Build alternative is used as the baseline of future traffic noise levels. Noise levels for the No-Build alternative are identical to existing conditions noise levels as the No Build includes the same lane configuration and peak hour volume as existing conditions.

Input variables to noise modeling and analysis include traffic volumes, speeds and vehicle fleet mix (auto, medium truck, heavy truck, motorcycle, and bus percentages). The noise analysis considers noisiest hour of the day, which is based on maximum hourly traffic volumes under LOS C (i.e. the most vehicles travelling at near the posted speed limit). With three through lanes, LOS C conditions on Interstate Route H-1 is 5,250 vehicles per hour travelling at 50 mph.

The TNM indicates that the NAC of Leq(h) 67 dBA is predicted to be approached or exceeded at 53 sites representing 594 residences, five parks, five schools, and two places of worship (Table 2-9). The No Build results are identical to the existing conditions because Interstate Route H-1 currently operates at and over its capacity.

Figure 2-4 indicates the approximate location of each of the modeled sites listed in Table 2-9, and the colors indicate under what circumstances (existing/No Build and/or Build) the NAC is approached or exceeded.

Table 2-9: Existing, No Build, and Build Predicted Worst-Hour Traffic Noise Levels

Site ID	Location	Number of Receivers Represented	HDOT Noise Abatement Category (Criterion)*	Modeled Existing and No Build Worst-Hour Leq(h), dBA	No Build Impact Type* (S, A/E, or None)	Modeled Build Worst-Hour Leq(h), dBA	Leq(h), dBA Increase (+) or Decrease (-)	Build Impact Type* (S, A/E, or None)
1	Residences on Captain Cook Ave and Magellan Ave between Emerson St and Malele St	120	B	69	A/E	69	0	A/E
2	Residences on Kinalau Pl west of Freeland Pl	2	B	71	A/E	71	0	A/E
3	Matsuyama Field and Royal School	Park/School	C	65	None	65	0	None
4	Residences and Commercial on N School St between Nuuanu and Lili'uokalani Botanical Garden	11	B/E	71	A/E	70	-1	A/E
5	Residences and Commercial on N School St between Frog Ln and Puuhue Pl	5	B/E	67	A/E	66	-1	A/E
6	Likelike Elementary School	School	C	70	A/E	69	-1	A/E
7	Residences on Kiapu Pl north of Liliha St	17	B	70	A/E	71	+1	A/E
8	Residences on N School St between Kiapu Pl and Panaluaau St	6	B	75	A/E	75	0	A/E
9	Residences on Kamehameha IV Rd north of H-1	8	B	72	A/E	69	-3	A/E
10	Kalihi Union School	School	C	70	A/E	70	0	A/E
11	Residences west of Richards Lane and north of H-1	14	B	76	A/E	75	-1	A/E
12	Residences Nakuina St north of Kamehameha Park	6	B	76	A/E	75	-1	A/E
13	Park at Nakuina St / Beckley St	Park	C	69	A/E	68	-1	A/E
14	2nd Row Residences on Kapalama Ave	5	B	66	A/E	68	+2	A/E
15	Athletic Fields at Farrington High School	School	C	67	A/E	64	-3	None
16	Residences on Olomea St between Mao Ln and Kama Ln	10	B	75	A/E	73	-2	A/E
17	Residences on Olomea St north of Palama St	23	B	71	A/E	70	-1	A/E

Site ID	Location	Number of Receivers Represented	HDOT Noise Abatement Category (Criterion)*	Modeled Existing and No Build Worst-Hour Leq(h), dBA	No Build Impact Type* (S, A/E, or None)	Modeled Build Worst-Hour Leq(h), dBA	Leq(h), dBA Increase (+) or Decrease (-)	Build Impact Type* (S, A/E, or None)
18	Residences on Halona St between Kohou St and Kaauwai Pl and Damien Memorial High School	6	B/C	76	A/E	75	-1	A/E
19	Residences on Magellan Ave between Miller St and Pele St	58	B	69	A/E	68	-1	A/E
20	Residences and Commercial on S School St between Lusitana St and Pali Highway	16	B/E	69	A/E	68	-1	A/E
21	Foster Botanical Garden	Park	C	71	A/E	70	-1	A/E
A	Residences on Kinau St between Ward Ave and Freeland Pl	98	B	67	A/E	66	-1	A/E
B	Residences on Lunalilo St between Ward Ave and Emerson St	8	B	72	A/E	71	-1	A/E
C	Residences on Magellan Ave between Frear St and Miller St and Dole Park	6 + Park	B/C	68	A/E	68	0	A/E
D	Residences on Magellan Ave between Pele St and Lolani Ave	22	B	69	A/E	68	-1	A/E
E	Residences on Captain Cook Ave and Miller St	8	B	76	A/E	76	0	A/E
F	Residences on Lusitana St between Miller St and Pele St	6	B	77	A/E	76	-1	A/E
G	Residences on Lusitana St between Pele St and Punchbowl St	19	B	68	A/E	67	-1	A/E
H	Residences on Lolani Ave between Kamamalu Ave and Lusitana St	14	B	71	A/E	70	-1	A/E
I	Residences on H-1 between Pali Hwy and Nuuanu Ave and Queen Emma Gardens	44 + Park	B/C	62	None	62	0	None
J	Residences on N School St between Stillman Ln and Frog Ln	5	B	71	A/E	69	-2	A/E
K	Residences on Panalaau St and Sing Loy Ln	4	B	66	A/E	65	-1	None

Site ID	Location	Number of Receivers Represented	HDOT Noise Abatement Category (Criterion)*	Modeled Existing and No Build Worst-Hour Leq(h), dBA	No Build Impact Type* (S, A/E, or None)	Modeled Build Worst-Hour Leq(h), dBA	Leq(h), dBA Increase (+) or Decrease (-)	Build Impact Type* (S, A/E, or None)
L	Residences on N School St between Kiapu Pl and Panaluaau St	4	B	75	A/E	75	0	A/E
M	Residences on Halona St north of Palama St	5	B	72	A/E	70	-2	A/E
N	Residences and Hawai'i First Samoan Assembly Church on Olomea St and Palama St	5 + Church	B/C	68	A/E	68	0	A/E
O	Residences on Halona St at Auld Ln	4	B	71	A/E	71	0	A/E
P	Residences on Halona St between Auld Ln and Kokea St	6	B	74	A/E	74	0	A/E
Q	Residences on Olomea St between Kohou St and Mao Ln	8	B	74	A/E	73	-1	A/E
R	Residences on Halona St between Kaauwai Pl and Houghtailing St	12	B	74	A/E	71	-3	A/E
S	Hawai'i Kotohira Jinsha – Hawai'i Dazaifu Tenmangu on Kama Ln	Temple	C	74	A/E	72	-2	A/E
T	Residences on Kapalama Ave and Peter Buck Mini Park	3 + Park	B	76	A/E	74	-2	A/E
U	Residences on Kapalama Ave south of Planetarium	7	B	78	A/E	77	-1	A/E
V	Residences on Kaili St west of H-1	6	B	77	A/E	76	-1	A/E
W	Residences on Nakuina St west of H-1	4	B	77	A/E	75	-2	A/E
X	Residences on Pahukui St south of Gulick Ave	8	B	71	A/E	69	-2	A/E
Y	Residences on Gulick Ave and Pinkham St west of H-1	4	B	77	A/E	75	-2	A/E
Z	Residences on Richard Ln and Puanani Ln	8	B	68	A/E	68	0	A/E
A1	Residences on Kamehameha IV Rd north of H-1	4	B	79	A/E	78	-1	A/E
B1	Residences on Middle St north of Ola Ln	6	B	65	None	64	-1	None

Site ID	Location	Number of Receivers Represented	HDOT Noise Abatement Category (Criterion)*	Modeled Existing and No Build Worst-Hour Leq(h), dBA	No Build Impact Type* (S, A/E, or None)	Modeled Build Worst-Hour Leq(h), dBA	Leq(h), dBA Increase (+) or Decrease (-)	Build Impact Type* (S, A/E, or None)
C1	Residences on Ola Ln north of Kamehameha IV Rd	3	B	69	A/E	67	-2	A/E
D1	Kalihi Waena Elementary School	School	C	67	A/E	65	-2	None
E1	Jabulka Pavillion & Planetarium	Park	C	64	None	64	0	None
F1	Outdoor area at Farrington High School	School	C	67	A/E	65	-2	None
G1	Residences on Olomea St and Kokea St	12	B	71	A/E	71	0	A/E
H1	Palama Settlement	Other	E	68	None	66	-2	None
I1	Kauluwela Elementary School / Liliha Public Library	School and Library	C	62	None	62	0	None
J1	Kauluwela Elementary School	School	C	58	None	57	-1	None
K1	Foster Botanical Garden	Park	C	59	None	59	0	None
L1	Foster Botanical Garden	Park	C	60	None	60	0	None
M1	Residences and Commercial on S School St between Pali Hwy and Nuuanu Ave	8	B/E	62	None	62	0	None
N1	Lili'uokalani Botanical Garden	Park	C	69	A/E	68	-1	A/E
O1	Residences on Halona St between Holona and Iao St	2	B	71	A/E	70	-1	A/E
P1	Residences on Halona St north of Iao St	2	B	71	A/E	70	-1	A/E
Q1	Kamehameha Park	Park	C	58	None	57	-1	None

Note: See Table 2-7 for descriptions of Noise Abatement Categories.
Bold = level approaches or exceeds the NAC.
A "Receiver" is an area of frequent human outdoor activity, homes, apartments, motel, hotels, etc.
*Impact Type: S = Substantial Increase (15 dBA or more), A/E = Approach or Exceed NAC
Sites that begin with letters are modeled only sites.

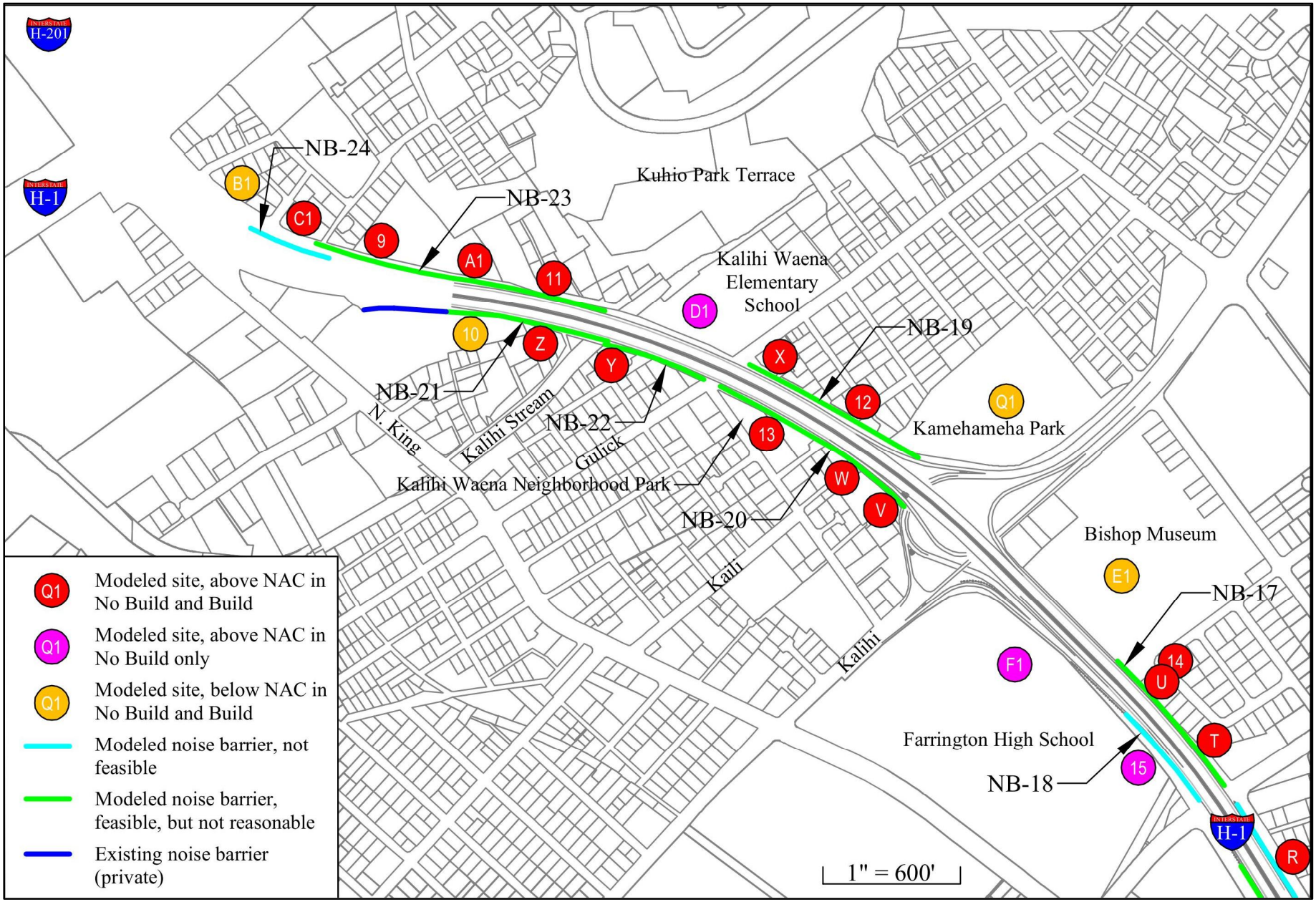


Figure 2-4a: Location of Noise Modeling Sites and Modeled Noise Barriers

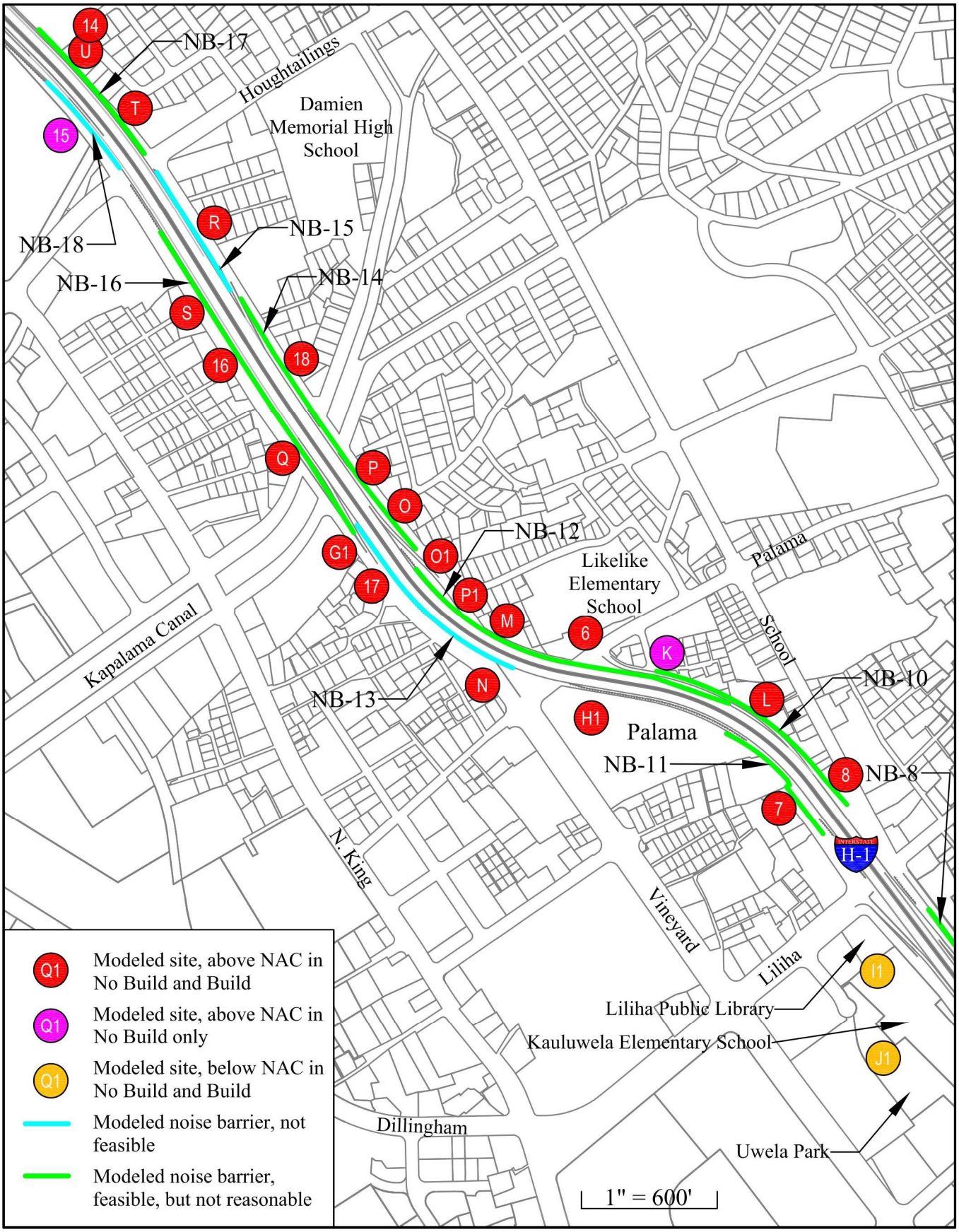


Figure 2-4b: Location of Noise Modeling Sites and Modeled Noise Barriers

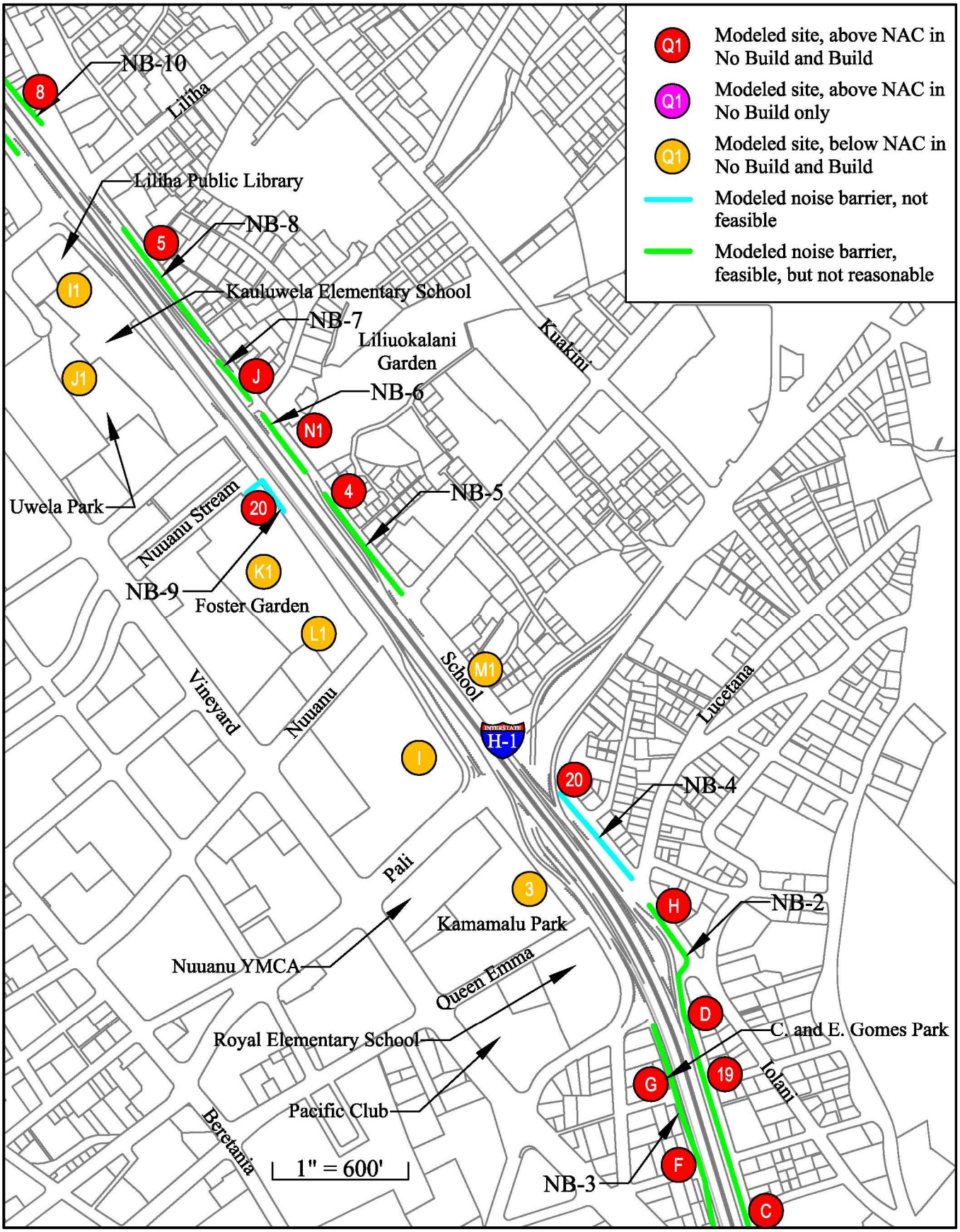


Figure 2-4c: Location of Noise Modeling Sites and Modeled Noise Barriers

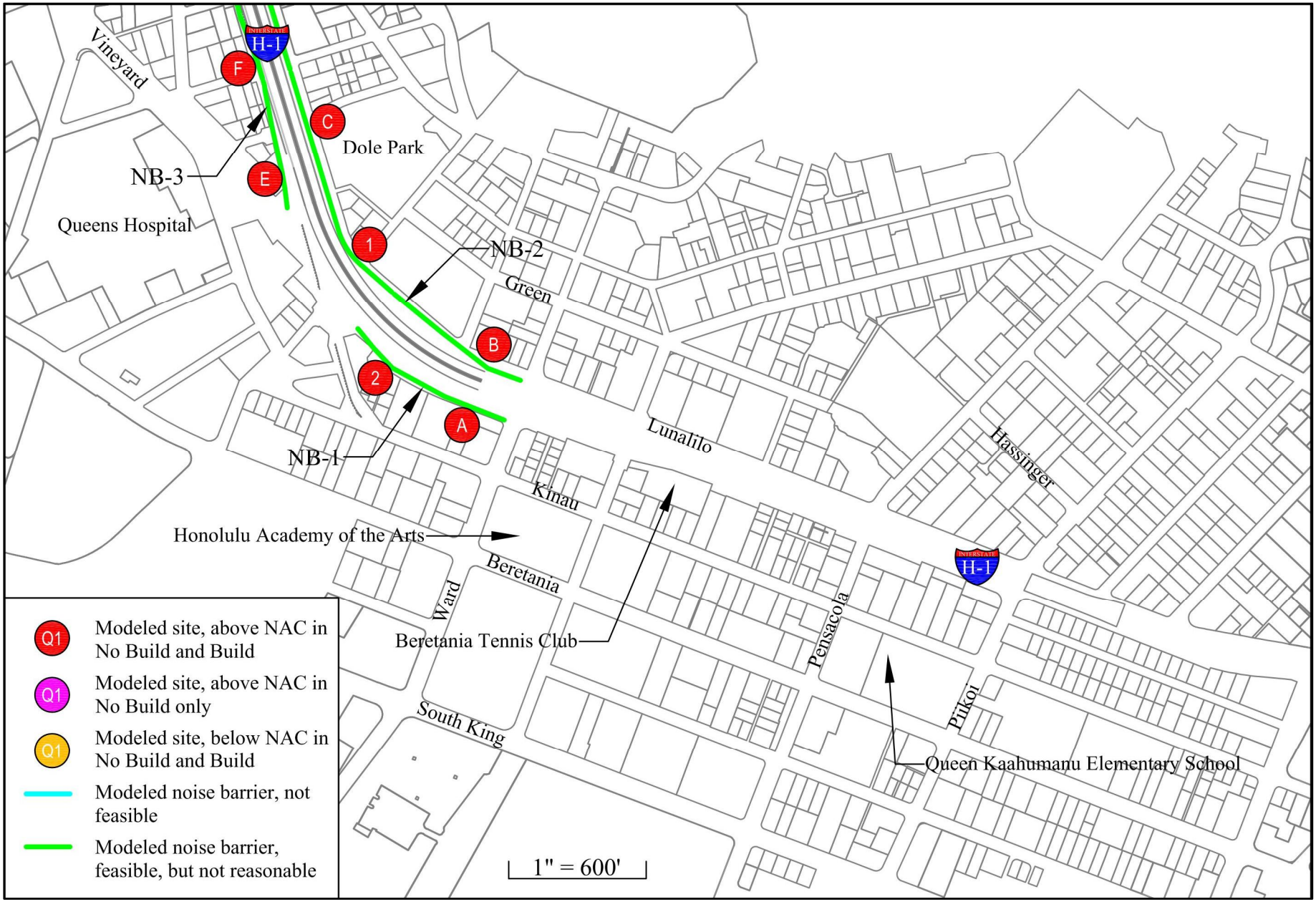


Figure 2-4d: Location of Noise Modeling Sites and Modeled Noise Barriers

Build Alternative

The same FHWA TNM was used to model the noise levels at the 64 sites (the 21 measurement sites and 43 selected sites) for the Build alternative. Input variables to noise modeling and analysis include traffic volumes, speeds and vehicle fleet mix (auto, medium truck, heavy truck, motorcycle, and bus percentages). The noise analysis considers noisiest hour of the day, which is based on maximum hourly traffic volumes under LOS C (i.e. the most vehicles travelling at near the posted speed limit). With four through lanes, LOS C conditions on Interstate Route H-1 will be 6,0000 vehicles per hour travelling at 45 mph.

Predicted traffic noise levels for the Build alternative are expected to be within 2 to 3 dBA of existing and No Build noise levels. The NAC of 67 dBA Leq(h) is predicted to be approached or exceeded at 49 modeled sites representing 590 residences, five parks, two schools, and two places of worship (Table 2-9). Figure 2-4 indicates the approximate location of each of the modeled sites listed in Table 2-9, and the colors indicate under what circumstances (existing/No Build and/or Build) the NAC is approached or exceeded.

An increase of 1 to 2 dBA in Build alternative noise levels is predicted over the existing/No Build condition at two of the 64 total sites. A decrease of 1 to 3 dBA or no change is predicted at the majority of the 64 total sites. The decrease in Build alternative noise levels at several sites is a result of lowering the Interstate Route H-1 speed limit in the project area from 50 mph currently to 45 mph with the project.

Typically, humans cannot detect a noise difference of less than 3 dBA; therefore, both the overall drop in noise (an average of 1.2 dBA across the 64 sites) and the few increases in noise (maximum of 2.3 dBA) will not be noticeable.

2.4.5 Mitigation Measures

Noise Barriers

Noise abatement measures must be considered as part of the project if traffic noise impacts are identified and must be provided where it is feasible and reasonable to do so. Impacts occur at sites where traffic noise levels approach or exceed the NAC of Leq(h) 67 dBA, or substantially exceed (by 15 dBA or more) the ambient noise levels. HDOT's Highway Noise Policy and Abatement Guidelines are used to determine whether noise abatement measures can be implemented, depending on whether these measures are feasible, reasonable, and desired based on the following criteria:

- **Feasible**. The TNM is used to establish if each noise abatement measure is feasible per the following criteria:
  - Provide at least 5 dBA highway traffic noise reduction for two thirds of front row receptors located along the subject Type I project.
  - Determination that it is possible to design and construct the barrier after considering issues related to safety, barrier height, topography, drainage, utilities, and maintenance, and maintenance access to adjacent properties, and access to adjacent properties.

- Achieve noise reduction design goal of 7 dBA for 75% of the benefiting front-row receptors located along the subject project.

- **Reasonable**: If a noise abatement measure is found to be feasible, then its reasonableness is established. If the cost of noise abatement does not exceed $60,000 per benefited receptor, it is deemed reasonable.
- **Desired**. If a noise abatement measure is found to be both feasible and reasonable, then the property owners and residents benefited by the barrier are asked if the noise barrier is desired. A noise abatement measure must be desired by at least two-thirds of the land owners and residents of impacted receptor units to move forward.

The most common noise abatement measure for highway noise is the construction of noise barriers along the side of the highway. Twenty-five separate noise barriers up and down both sides of Interstate Route H-1 throughout the proposed project area were evaluated (Figure 2-4 and Table 2-10).

Many of the noise barriers were found to be feasible; however, none of the noise barriers were found to be reasonable. The constructions costs were higher than the allotted $60,000 per benefited unit for many reasons. The primary reasons were:

- New or upgraded retaining walls, which are expensive to build, would be required prior to the construction of the noise barriers.
- There is insufficient right-of-way to allow for noise barrier construction. The acquisition of new right-of-way is costly.
- The noise barriers need to stretch across bridges to be feasible, but the bridges were not built to accommodate noise barriers and upgrading the bridge would be prohibitatively expensive.
- Other factors such as traffic control, backfill, and landscaping would be necessary.

Based on the assessment, no noise barriers are considered both feasible and reasonable. Therefore, no noise barriers will be included in the proposed project.

Speed Limit

The reduction of the speed limit from 50 mph to 45 mph will reduce the level of noise generated by vehicles on Interstate Route H-1. Vehicle speed correlates directly to the noise they produce; the slower the vehicle speed the less noise produced. Therefore, the reduction in speed limit is a noise mitigation measure, as well as a safety mitigation measure. The reduced speed limit is factored into the modeling results detailed above in Section 2.4.4.

Table 2-10: Summary of Noise Barrier Feasibility and Reasonableness

Noise Barrier I.D.	Height	Number of Benefited Residences	Maximum Cost Allowance Per Noise Barrier	Noise Barrier Engineer's Cost Estimate	Is Barrier Feasible and Reasonable?
NB-1	18 feet	20	$1,200,000	$1,297,800	Not Reasonable
NB-2	10 feet	50	$3,000,000	$3,500,580	Not Reasonable
NB-3	10 feet	33	$1,980,000	$3,298,860	Not Reasonable
NB-4	up to 20 feet	0	$0	N/A	Not Feasible
NB-5	14 feet	18	$1,080,000	$7,244,800	Not Reasonable
NB-6					
NB-7					
NB-8					
NB-9	8 feet	1	$60,000	$239,600	Not Reasonable
NB-10	8 feet	14	$840,000	$3,576,960	Not Reasonable
NB-12					
NB-11	14 feet	17	$1,020,000	$1,513,760	Not Reasonable
NB-13	up to 20 feet	0	$0	N/A	Not Feasible
NB-14	10 feet	16	$960,000	$1,701,560	Not Reasonable
NB-15	up to 20 feet	0	$0	N/A	Not Feasible
NB-16	8 feet	18	$1,080,000	$1,558,880	Not Reasonable
NB-17	18 feet	15	$900,000	$3,680,700	Not Reasonable
NB-18	up to 20 feet	0	$0	N/A	Not Feasible
NB-19	8 feet	14	$840,000	$1,324,820	Not Reasonable
NB-20	8 feet	10	$600,000	$3,564,620	Not Reasonable
NB-21	12 feet	8	$480,000	$3,847,520	Not Reasonable
NB-22	8 feet	4	$240,000	$1,923,760	Not Reasonable
NB-23	10 feet	26	$1,560,000	$2,912,420	Not Reasonable
NB-24	up to 20 feet	0	$0	N/A	Not Feasible
NB-25	up to 20 feet	0	$0	N/A	Not Feasible

Note: NA = Not Applicable; cost not calculated because the evaluated noise barrier did not meet HDOT Feasibility Criteria.

2.5 Land Use

2.5.1 Existing Conditions

Figure 2-5 shows the general existing land uses along the project corridor. Existing land uses along this portion of Interstate Route H-1 include roadways, commercial businesses, office buildings, residential buildings, mixed use buildings, schools, parks, museums, libraries, and other uses. There is very little undeveloped land in the project corridor.

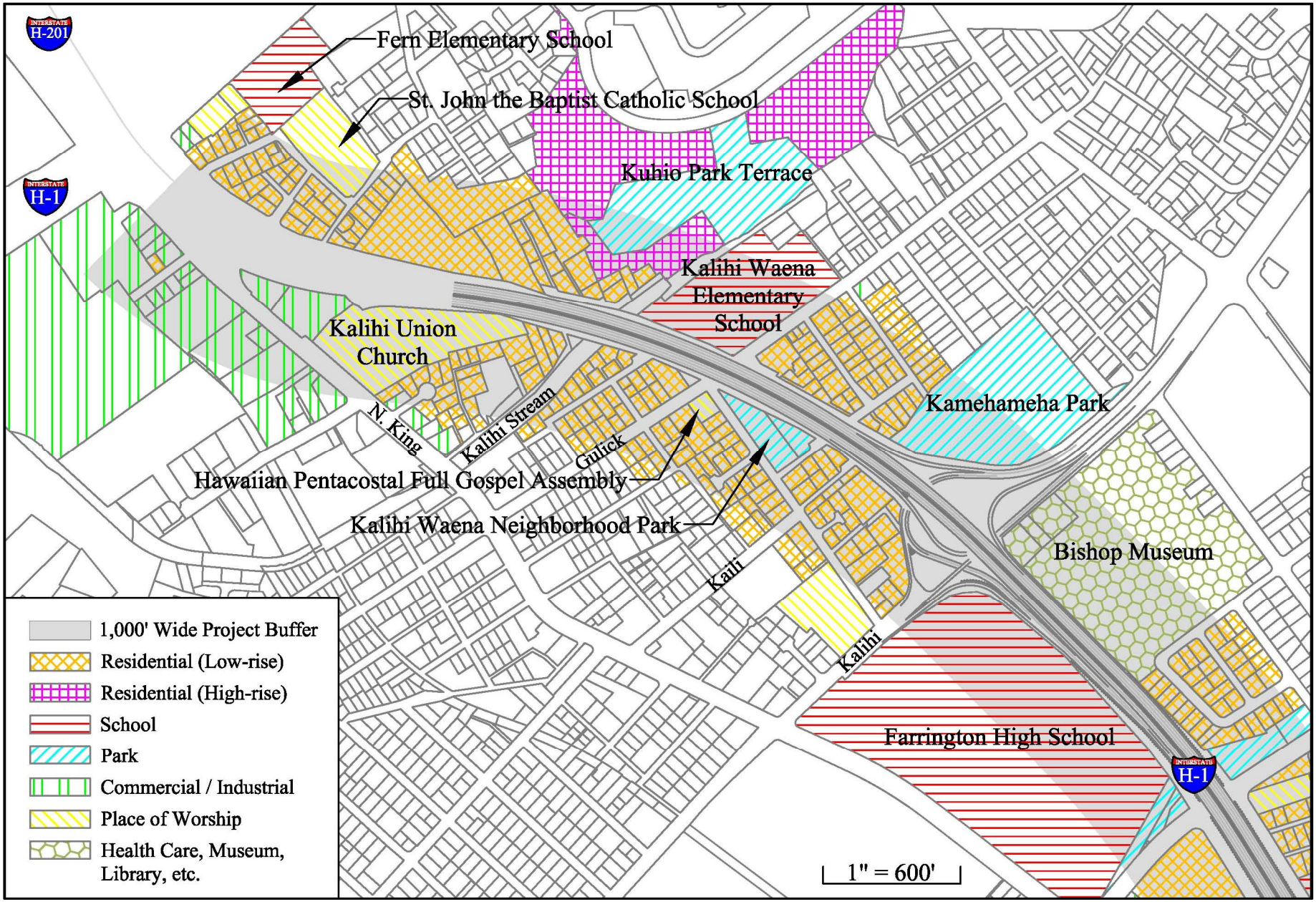


Figure 2-5a: Existing Land Use

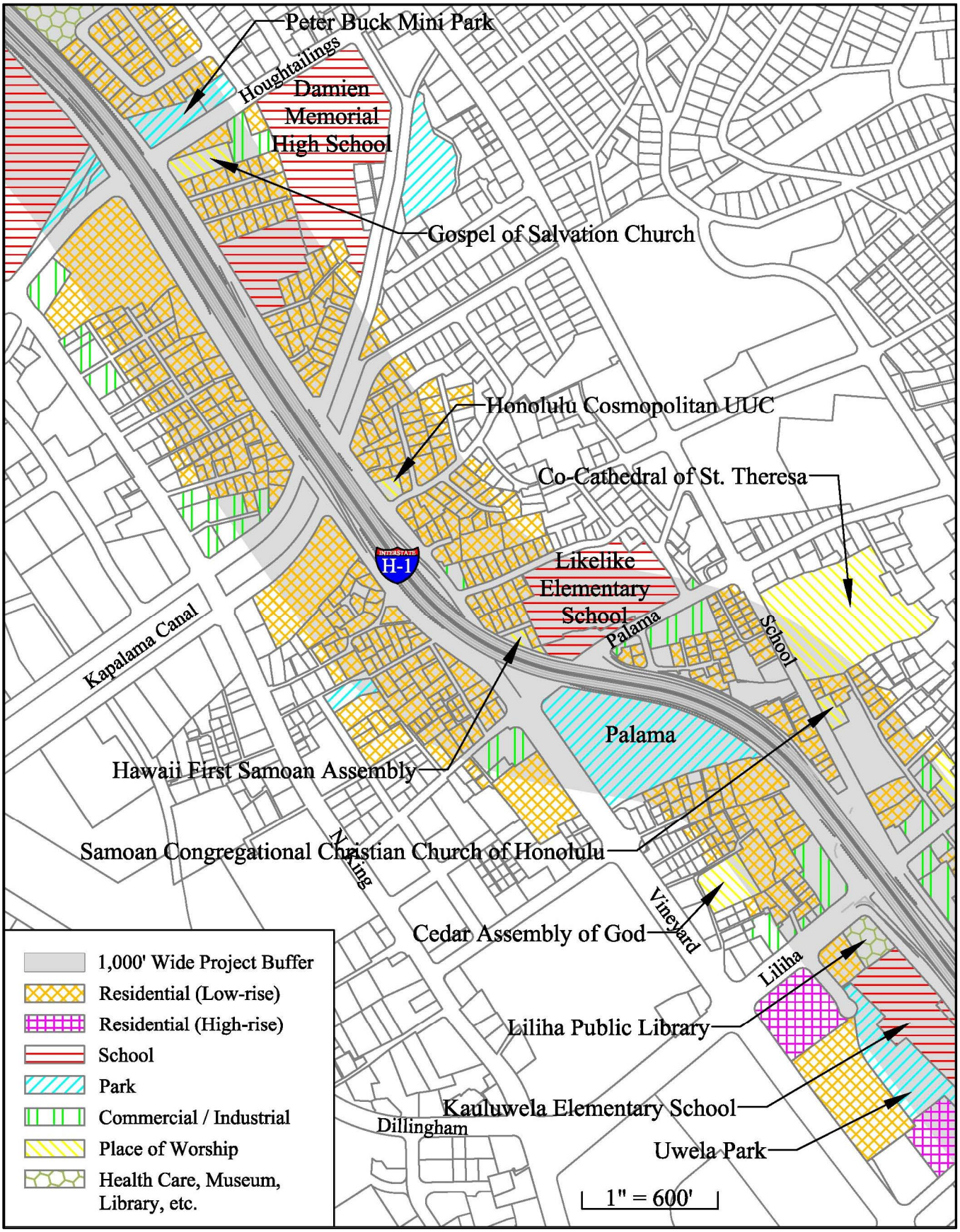


Figure 2-5b: Existing Land Use

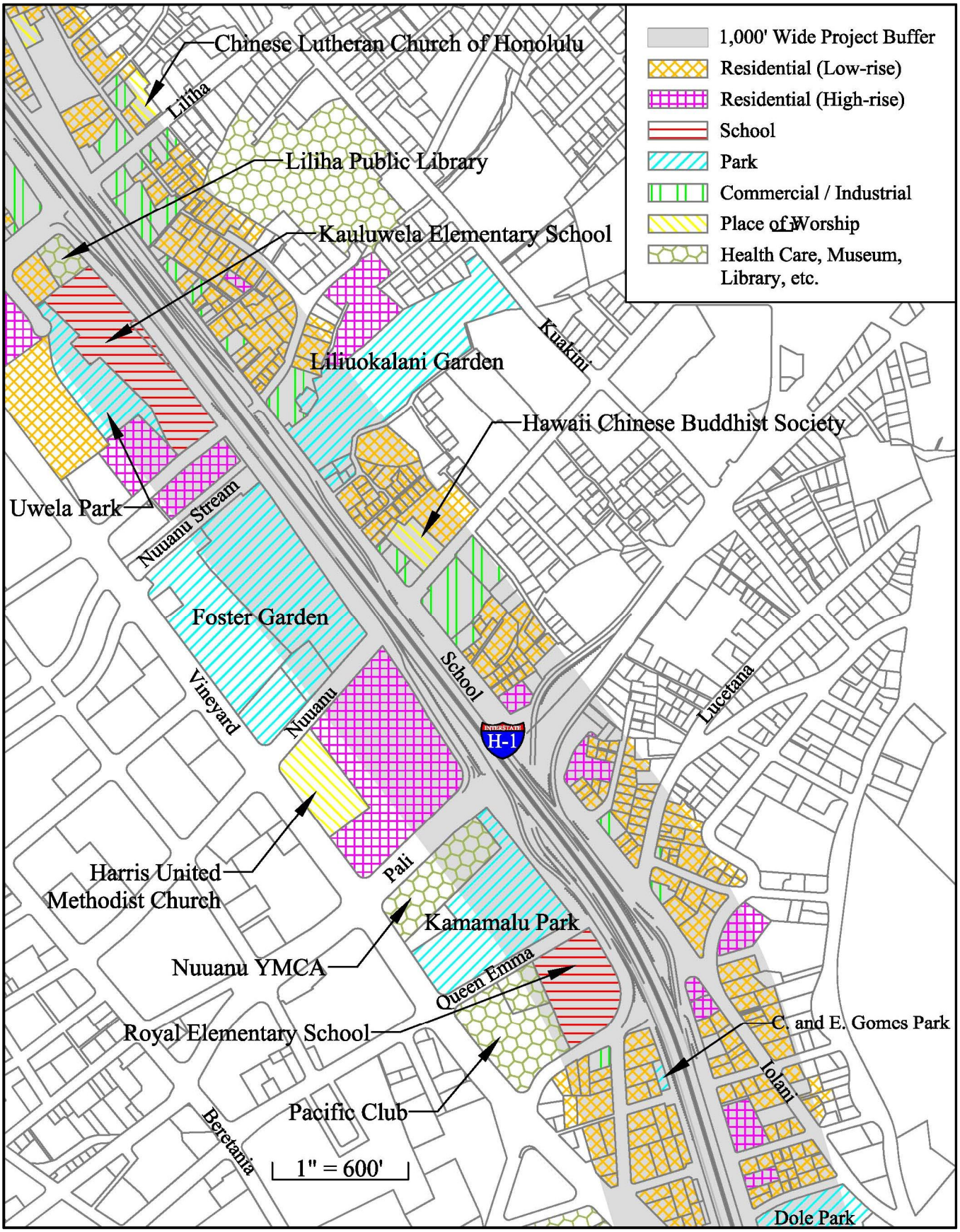


Figure 2-5c: Existing Land Use

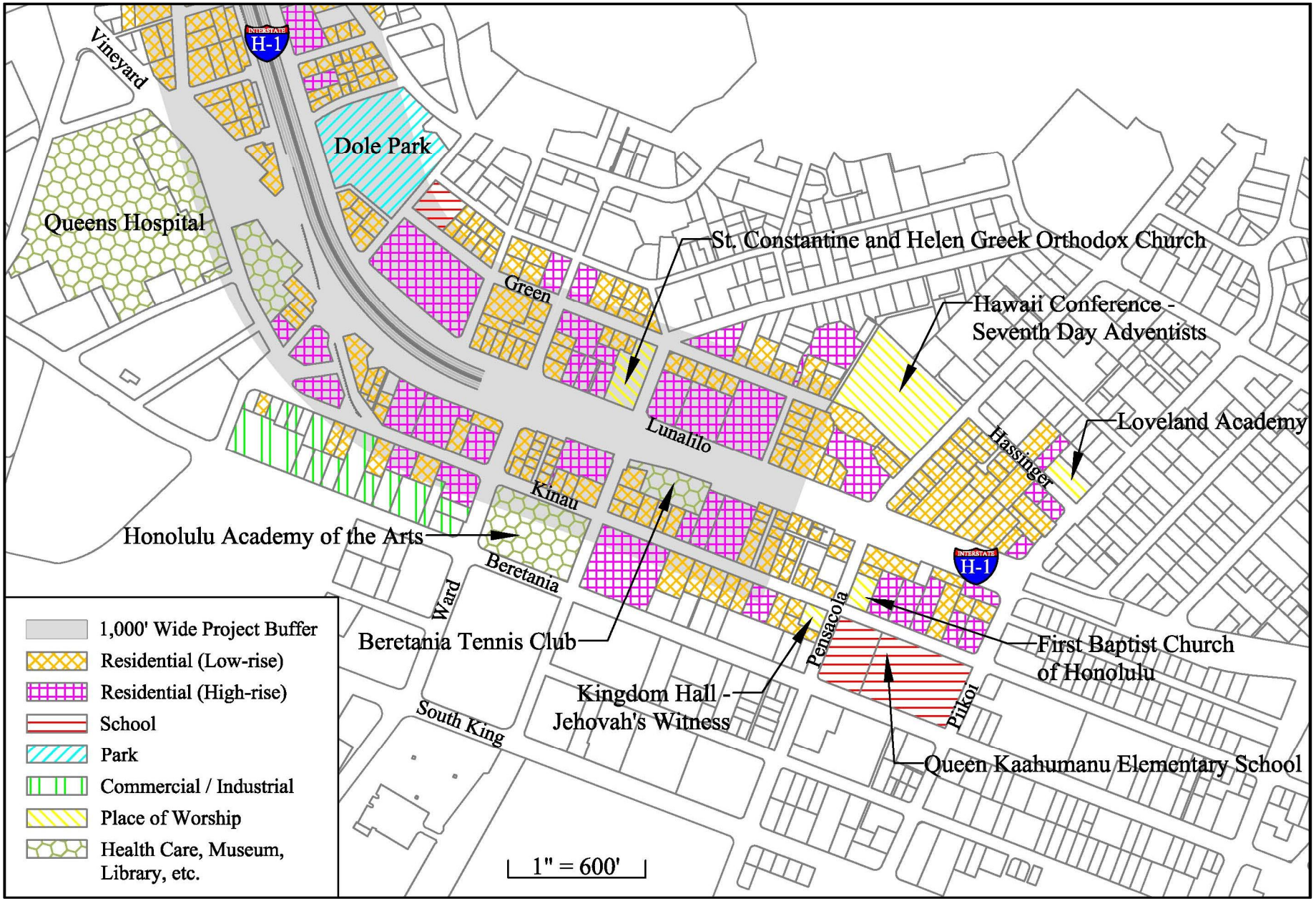


Figure 2-5d: Existing Land Use

2.5.2 Land Use Development Trends

The entire project area is zoned urban by the State of Hawai‘i.

Comparing City and County of Honolulu zoning categories (Figure 2-6) with the existing land uses (Section 2.5.1; Figure 2-5), most of the existing land use is consistent with current zoning. Due to the highly developed nature of the project corridor, very few changes in land use and zoning are anticipated. The only planned significant changes to zoning and land use conditions are those associated with transit oriented development (TOD) in the proximity to Honolulu Rail Transit Project (HRTP) stations. None of the HRTP stations are in close proximity to Interstate Route H-1 in the project area.

2.5.3 Potential Impacts

No Build Alternative

Under the No-Build Alternative, no land use impacts would occur.

Build Alternative

Under the Build Alternative, no new right-of-way (ROW) will be acquired; therefore, no displacements or other impacts on land use will occur.

2.5.4 Mitigation Measures

No mitigation measures are necessary because no adverse effects will occur.

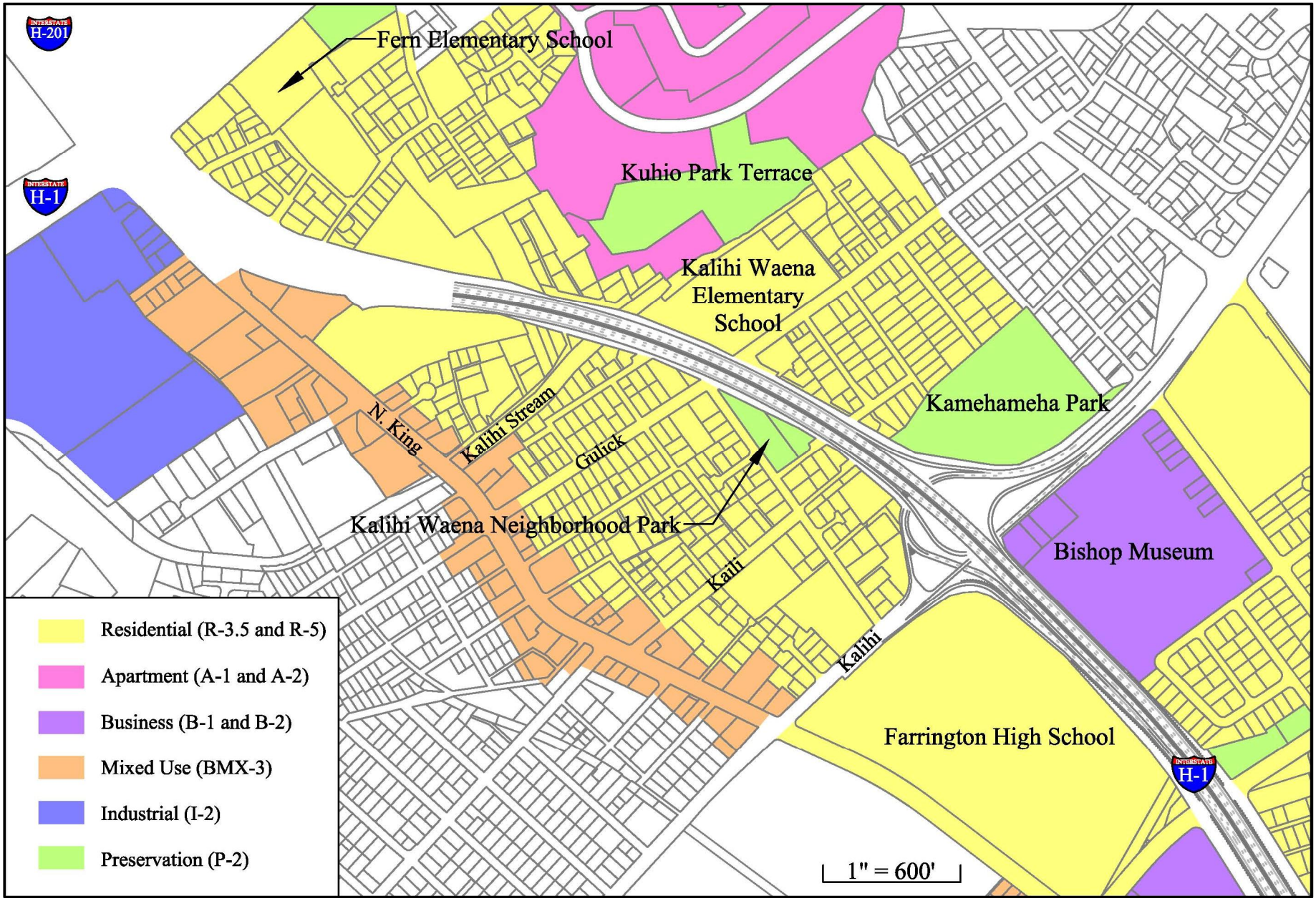


Figure 2-6a: City and County of Honolulu Zoning

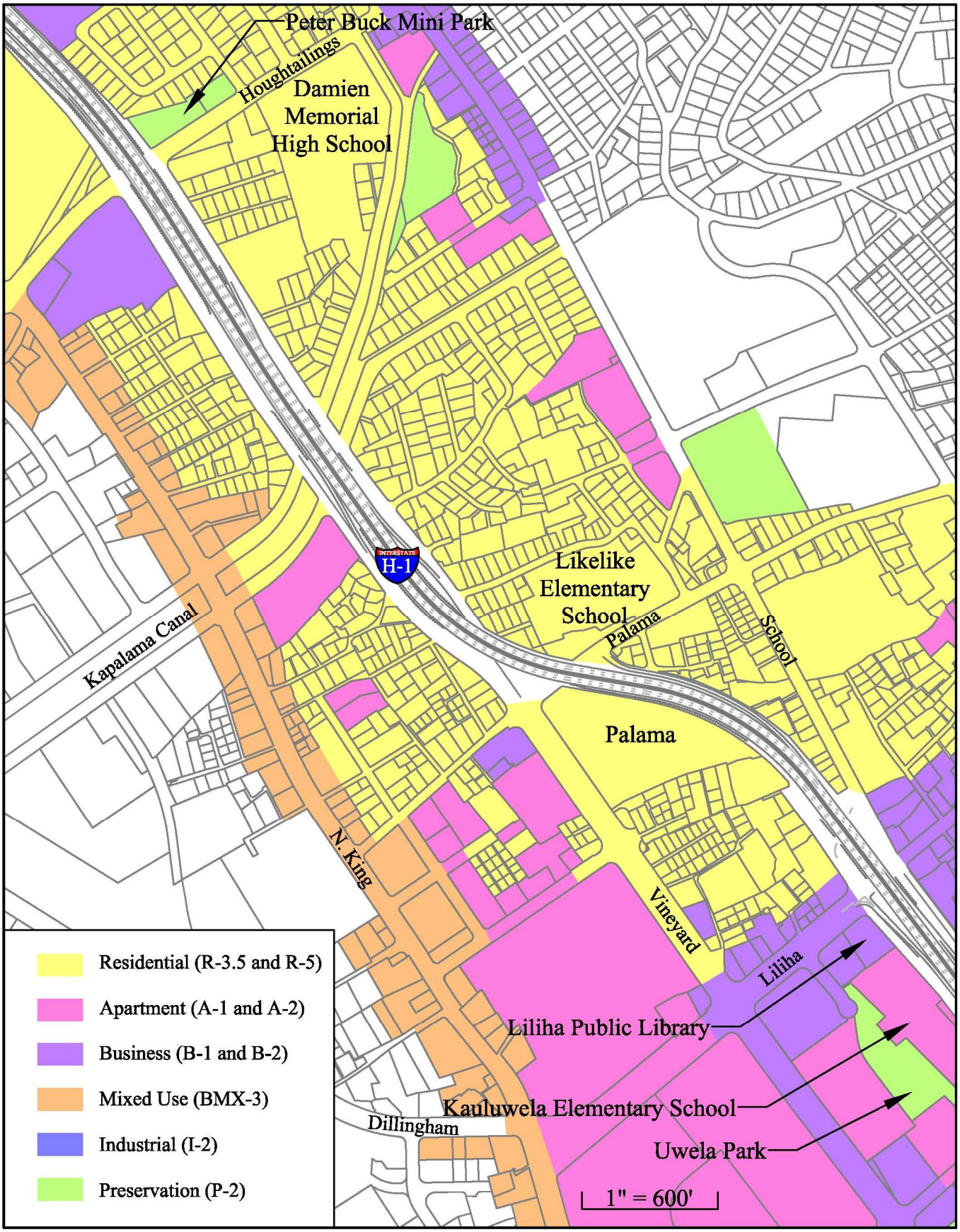


Figure 2-6b: City and County of Honolulu Zoning

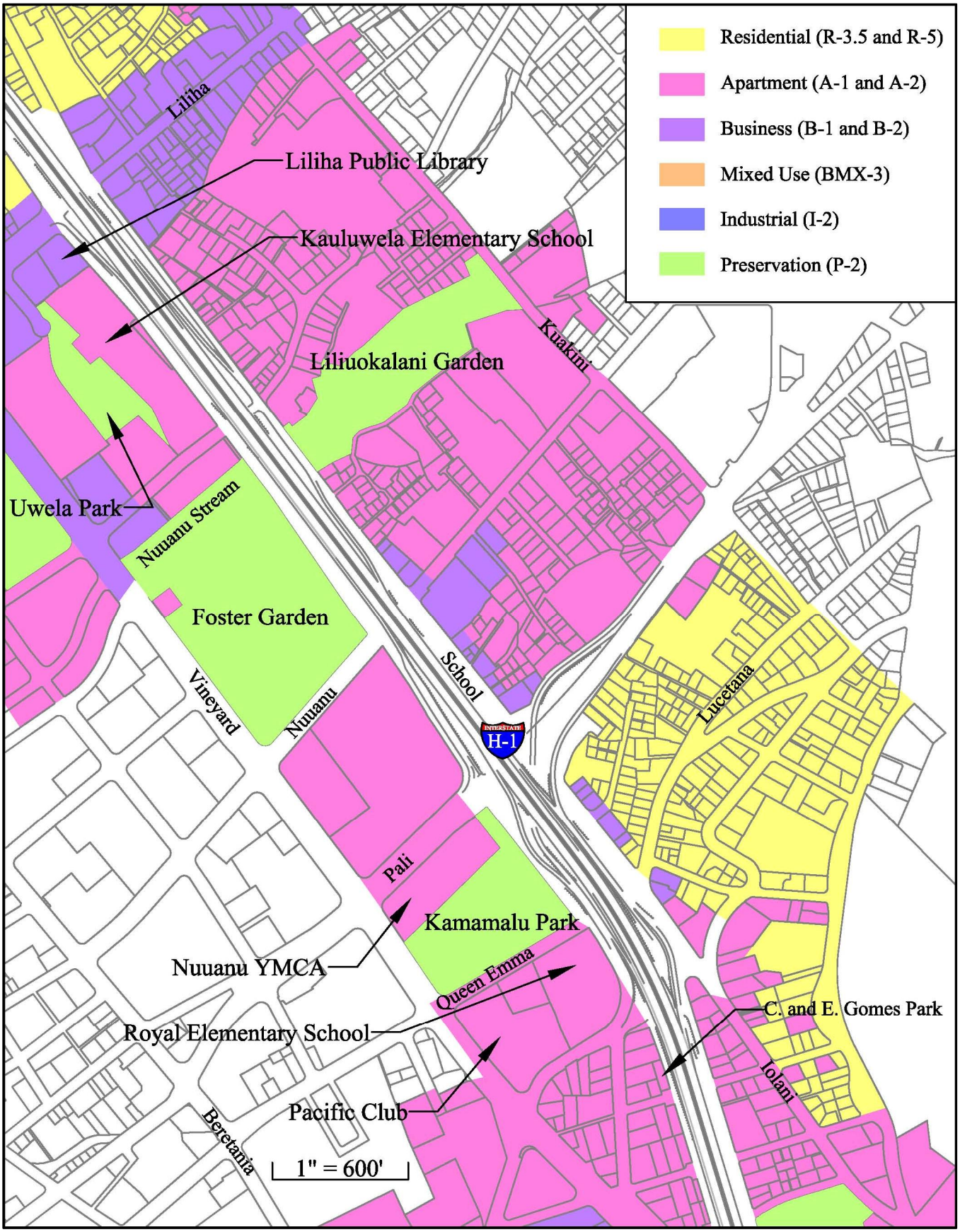


Figure 2-6c: City and County of Honolulu Zoning

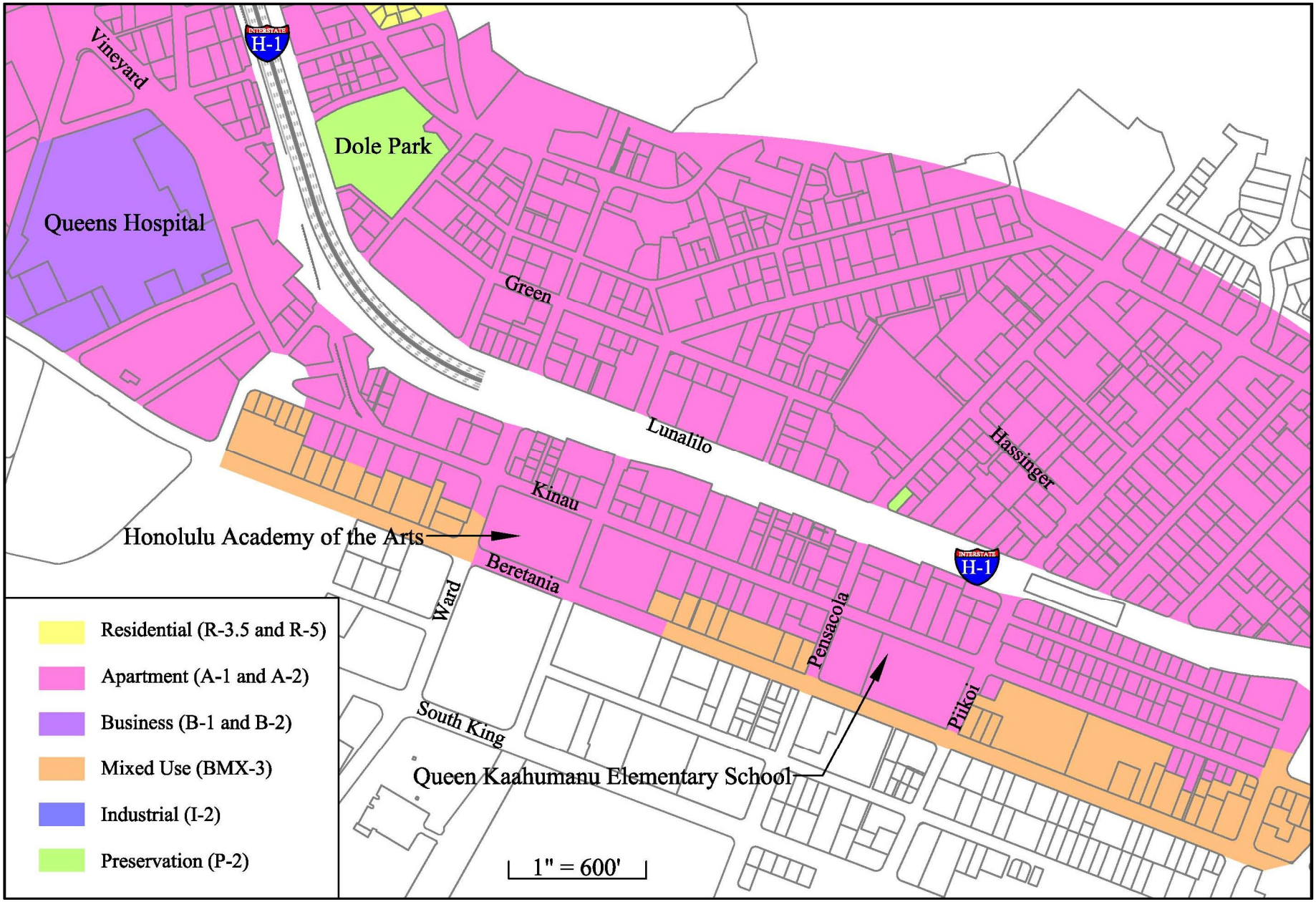


Figure 2-6d: City and County of Honolulu Zoning

2.6 Consistency with Government Plans, Policies, and Controls

This section discusses whether the No-Build and Build Alternatives are consistent with existing government plans, policies, and controls.

2.6.1 State of Hawai‘i Plans and Controls

Hawai‘i 2050 Sustainability Plan

The Hawai‘i 2050 Sustainability Plan, January 2008 (Hawai‘i State Plan), serves as a guide for the future long-range development of the State. The State Plan promotes the growth and diversification of the State’s economy, the protection of the physical environment, the provision of public facilities, and the promotion of and assistance to socio-cultural advancement.

The project is consistent with the Hawai‘i State Plan’s Goal 2, Strategic Action 4 “Identify, prioritize and fund infrastructure ‘crisis points’ that need fixing.”

Hawai‘i State Plan Transportation Functional Plan

The Hawai‘i State Plan Transportation Functional Plan (Transportation Functional Plan), 1991, compliments the Hawai‘i State Plan by going into detail on how Hawai‘i can meet the goals set forth in the Hawai‘i State Plan with regards to transportation. Since the Transportation Functional Plan is dated, many of the specific actions have already been completed. The objectives, however, remain.

The project is consistent with Objective I.C.1. Increase the capacity of the existing transportation infrastructure.

Hawai‘i State Land Use Controls

The State Land Use Commission (SLUC), under the authority granted in HRS Chapter 205, regulates land use through classification of State lands into four districts: Urban, Agriculture, Conservation, and Rural. The intent of the land classification is to accommodate growth and development while retaining the natural and agricultural resources of the State. Each district has specific land use objectives and development constraints.

The project will not change any existing land uses.

2.6.2 Coastal Zone Management

The entire State of Hawai‘i is within the Coastal Zone Management (CZM) area, as federally-defined. The objectives and policies of the Hawai‘i CZM Program are to protect and manage Hawai‘i’s coastal resources. Federally-assisted activities within Hawai‘i’s coastal zone, including the project site, must be consistent with CZM objectives and policies.

A copy of the CZM consistency assessment is attached in Appendix C. The following sections provide a brief overview of the information provided in the consistency assessment.

Recreation Resources

The project is a public right-of-way, is near (within 500 feet) multiple County parks, and crosses multiple perennial streams (Figure 2-12); however, the project will not result in a significant adverse affect to any parks and recreational resources in the project area.

None of the parks will be adversely affected by the project.

There will be relatively minor modifications to the bridge over Nu‘uanu Stream, but no changes at the other stream crossings. The minor changes at Nu‘uanu Stream will not impact the recreational opportunities at Nu‘uanu Stream. None of the perennial streams are fishing areas.

Historic Resources

The project site is not listed on or nominated to be listed on the Hawai‘i or National register of historic places. However, within 500 feet of the project site there are multiple properties listed on the Hawai‘i and/or National register of historic places. Historic documents indicate that the area had, in pre-contact traditional Hawaiian times, an expansive network of irrigated taro fields with associated habitation sites that extended from Kou, the settlement area focused around present day Honolulu Harbor. The taro fields, or lo‘i, extended from near the shoreline, where fish ponds were present, through the project area, and to the foothills of the Ko’olau Mountains.

The project has coordinated with and will continue to coordinate with the State Historic Preservation Division (SHPD), Native Hawaiian organizations (NHOs), and others stakeholders regarding National Historic Preservation Act Section 106 compliance. Based on the consultations performed to date, FHWA anticipates making a "No Adverse Effect" determination (see Section 2.15).

Scenic and Open Space Resources

Existing mountain and ocean vistas will be unaffected by the project. The project will not adversely affect scenic and open space resources (see Section 2.12).

Coastal Ecosystems

The project is not within the Shoreline Setback Area but will require earthwork beyond clearing and grubbing and the project crosses three perennial streams. There will be relatively minor modifications to the bridge over Nu‘uanu Stream, but no changes at the other stream crossings. Two of the streams flow into Honolulu Harbor and the third flows into Ke‘ehi Lagoon. All three project crossings are at least 3,300 feet upstream of where they discharge.

The project will not affect coastal ecosystems (see Section 2.9).

Economic Uses

The project will benefit Honolulu’s residents, workers, and visitors by alleviating roadway congestion on Interstate Route H-1, thereby improving the transportation network and improving access to community resources. Project construction will also contribute to the local economy. For further information see Section 2.13.

Coastal Hazards

The project site is not near the coast and is not within a potential tsunami inundation area. Where the project crosses Kalihi Stream, Kalihi Stream is designated as a floodway and some floodzones are adjacent to the floodway upstream and downstream of the crossing. Above the project's crossing of Nu'uanu Stream, Nu'uanu Stream is designated as a floodway and some floodzones are adjacent to the floodway. Interstate Route H-1 is not anticipated to be affected by flooding.

The project will not change conditions affected by natural hazards. For further information about natural hazards see Section 2.1.

Managing Development

The project conforms with the land use designations for the site and is consistent with government plans, policies, and controls.

Along with the CZM Consistency Assessment, the project requires a National Pollution Discharge Elimination System (NPDES) permit and a Noise Variance for construction activities, and consultations required under the Endangered Species Act (ESA) Section 7 and the National Historic Preservation Act Section 106. Evidence of these coordination activities is attached.

The project will complete a National Environmental Policy Act (NEPA) Categorical Exclusion, and will complete a State of Hawaii HRS Chapter 343 Final EA/FONSI.

Public Participation

The project is over half a mile away from the coast and will not produce any coastal management issues. Therefore, no public participation specifically related to coastal management or processes is planned.

A public informational meeting regarding the project was held on November 7, 2012, and another public meeting was held during the Draft EA review period on February 6, 2013. For more information regarding public participation see Section 3.0.

Beach Protection

The project is over half a mile away from the coast and generally includes working within the limits of an existing roadway and in a highly-developed urban area. The project will not result in the construction of any structure that could increase beach or shoreline erosion.

Marine Resources

The project does not involve any marine or coastal construction or other aspects that relate to the State's ocean resources management plan. The project will not have an impact on marine resources.

2.6.3 City and County of Honolulu Plans and Controls

City and County of Honolulu General Plan

The General Plan Objectives and Policies (General Plan) for the City and County of Honolulu (City) is a requirement of the City Charter. The City first adopted the General Plan in 1977 and since that date, the General Plan has been amended several times, most recently in 2002. This project is consistent with the following objectives and policies in Section V. Transportation and Utilities:

- Objective A, Policy 5 "Improve roads in existing communities to reduce congestion and eliminate unsafe conditions."
- Objective D, Policy 1 "Give primary emphasis in the capital-improvement program to the maintenance and improvement of existing roads and utilities."

The General Plan divides up the island of O‘ahu into eight sections (Figure 2-7), each having their own development plans, which are intended to guide City land use approvals, infrastructure improvements and private sector investment decision. This project is located in the Primary Urban Center.

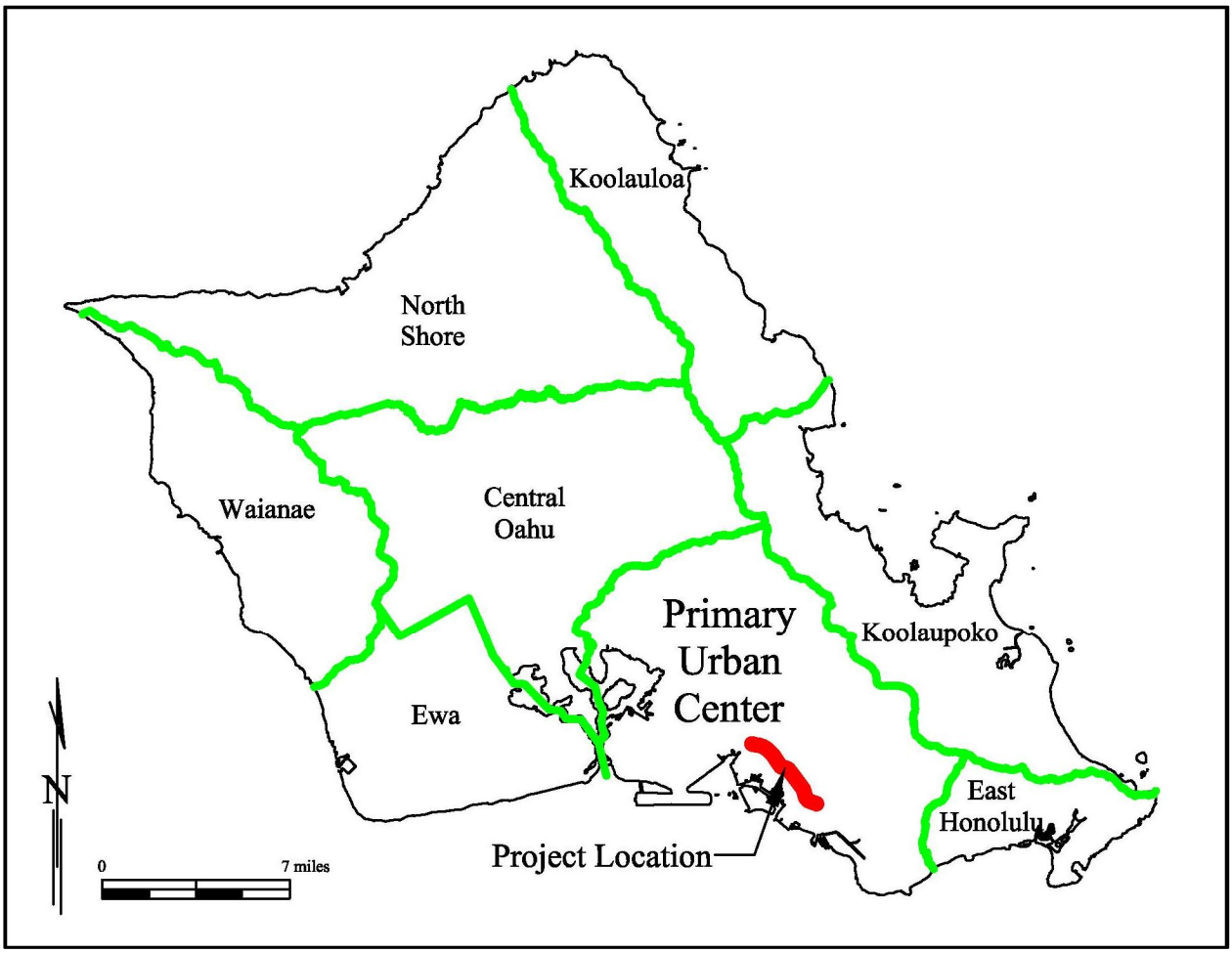


Figure 2-7: Development Plan Areas

Primary Urban Center Development Plan

The Primary Urban Center Development Plan (PUC Plan) includes specific guidelines for the development of the PUC and focuses on preserving existing conditions, such as visual, natural, and cultural resources, as well as managing growth and development, such as housing and transportation facilities. The proposed project is consistent with the policies of the PUC Plan because the proposed project improves mobility within the PUC.

O‘ahu Regional Transportation Plan

The O‘ahu Regional Transportation Plan 2035 (ORTP), dated April 2011, identifies the major land transportation improvements needed by the year 2035. The recommendations of the ORTP represent those projects needed to support anticipated growth and development on the Island of O‘ahu. The proposed project is consistent with the goals and objectives identified in the ORTP.

The ORTP includes congestion relief projects targeted at mitigating existing and future congestion on O‘ahu. There are two projects identified in the ORTP that are within the project area and additional projects identified for the general area of the proposed project:

1. No. 32 - Interstate Route H-1, Widening, Ola Lane to Vineyard Boulevard. Project description: widen the Interstate Route H-1 by one lane, in the eastbound direction, from Ola Lane to Vineyard Boulevard and widen the Gulick Avenue and Kalihi Interchange overcrossings to allow for the widening. The preliminary cost estimate for this project in the ORTP is $104 million. This project has been deferred indefinitely due to higher cost than originally estimated and is being replaced by the proposed project.
2. No.33 - Interstate Route H-1, Operational Improvements, Lunalilo Street Off-Ramp and On-Ramp (Between Lunalilo Street On-Ramp and Vineyard Boulevard Off-Ramp). Project description: improve operation and capacity on the westbound H-1 Freeway by modifiying weaving movements between the Lunalilo Street on-ramp and Vineyard Boulevard off-ramp. The preliminary cost estimate for this project in the ORTP is $6 million. The demonstration project implemented in the summer of 2012 replaced this project.
3. No. 34 - Interstate Route H-1, Operational Improvements, Ward Avenue On-Ramp to University Avenue Interchange. Project description: improve traffic flow on the Interstate Route H-1, in the eastbound direction, from the Ward Avenue on-ramp to the University Avenue Interchange through operational improvements. The preliminary cost estimate for this project in the ORTP is $65 million. The demonstration project implemented in the summer of 2012 replaced the Ward Avenue on-ramp to Punahou Avenue off-ramp portion of this project.
4. No. 36 - Honolulu High-Capacity Transit Corridor Project. Project description: plan, design, and construct a fixed-guideway system between East Kapolei and Ala Moana Center. This project includes intermodal connections with TheBus system to provide feeder services to fixed-guideway stations. The preliminary cost estimate for this project in the ORTP is $5,532.5 million. This project is completing a required archaeological inventory survey (AIS).

The proposed project is a Transportation System Management (TSM) alternative that replaces ORTP project number 32. Therefore, the proposed project is consistent with the ORTP.

2.7 Natural Hazards

2.7.1 Flooding

There is an extensive network of storm drains designed to drain the interstate in the project area; nevertheless, minor flooding during period of intense rainfall has been known to occur along some stretches of Interstate Route H-1. One portion of the project area, where Interstate Route H-1 crosses Kalihi Stream, is within the 100 year floodplain (Figure 2-8). There are two other streams that flow near the project, but although some parcels along Waolani Stream and Nuʻuanu Stream are within the 100 year floodplain, Interstate Route H-1 does not fall within the 100 year flood plain (Figure 2-9). Kapālama Canal Stream becomes a drainage canal just mauka of Interstate Route H-1 and there is no flood zone mapped in its vicinity.

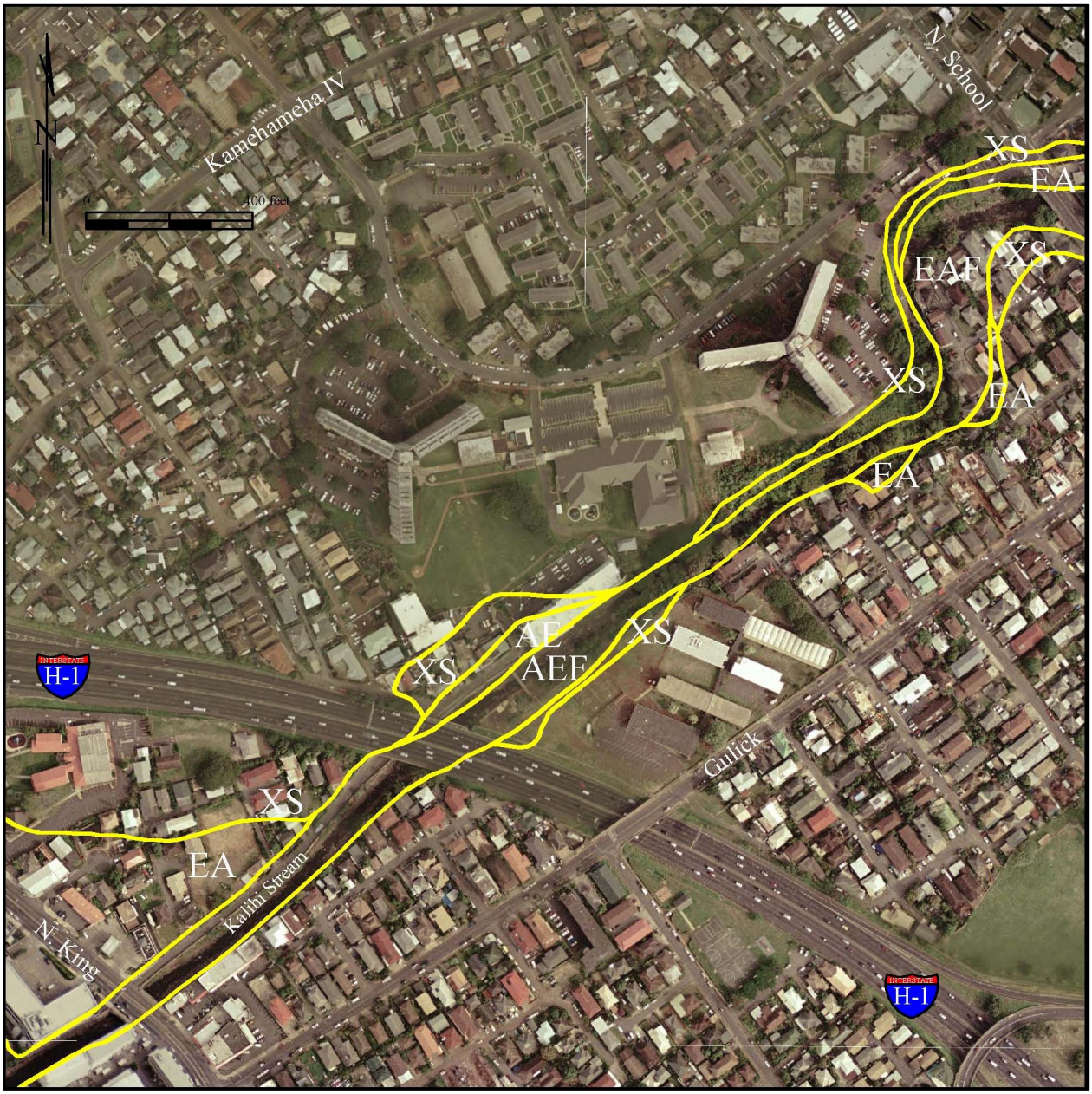


Figure 2-8: Floodzones Associated with Kalihi Stream

Notes:
AEF = The area within Zone "AE" reserved to pass the base flood; also known as the Floodway.
AE = The 100-year floodplain, where the average water depth is predicted to exceed 1 foot.
XS = The 500-year floodplain, and areas where the 100-year flood is predicted to have an average water depth of less than one foot.

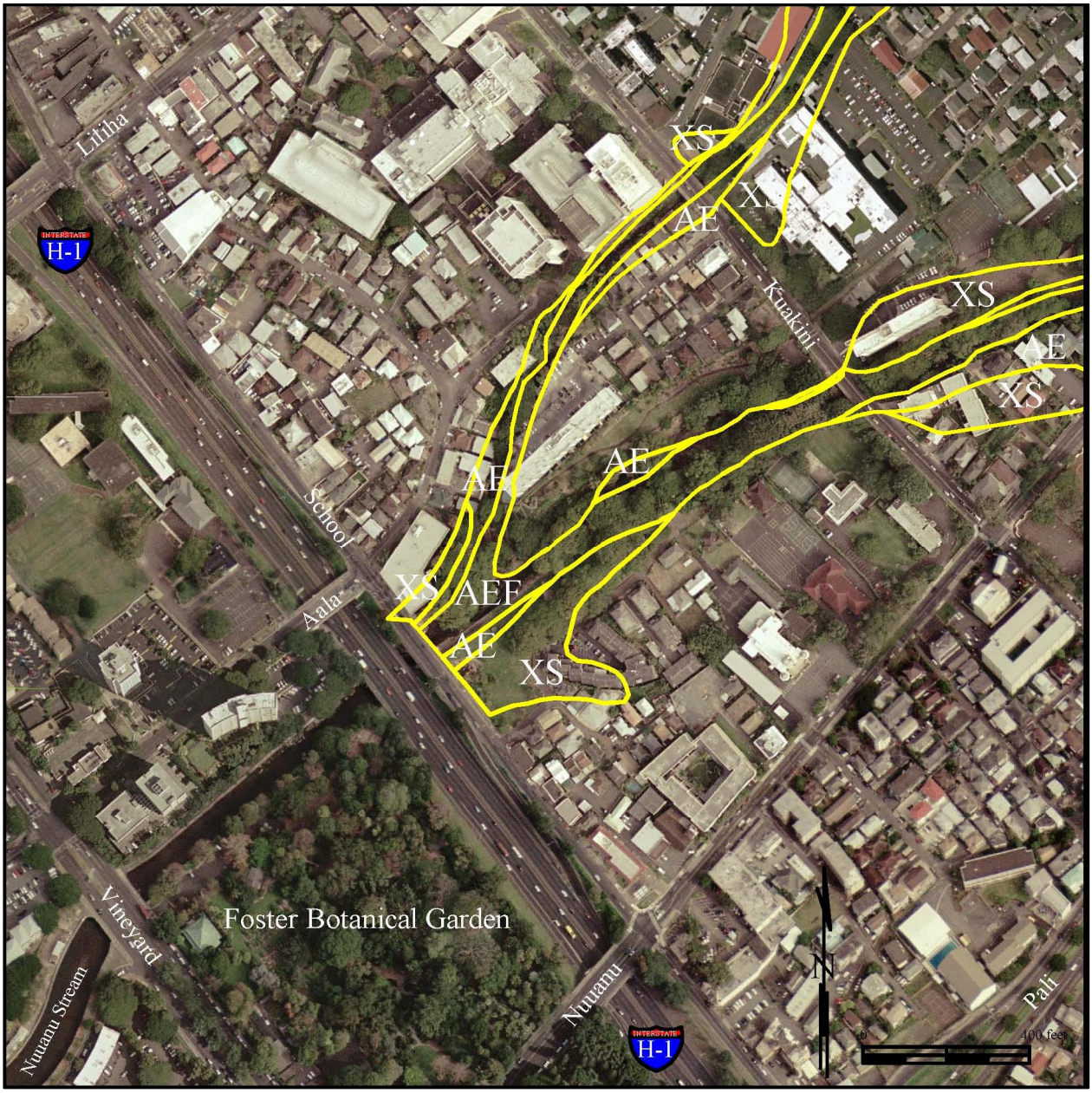


Figure 2-9: Floodzones Associated with Nu‘uanu Stream

Notes:
AEF = The area within Zone “AE” reserved to pass the base flood; also known as the Floodway.
AE = The 100-year floodplain, where the average water depth is predicted to exceed 1 foot.
XS = The 500-year floodplain, and areas where the 100-year flood is predicted to have an average water depth of less than one foot.

The storm drain network will be slightly modified to accommodate features of the project such as the restriping and Nu‘uanu Stream Bridge widening. If modifications were not made, the restriping would result in vehicles passing directly over storm drain inlet grates. Frequent crossings of a grate can degrade the grate and cause it to become a hazard. Maintaining an inlet grate within the travel way can also bring vehicles in closer proximity to storm water flow. A storm drain pipe is currently located in the area where the Nu‘uanu Stream Bridge will be

widened. That pipe will be shifted further makai so that it is beyond the structural components of the widened bridge.

Under the No Build Alternative, the existing drainage system would remain unchanged.

Under the Build Alternative, the modifications to the storm drain system will be designed such that the capacity of the storm drain system is not reduced. However, the reduced shoulder widths will increase the spread of storm water that collects in sumps during heavy rainfall events. This storm water may encroach upon the travel lane to a greater extent than the existing condition.

Example of storm drain inlet along median

2.7.2 Hurricane

Intense rainfall, which can be associated with hurricanes, is discussed in Section 2.7.1. High winds associated with hurricanes will not directly affect Interstate Route H-1; all existing structures, such as bridges and overpasses, were designed to withstand natural disasters, such as hurricanes.

Under both the No Build Alternative and Build Alternative, no impacts would occur. Therefore, no mitigation measures are necessary.

2.7.3 Tsunami

Based on the Tsunami evacuation zone maps prepared by the City and County of Honolulu Department of Emergency Management (http://www1.honolulu.gov/dem/draft_tsunami_evacuation_zone_maps_.htm), the project is not within the tsunami evacuation zone (Figure 2-10). Moreover, the project is not anticipated to impact streets heading mauka across the freeway, should a tsunami warning be issued.

Under both the No Build Alternative and Build Alternative, no impacts would occur. Therefore, no mitigation measures are necessary.

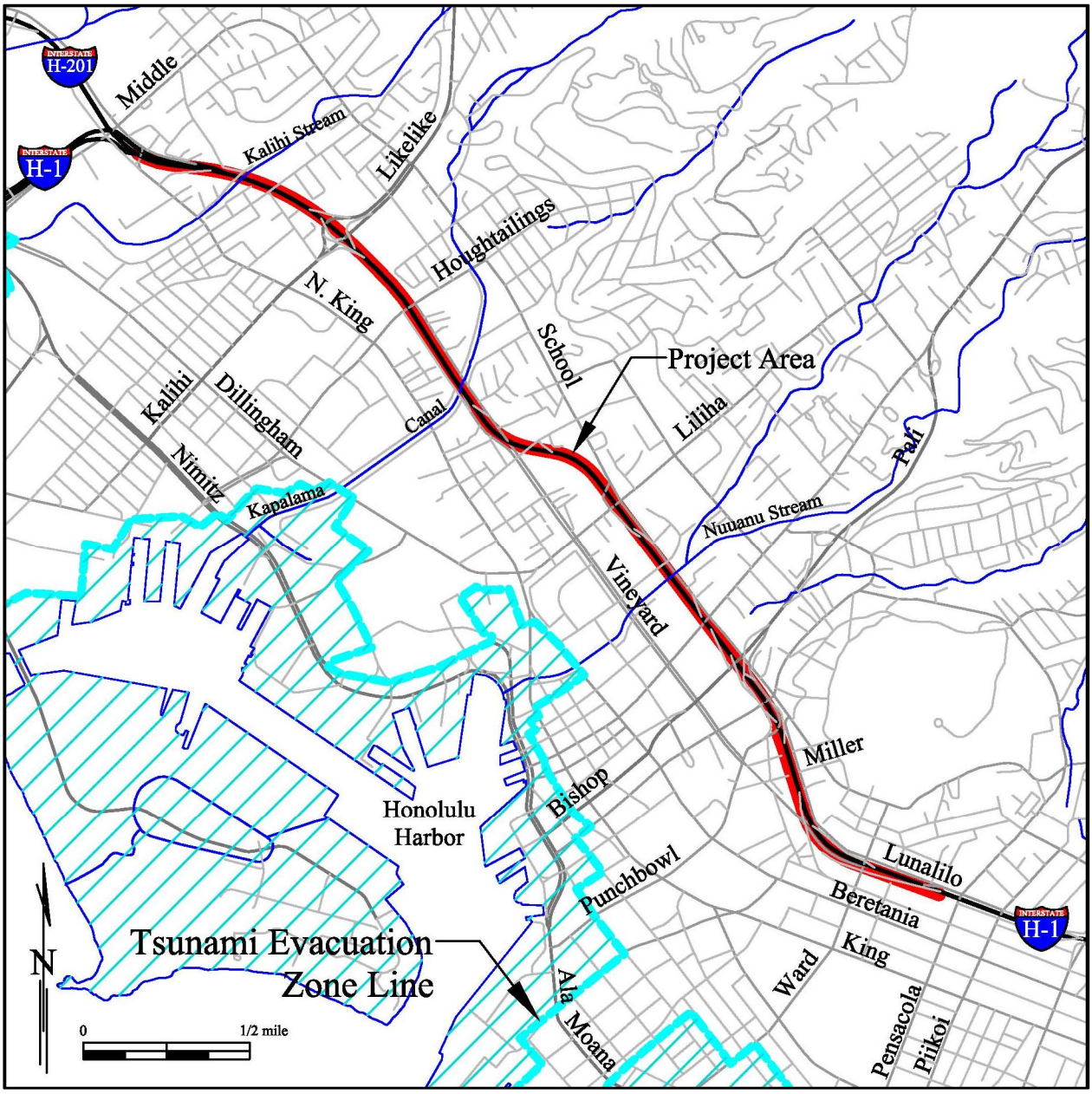


Figure 2-10: Tsunami Evacuation Zone

2.8 Hazardous Materials

There have been a few reported spills along Interstate Route H-1 in the project area. According to HDOH database records (http://hawaii.gov/health/environmental/hazard/publicrecorddetails.html), these spills have involved small quantities of petroleum products and, in one case, pesticides associated with landscape maintenance. All of the spills were cleaned up and no further investigation performed.

Under the No Build Alternative, no impacts to hazardous materials would occur.

Under the Build Alternative, no change in the quantity or type of hazardous materials being transported through the project area or used to maintain and operate Interstate Route H-1 in the project area are anticipated.

2.9 Water Resources

HAR Chapters 11-54 and 11-55 outline a number of requirements related to water quality in the State of Hawai‘i. These include an antidegradation policy; designated uses of waters, which must be maintained; water quality criteria, which must be met during construction and operation; permitting requirements; and more.

2.9.1 Existing Conditions

Three streams flow under Interstate Route H-1 in the project area: Nu‘uanu Stream, Kapālama Canal Stream, and Kalihi Stream. In all three cases the streams are channelized where they pass under Interstate Route H-1 (see photograph). At Nu‘uanu Stream, the channel consist of both hardened sidewalls and a hardened floor. Due to their highly channelized nature, these water resources are primarily used to convey storm water and do not provide significant habitat for plants or animals, such as water birds or fish (biological resources are discussed more in Section 2.10).

Nu‘uanu Stream and Nu‘uanu Stream Bridge

Water quality in these urban streams tends to be poor and Nu‘uanu Stream, Kapālama Stream, and Kalihi Stream are all listed on the State 303(d) List of Impaired Waters (HDOH 2008). All three are cited on the 303(d) list because of trash. Nu‘uanu and Kalihi are also listed because of suspended solids and, in addition, Nu‘uanu Stream has been found to contain pesticides.

2.9.2 Potential Impacts

No Build Alternative

Under the No-Build Alternative, no new impacts to water resources would occur.

Build Alternative

Kapālama Canal Stream and Kalihi Stream will not be directly impacted by the proposed project. The Interstate Route H-1 bridge over Nu‘uanu Stream will be widened as part of the proposed project and an existing 42-inch diameter storm drain pipe that discharges to the stream will be relocated slightly to accommodate the bridge widening. The only direct affect on Nu‘uanu Stream will be additional shading due to the widening of the Interstate Route H-1 bridge. The stream channel will otherwise remain the same as it is today – hardened. The five feet of additional shade is anticipated to have a negligible effect on water quality.

The bridge widening will add roughly 600 square feet of impermeable surface in the project area. Therefore, the bridge widening will not significantly increase the volume of storm water runoff into Nu‘uanu Stream.

By increasing the capacity of Interstate Route H-1, the proposed project will increase the number of vehicles traveling through the project area. Vehicle components, such as tire dust and oil drips, are a potential source of stormwater pollutants. The amount of pollutants associated with vehicles will increase proportionally to the number of vehicles travelling through the project area. Those pollutants become entrained or dissolved in storm water and enter streams in the area.

2.9.3 Mitigation Measures

In coordination with the U.S. Army Corp of Engineers (USACE) ~~is being conducted in accordance with~~ it has been determined that a Clean Water Act Section 404 permit is not required for the project. See Section 3.2.3 and Appendix A for records of coordination.

HDOT is committed to maintaining the current level of water quality in State waters and not impacted the designated uses of State waters. To achieve this, HDOT will avoid~~ing~~ dredging materials from the channel or placing fill within the Waters of the U.S. during the widening of Nu‘uanu Stream Bridge and relocating the nearby storm drain line. The design for the improvements will not require any permanent structural components be placed below the ordinary high water level. HDOT will ~~require~~ indicate in the bid documents that contractors ~~clearly illustrate how they will achieve the~~ complete all work without placing materials (temporary or permanent) below the ordinary high water level ~~in their proposal~~. One possible method includes the following:

- Dredging is not considered to be needed due to the channelized nature of the stream.
- Lowering materials into the channel from the deck of the interstate without the need for heavy equipment in the stream.
- Mounting temporary horizontal beams on the sidewalls and vertical walls of the existing bridge above the water level.
- Building a temporary solid scaffold on those horizontal beams as a work platform and to capture any falling materials to prevent discharges to the stream.
- Removing the temporary scaffold materials using equipment on the deck of the interstate without the need for heavy equipment in the stream.

~~HDOT believes that~~ Requiring the contractor to keep all of their equipment and materials above the ordinary high water level ~~will~~ eliminates the need for a Section 404 Department of the Army (DA) permit.

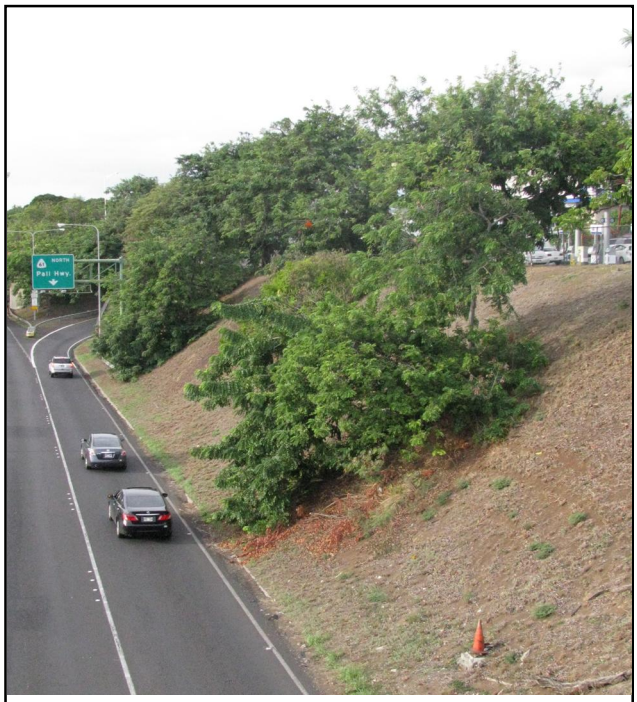
2.10 Biological Resources

2.10.1 Existing Conditions

Within the Interstate Route H-1 right-of-way, there are few biological resources. HDOT maintenance crews maintain the landscape within the right-of-way, which consists primarily of

grass and a few species of common shade trees, such as Rainbow Shower trees. There are no natural or wild areas within the project area.

The three streams, Nuʻuanu Stream, Kapālama Canal Stream, and Kalihi Stream, that cross under Interstate Route H-1 in the project area also provide limited habitat for biological resources. As discussed in Section 2.9, all the streams are channelized. Water birds, such as ducks and herons, have been observed in the streams during visits to the streams made to support the development of this document. Some people feed the birds nearby, attracting them to the area.



Typical landscaping along Interstate Route H-1

Several species of small fish were observed in the streams, they typically congregate under the bridge in shaded areas but are also present in open waters. Some streams that connect the ocean and upland aquatic habitats support native, amphidromous species such as ʻoʻopu. Amphidromous species require a connection through the lowlands to maintain a viable population in the upper reaches of a stream. These are species that reside as adults in suitable stream habitats but have a larval stage that lives in the ocean. The juveniles develop in the sea and then migrate to a suitable stream habitat to complete their life cycle. Although not abundant, ʻoʻopu have been observed in all three streams.

The U.S. Fish and Wildlife Service (USFWS) has confirmed that there are no known threatened or endangered species or designated critical habitat within the project area (Appendix A). See Section 3.2.2 and Appendix A for records of coordination.

2.10.2 Potential Impacts

No Build Alternative

The No Build Alternative would not result in any new impacts to biological resources. Landscaping would continue to be maintained as it is now, which includes trimming grass and trimming trees as necessary to maintain safe highway operation.

Build Alternative

The proposed project will result in a minor reduction in the grassed areas along Interstate Route H-1 in the project area. These reductions will occur in areas where new structural features will be built, including the minor grade adjustment walls and the Nuʻuanu Stream Bridge widening.

Some trees within the right-of-way or overhanging the right-of-way will need to be trimmed or removed in order to complete the proposed project. In order to widen Nu‘uanu Stream Bridge the following tree impacts will occur on the makai side of the interstate:

- On the ‘Ewa (west) side of the stream, between Nu‘uanu Stream and A‘ala Street:
  - Eight Shower trees within the right-of-way will be removed.
  - One Monkeypod tree that overhangs the right-of-way may need to be trimmed.
- On the Diamond Head (east) side of stream, between Nu‘uanu Stream and Nu‘uanu Street, one Shower tree within the right-of-way will be removed, other Shower trees within the right-of-way will be trimmed, and one Monkeypod tree that overhangs the right-of-way will be trimmed.

In the vicinity of Peter Buck Mini Park (corner of Houghtailings and Halona Streets) four rainbow shower trees will be removed. The four trees are within the Interstate Route H-1 right-of-way; two are near the Peter Buck Mini Park basketball court and two are behind a nearby home at 1244 Kapālama Avenue. Their removal is necessary to complete some pavement rehabilitation work, where embankment reconstruction has been determined to be necessary.

During work to replacing the lighting some additional trees may need to be trimmed in order to access the work area and safely install the new lighting.

The proposed project will not result in any new long-term landscape maintenance requirements; the grass will continue to require regular trimming and trees along the interstate will continue to require periodic trimming.

No impact to wildlife is anticipated. Although some birds, including ducks and cranes, and some fish inhabit the streams in the area, the proposed project is not anticipated to detract from the environment they inhabit, which is already very urban in nature.

No significant impacts to biological resources are anticipated.

2.10.3 Mitigation Measures

Road lighting will be designed to employ flat lens fixtures to minimize impacts on protected species (i.e. Newell’s shearwater and the Hawaiian dark-rumped petrel) that potentially fly over the region. The flat lens light fixtures are designed to reduce glare and shield light from migrating birds. When possible, the HDOT will use “The Newell’s Shearwater Light Attraction Problem, A Guide for Architects, Planners, and Resort Managers” in designing the luminaries.

Areas that are disturbed during construction will be restored. This will include planting grass in currently grassed areas. Where trees are removed, some new trees will be planted. On the ‘Ewa (west) side of the Nu‘uanu Stream Bridge five Shower trees will be planted to replace the eight removed. On the Diamond Head (east) side of the Nu‘uanu Stream Bridge one Shower tree will be planted to replace the one removed. In the vicinity of Peter Buck Mini Park, four Shower trees will be planed to replace the four removed.

Shower trees on ‘Ewa (west) side of Nu‘uanu Stream Bridge. The eight trees removed (2 rows of 3 and a single row of 2 behind) would be replaced by a single row of 5 trees.

2.11 Air Quality

As required by the 1977 Clean Air Act (CAA), National Ambient Air Quality Standards (AAQS) were established by the U.S. Environmental Protection Agency (USEPA) for seven major air pollutants: carbon monoxide (CO), nitrogen oxides (NOx), ozone (O_3), particulate matter smaller than 10 microns (PM_{10}), particulate matter smaller than 2.5 microns ($PM_{2.5}$), sulfur oxides (SOx), and lead. Current standards for ozone and $PM_{2.5}$ were established in September 1997. The State of Hawai‘i has also established its own standards for these pollutants. Both the National and State AAQS are listed in Table 2-11.

CAA Section 107 requires the USEPA to publish a list of geographic areas that are not in compliance with the National AAQS, and these areas are called non-attainment areas. Areas that have insufficient data to make a determination are unclassified, and are treated as attainment areas until proven otherwise. The designation of an area is made on a pollutant-by-pollutant basis.

Table 2-11: National and State Ambient Air Quality Standards

Pollutant	Standards		
	Hawai'i State	Federal Primary[a] (Health)	Federal Secondary[b] (Welfare)
Carbon Monoxide (CO)			
1 Hour[1]	9 ppm	35 ppm	----
8 Hour[1]	4.4 ppm	9 ppm	----
Nitrogen Dioxide (NO_2)			
1 Hour	----	0.1 ppm	----
Annual Mean	----	0.053 ppm	0.053 ppm
Annual Average	70 ug/m^3 (0.04 ppm)	----	----
PM10[c]			
24 Hour[3]	150 ug/m^3	150 ug/m^3	150 ug/m^3
Annual (Arithmetic)[2]	50 ug/m^3	----	----
PM2.5[d]			
24 Hour[5]	----	35 ug/m3	35 ug/m^3
Annual (Arithmetic)[4]	----	15 ug/m3	15 ug/m^3
Ozone (O_3)			
8 Hour Rolling Average	157 ug/m^3 (0.08 ppm)	0.075 ppm	0.075 ppm
Sulfur Dioxide (SO_2)			
1 Hour	----	0.075 ppm	----
3 Hour[1]	0.5 ppm	----	1,300 ug/m^3 (0.5 ppm)
24 Hour Block Average	0.14 ppm	0.14 ppm	----
Annual Average	80 ug/m^3 (0.03 ppm)	80 ug/m^3 (0.03 ppm)	----
Lead (Pb)			
3 Months (Arithmetic)	1.5 ug/m^3	0.15 ug/m^3	0.15 ug/m^3
Hydrogen Sulfide (H_2S)			
1 Hour	0.025 ppm	----	----

Source: State of Hawai'i, Department of Health, Clean Air Branch – Hawai'i Administrative Rules, Chapter 59. Code of Federal Regulations, Title 40, Part 50, January 2007 and EPA. http://epa.gov/air/criteria.html

Notes:
[a] Designated to prevent against adverse effects on public health
[b] Designated to prevent against adverse effects on public welfare, including effects on comfort, visibility, vegetation, animals, aesthetic values, and soiling and deterioration of materials.
[c] Particulate matter 10 microns or less in diameter
[d] Particulate matter 2.5 microns or less in diameter.
(1) Not to be exceeded more than once per year.
(2) Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the agency revoked the annual PM_{10} standard in 2006 (effective December 17, 2006).
(3) Not to be exceeded more than once per year on average over 3 years.
(4) To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 μg/m^3.
(5) To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 μg/m^3 (effective December 17, 2006).

2.11.1 Existing Conditions

The State of Hawai'i is designated as an attainment area for CO, ozone (O3), PM_{10}, and $PM_{2.5}$. There is an air monitoring site near the Interstate Route H-1 corridor on Punchbowl Street located on the roof of the Department of Health building.

2.11.2 Potential Impacts

The pollutants relevant to evaluating the air quality impacts of a roadway project are those contained in motor vehicle emissions. Vehicles emit carbon monoxide (CO), volatile organic compounds (VOCs), the six priority mobile source air toxics (MSAT), nitrogen oxide (NOx), and lead (lead levels have decreased substantially and will continue to do so due to the mandated elimination of lead in gasoline). Those pollutants can react in the atmosphere to generate PM_{10} and $PM_{2.5}$ on a regional basis. CO air pollution is generally considered to be a microscale problem that can be addressed locally to some extent. The other pollutants degrade air quality at a regional scale.

Regional air quality impacts related to VOC, the six priority MSAT, NOx, PM_{10}, and $PM_{2.5}$ are primarily dependent on changes in vehicle miles traveled (VMT), vehicle hours traveled (VHT), and vehicle mix (gasoline-fueled cars vs. diesel-fueled trucks and buses). None of these factors are predicted to change significantly due to building the project. Therefore, the build alternative will have similar impacts as the no-build.

The proposed project is not predicted to cause or exacerbate a violation of the State or National AAQS.

2.11.3 Mitigation Measures

Implementing air quality mitigation measures for long-term traffic-related impacts are unnecessary and unwarranted because no significant variation of VMT, VHT, and vehicle mix is expected between the No Build and Build Alternatives. In addition, CO concentrations are expected to remain well within the National and State AAQS.

2.12 Visual and Aesthetic Resources

The proposed project involves the improvement of existing structures within the existing interstate right-of-way; therefore, there will be very limited visual and aesthetic impacts. There will be slight visual changes associated with the minor structural changes made and the fact that there will be four through lanes instead of three. There will also be limited changes associated with the Nuʻuanu Stream bridge. The Nuʻuanu Stream bridge will be widened from a current width of roughly 106.5 feet to roughly 111.5 feet, a less than a 5 percent increase in overall bridge width.

The bridge is lower in elevation than the nearby land uses, including Foster Community Garden and the Keola Hoʻonanea residential building. Trees overhang the stream downstream of the bridge, concealing the view of the bridge from Keola Hoʻonanea residents. There are no trails within Foster Botanical Garden that provide views of the bridge. The only public area from which the bridge is readily visible is College Walk on the ʻEwa side of Nuʻuanu Stream. College Walk is a walkway that extends along the ʻEwa side of the stream from North Beretania Street to near Interstate Route H-1, the portion between North Beretania and North Kukui Streets is also known as Kila Kalikimaka Mall. As it approaches Interstate Route H-1, the walkway turns ʻEwa away from the stream, goes up some stairs, and connects to ʻAʻala Street. Between North Vineyard Boulevard and ʻAʻala Street, the section of College Walk nearest the bridge, College Walk is not heavily travelled. Walking mauka on College Walk in this area the bridge is visible straight on and there is little perception of the bridge's width (see photograph, next page). The

view of the bridge is not the primary view direction from College Walk, the primary view is toward the stream and Foster Garden on the opposite side of the stream. For these reasons, the widening of the bridge is not anticipated to have a negative visual and aesthetic impact to people on College Walk.

Nu'uanu Stream Bridge viewed from College Walk

Those travelling on Interstate Route H-1 eastbound will have a view of the widened bridge. The minor widening of the bridge is not anticipated to have a negative visual and aesthetic impact on interstate users for whom the bridge will fit in the context and who will pass over the bridge quickly.

2.13 Social and Economic Conditions

As discussed in Section 2.2, the proposed project will not require the acquisition of any new right-of-way; therefore, no direct impacts to social and economic conditions in the project corridor are anticipated.

Social quality-of-life and economic conditions may be improved due to the reduction in traffic congestion anticipated as a result of the proposed project. The reduction in congestion may result in reduced commute times for the general public that commute through the project area. Improvements in connectivity also may improve economic conditions in the region.

2.14 Environmental Justice

Executive Order (EO) 12898 regarding Environmental Justice (EJ) requires federal agencies to take appropriate and necessary steps to identify and address disproportionately high and adverse effects of federal projects on minority and low-income populations' health or environment. Because of expected federal participation in the construction funding of this project, the project must comply with EO 12898.

The proposed project is not anticipated to have a direct impact on any specific population, other than the travelling public on Interstate Route H-1. Because those travelling of Interstate Route H-1 represent a cross section of Honolulu's population, minority and low-income as well as all others, there will be no disproportionate impact on minority and low-income populations.

2.15 Cultural, Historic, and Archaeological Resources

2.15.1 Regulatory Requirements

Section 106 of the National Historic Preservation Act (NHPA) requires that federal agencies consider the effect of their projects (referred to as "undertakings" in NHPA Section 106) on any resource listed on or eligible for the National Register of Historic Places (National Register). In accordance with regulations provided in 36 Code of Federal Regulations (CFR) 800, the NHPA Section 106 process involves coordination and consultation with the State Historic Preservation Officer (SHPO), and other agencies and organizations that have an interest in or are mandated to protect historic properties. In addition, the Advisory Council on Historic Preservation (ACHP) is afforded the opportunity to comment on actions that may potentially affect historic properties. Chapter 6E of the Hawai‘i Revised Statutes (HRS), as described in regulations provided in Title 13, Chapter 275 of the Hawai‘i Administrative Rules (HAR), places similar responsibilities on State agencies to evaluate their projects. Since the project involves both federal and State agencies and funds, both regulations apply to the project.

After initiating the Section 106 process, the federal sponsoring or regulating agency identifies whether there are any historic properties in the project's Area of Potential Effect (APE); assesses whether properties identified in the APE, if any, will be adversely affected by the proposed project; and resolves adverse effects, if necessary. The APE is defined as the geographic areas within which an undertaking may directly or indirectly cause changes in the character of historic properties, if any such properties exist. Adverse effects, if any, are resolved through a Memorandum of Agreement with the SHPO, which may include the ACHP.

For a district, site, building, structure, or object to be considered eligible (or be considered "historic" or a "historic property") for the National Register, it must be at least 50 years old and have quality of significance in American history, architecture, archeology, engineering, and culture that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

A. Be associated with events that have made a significant contribution to the broad patterns of our history; or

B. Be associated with the lives of significant persons in or past; or

C. Embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. Have yielded or may be likely to yield, information important in history or prehistory.

For a district, site, building, structure, or object to be considered eligible for the Hawai‘i Register of Historic Places (Hawai‘i Register), it must be at least 50 years old and meet any one of the four above criteria or an additional criterion specific to the State:

E. The site has traditional cultural significance to an ethnic group.

Under Section 106, the federal agency – in this case, FHWA – is responsible for assessing the effects of the project (i.e., Build Alternative) on all eligible historic properties within the APE.

Pursuant to Section 106 (36 CFR 800), FHWA can render one of the following three possible findings:

- No historic properties affected. This determination means that either there are no historic properties present within the APE, or there are historic properties present but the undertaking would have no effect upon them of any kind (that is, neither harmful nor beneficial).
- No adverse effect. This determination means that there could be an effect, but the effect would not be harmful to those characteristics that qualify the property for inclusion in the National Register.
- Adverse effect to a significant cultural and/or historical resource. This determination means an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property.

The Section 106 consultation process for the proposed project is on-going but will be completed before the Final EA. It is anticipated that the HRS Chapter 6E review will be concluded by SHPD in conjunction with the Section 106 process. Section 3.0 and Appendix A provide details of coordination conducted to date with the SHPD and cultural informants, pursuant to Section 106 and HRS Chapter 6E-8.

2.15.2 Area of Potential Effect

The area of potential effect (APE) for the project is right-of-way limits of Interstate Route H-1 within the project area (Figure 1-1) plus the roughly 15-foot wide construction easements that will be necessary on Farrington High School, TMK 1-6-021:005; Bishop Museum, TMK 1-6-024:001; and Kalihi-Pālama Library, TMK 1-6-024:003 (Figure 1-6). The width of the existing Interstate Route H-1 right-of-way varies from 120 to 300 feet wide in the project area. The project is roughly 3.5 miles long. The roughly 15-foot construction easement strips total roughly 1,000 feet in length and amount to less than 0.4 acre. The total APE is estimated to be 91 acres.

2.15.3 Existing Conditions

Background

The project crosses through three Ahupuaʻa, the traditional land divisions of Native Hawaiians. As illustrated on Figure 2-11, those Ahupuaʻa are Kalihi, Kapālama, and Honolulu.

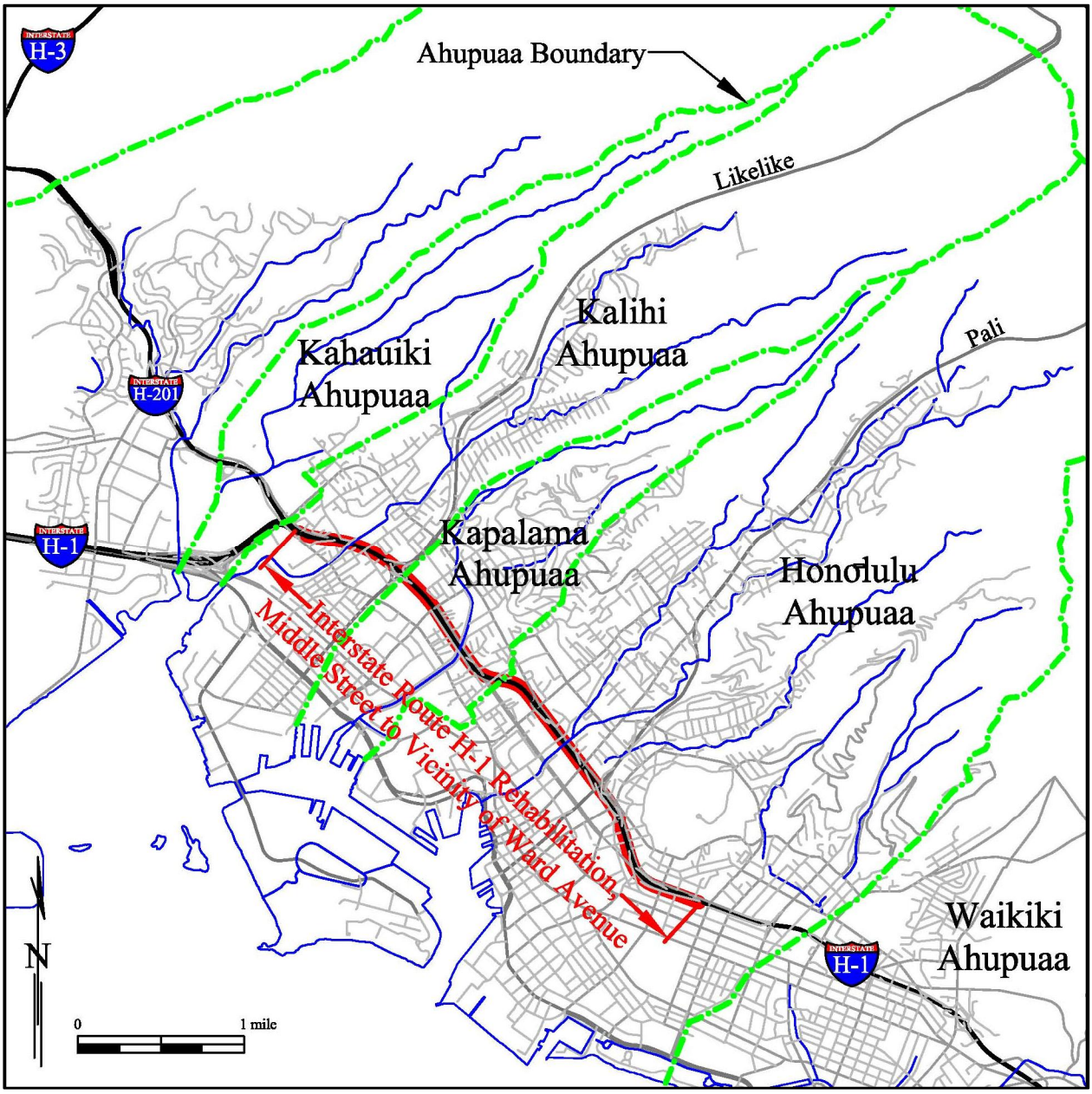


Figure 2-11: Ahupuaʻa in Project Area

Historic documents indicate that the area had, in pre-contact traditional Hawaiian times, an expansive network of irrigated taro fields with associated habitation sites that extended from Kou, the settlement area focused around present Honolulu Harbor. The taro fields, or loʻi, extended from near the shoreline, where fish ponds were present, through the project area, and to the foothills of the Koʻolau Mountains.

During the second half of the nineteenth century (1850 – 1900) the taro field loʻi were converted to rice fields, especially in the Kapālama ahupuaʻa. Urbanization of Honolulu ahupuaʻa, including Nuʻuanu Valley, was occurring during this period as well; streets, including Liliha,

Nuʻuanu, and Judd Streets, extended into Nuʻuanu Valley and western homes were being built. Chinatown was also being established during this time period.

By the middle of the twentieth century (1950) most of the streets present today had been established and the entire area urbanized.

Interstate Route H-1 in the project area was built in the late 1950s and early 1960s. The construction of the interstate significantly changed the landscape in the project area. Since that time development in the area has continued, primarily as redevelopment of parcels to higher/more dense uses.

The last roughly 150 years of intensive development in the project area has altered and/or destroyed evidence of the pre-contact Native Hawaiian developments, such as the loʻi and related habitations. Archaeological monitoring has been performed for utility and roadway projects nearby Interstate Route H-1 and has encountered modern and historic debris and artifacts such as glass bottles, ceramics, and metallic items. However, reports associated with those monitoring efforts indicate that no significant cultural resources have been encountered. Human burials have been discovered during development in the Kapālama, Downtown, and Nuʻuanu Valley areas; however, these discoveries were determined to be post-contact burials. The nearest burials encountered according to records at the SHPD were found at the Kalihi Transit Center (711 Middle Street) and The Pacific Club (1451 Queen Emma Street).

Although not within the APE, Foster Botanic Garden (TMK 1-7-007:001 and 002; 1-7-008:001 and 002) abuts the APE and is on both the Hawaiʻi Register and the National Register (SIHP site number 80-14-1389).

Historic Properties in Area of Potential Effect

There are no known pre-contact historic resources within the APE.

The primary structure in the APE is the Interstate Route H-1. In the project area Interstate Route H-1 was built in the late 1950s to early 1960s; therefore, it is over 50 years old. The Advisory Council on Historic Preservation adopted the "Section 106 Exemption Regarding Effects to the Interstate Highway System" on March 10, 2005. The exemption states that all components of the interstate highway system, which includes Interstate Route H-1, are not to be considered eligible for the National Registry, except for a select list of interstate highway system facilities. Interstate Route H-1 is not on the "Final List of Nationally and Exceptionally Significant Features of the Federal Interstate Highway System," the select list of interstate highway system facilities that can be considered eligible for the National Registry once they are 50 years old. Therefore, features of Interstate Route H-1 that are older than 50 years old in the APE are exempt from consideration as historic properties.

The roughly 15 foot wide strips fronting Interstate Route H-1 are within the APE; therefore, small portions of the following properties are with the APE:

- Bishop Museum Complex (TMK 1-6-024:001) is on both the Hawaiʻi Register and the National Register (SIHP site number 80-14-1353).
- Farrington High School (TMK 1-6-021:005) is on the Hawaiʻi Registry (SIHP site number 80-14-9768).

These locations can be seen in Figure 1-6.

Nu‘uanu Stream quarried lava rock and mortar sidewall

The only other known potentially historic properties within the APE are structures related to the streams crossed by Interstate Route H-1 in the project area. Nu‘uanu Stream, Kapālama Canal, and Kalihi Stream are channelized where H-1 crosses them and the channel sidewalls are composed of quarried lava rock and mortar (see photograph). These stream sidewalls generally extend a relatively short distance upstream from Interstate Route H-1, but extend a significant distance downstream. Where Interstate Route H-1 crosses the streams, the lava rock and mortar stream sidewalls have been replaced by concrete bridge abutments. The exact age of the lava rock and mortar sidewalls is unknown, but they do appear in photographs dating to the Chinatown fire in 1900, indicating that at least the Nu‘uanu Stream sidewalls are more than 110 years old.

Cultural Resources

There are no specific cultural resources within Interstate Route H-1 right-of-way (ROW). No public activities other than transportation are allowed to occur within the ROW.

2.15.4 Potential Impacts

No Build Alternative

Under the No-Build Alternative, no historic properties would be affected.

Build Alternative

Under the Build Alternative, it is anticipated that the only historic property affected will be a short section of the Nu‘uanu Stream lava rock and mortar sidewalls. No other historic properties are anticipated to be affected because:

- All disturbances will occur within the right-of-way for Interstate Route H-1 except for minor disturbances outside of the existing right-of-way within the roughly 15-foot wide construction easements on Bishop Museum, Kalihi-Pālama Library, and Farrington High School properties. The disturbances within the construction easements will be restricted to equipment access, temporary materials storage, and tree trimming. No ~~excavation or~~ modifications of existing structures within the three properties will occur and the construction easement area will be restored to pre-construction conditions once construction is completed.
- The project will involve limited to no disturbance to previously undisturbed areas. The interstate is in a highly disturbed area with both cuts and fills used during its construction.

- Monitoring of excavations for utility and roadway projects nearby have not encountered any significant historic properties. Similar conditions are predicted in the project area.

Affects to the Nuʻuanu Stream lava rock and mortar sidewalls will be minor. The affect will consist of (a) removal of a roughly 5-foot length of the lava rock wall on both sides of the stream, and (b) removal and then reconstruction of a roughly 8 foot long by 10 feet deep portion of the lava rock wall on the ʻEwa (west) side for the relocation of the storm drain pipe. The affect is considered minor because (a) it is a very short portion of the wall relative to its total length (over 3,000 feet long); and (b) the affected area is not readily visible from any public access area. The stream sidewall will retain its integrity and eligibility for listing on the National Register.

The proposed project will not have a direct effect on cultural activities or resources, other than those described above.

2.15.5 Mitigation Measures

Mitigation measures during the construction of the proposed project will be implemented to minimize and avoid potential impacts to archaeological, cultural, and historic resources. Although the Section 106 process has not been completed and additional mitigation measures may be identified through the process, the following mitigation measures will be implemented at a minimum:

1. Where possible, the lava rock and mortar Nuʻuanu Stream sidewall will be rebuilt to the extent practicable where removed during construction activities. Some portion of the wall will be removed to allow for bridge widening and storm drain relocation. The removed rocks would be set aside for wall restoration following construction. During the construction period HDOT will require that the contractor store the lava rock in a locked location inaccessible to the general public. HDOT will also require that the contractor place a sign on the storage area so that the rocks are not used by contractor personnel for another purpose.

   In addition, excess rocks not utilized during the rebuilding of the sidewall will be recycled for incorporation into other projects.

2. HDOT will mandate archaeological monitoring during the following construction activities:
   - Nuʻuanu Stream bridge widening and lighting replacement activities that disturb soil within 100 feet of Nuʻuanu Stream.
   - Lighting replacement activities that disturb soil within 100 feet of Kapālama Canal.
   - Lighting replacement activities that disturb soil within 100 feet of Kalihi Stream.

   The archaeological monitoring plan (AMP) will be submitted to SHPD for review prior to construction.

3. If cultural materials are discovered during construction, all earth-moving activity within and around the immediate discovery area would be diverted until a qualified archaeologist can assess the nature and significance of the find.
4. If human remains are discovered, Hawaii Administrative Rules Title 13, Subtitle 13, Chapter 300 states that all activities shall cease in the immediate area of the human skeletal remains, that appropriate action to protect the integrity and character of the burial site from damage is undertaken, and SHPD and Police Department would be contacted. The appropriate process would then proceed in conformance with Hawaii Administrative Rules §13-300 Subchapter 4 "Procedures for Proper Treatment of Burial Sites and Human Skeletal Remains."
5. If the archaeological monitor believes a find may be significant, HDOT will inform SHPD and NHOs involved in the Section 106 consultation process (Section 3.2.1) and seek input on the protection of the find, if warranted.

HDOT and FHWA will prevent the disturbance or taking of any historic property or resource to the extent possible by instituting these mitigation measures and enforcing their implementation by contractors.

2.16 Parks and Recreational Resources

Along the project there are a number of parks and recreational resources, including City parks and private clubs (Figure 2-12). As discussed in Section 2.5, the proposed project will not require the acquisition of any new right-of-way; therefore, no direct impacts to parks and recreational resources in the project corridor are anticipated.

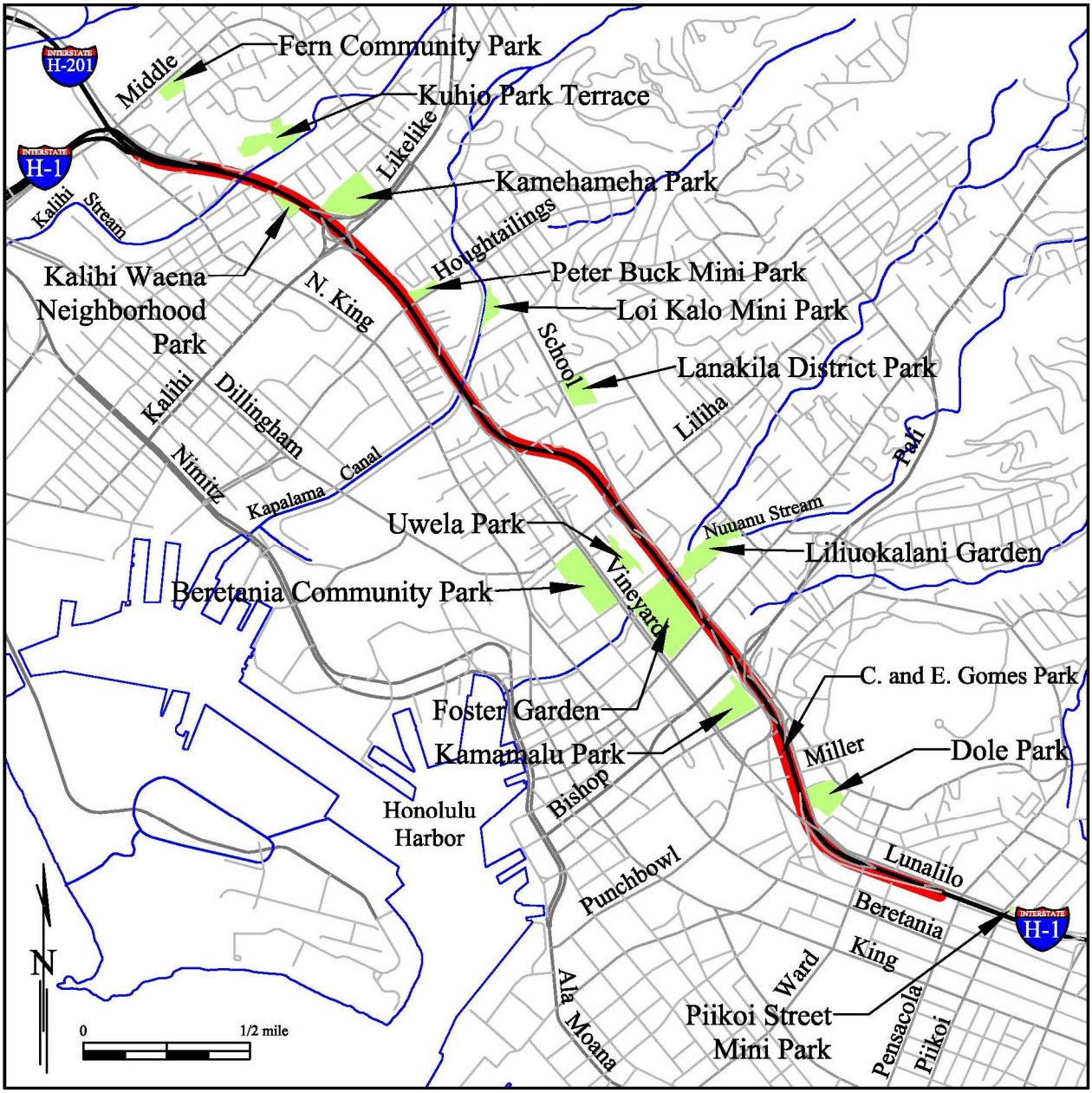


Figure 2-12: Parks

No significant indirect impacts to parks and recreations resources are anticipated. As discussed in Section 2.12, the project will not result in significant visual changes within the environment. Furthermore, Interstate Route H-1 is not highly visible from, nor is it a visual attraction at any of the parks and recreations resources along the project corridor. As discussed in 2.4, noise levels along the project corridor are not anticipated to change significantly from their current level along the project corridor. In fact, as summarized in Table 2-6, noise levels at most parks and recreational resources are anticipated to drop as a result of the project, including Kamehameha Park (#13 and #Q1 in Table 2-6), Farrington High School athletic fields (#15 in Table 2-6), Foster Botanical Garden (#21 in Table 2-6), Peter Buck Mini Park (#T in Table 2-6), and

Lili‘uokalani Botanical Garden (#N1 in Table 2-6). Therefore, no indirect effect to parks and recreational resources are anticipated as a result of the project.

2.17 Section 4(f) Evaluation

Section 4(f) of the Department of Transportation Act, 49 U.S.C. 303 and 23 U.S.C. 138 (referred to hereafter as “Section 4(f)”), permits the use of land for a transportation project from a significant publicly-owned public park, recreation area, wildlife and waterfowl refuge, or a historic site only when the FHWA has determined that:

- There is no feasible and prudent alternative to such use; and
- The project includes all possible planning to minimize harm to the property resulting from such use.

The purpose of Section 4(f) is to preserve significant parkland, recreation areas, refuges, and historic/archaeological sites by limiting the circumstances under which such land can be used for transportation projects. The word “use” in this case means:

- Land is permanently incorporated into a transportation facility;
- There is a temporary occupancy of land that is adverse in terms of preservation of the resource; or
- The project’s proximity to the site substantially impairs those functions that qualify the site as a Section 4(f) resource even though no land is permanently or temporarily acquired. This is called “constructive use.”

As noted in Section 2.16, the project will not take lands from publicly-owned public parks or recreational facilities. The project area also does not contain or impact wildlife and waterfowl refuges.

One historic site will be ~~affected~~ “used”, as discussed in Section 2.15, but the affect is not considered “adverse” as defined by regulation. Furthermore, there is no prudent or feasible alternative to affecting the historic stream channel sidewall: the bridge needs to be widened to accommodate the desired lanes and satisfy the project’s purpose and need (Section 1.2), and there is no way to widen the bridge without having a minor use ~~effects~~ on the historic sidewall.

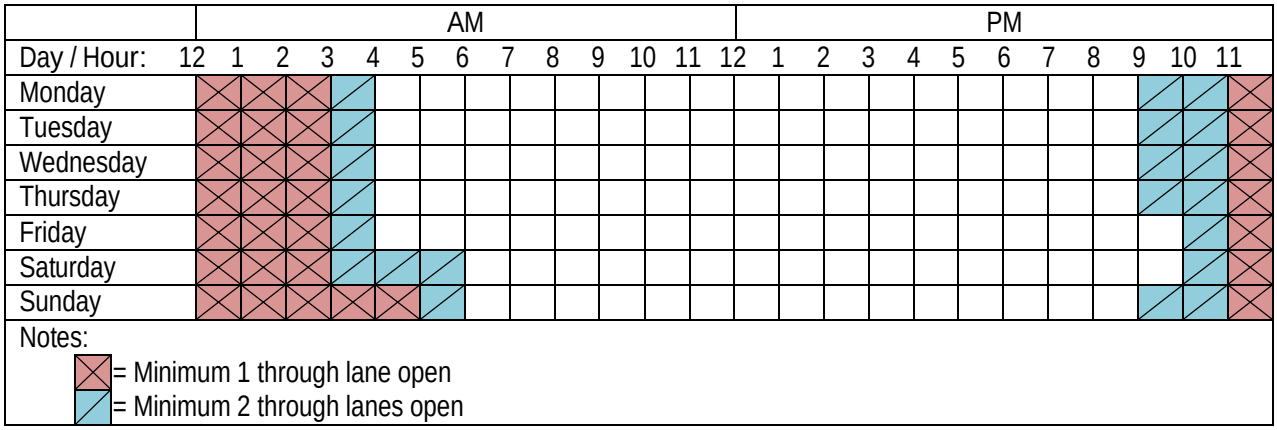
2.18 Construction Impacts and Mitigation Measures

2.18.1 Maintenance of Traffic

Construction activities will cause motorists traveling on Interstate Route H-1 to experience delay and inconvenience for approximately one year, the estimated duration of construction. To minimize traffic and access problems on Interstate Route H-1 and adjacent side streets, construction phasing and traffic control plans will be developed and implemented.

Most proposed project activities will be restricted to off-peak nighttime hours due to the traffic impacts that would occur if they were performed during daytime hours. Figure 2-13 summarizes the standard allowable lane closures during the construction period. Up to two lanes in each direction will be closed, as necessary, to complete the proposed project.

Figure 2-13: Summary of Standard Construction Period Lane Closures



In additional, there may be occasions when lane closures beyond these standards are necessary. During particular construction operations it may be necessary to close one or two through lanes of traffic for longer periods of time or to close all through lanes for a longer period of time.

Some construction work (i.e. bridge widening and shoulder activities such as lighting replacement) may take place at any time of the day (daytime and nighttime, 24-hours a day, 7 days a week), provided the activities require the closure of no more than one through lane for a short period of time or the closure of an auxiliary lane. For example, some of the bridge widening work may be able to take place with only the closure of the auxiliary fourth lane between Liliha Street and Pali Highway.

A maintenance of traffic (MOT) plan will be developed during final project design and implemented by the selected contractor. The MOT plan will provide the contractor with details regarding lane closures, such as those outlined in Figure 2-13, and other details necessary to maintain traffic movement through the area. The public and emergency responders will be routinely informed of planned construction activities and lane closures throughout the construction period. The public information program is described in Section 2.18.3.

If it is necessary to close all through lanes for any length of time, HDOT will coordinate with emergency responders to identify suitable alternative routes for emergency response vehicles. In addition, in the event of a natural disaster (i.e. tsunami warning or approaching hurricane), HDOT would either not close the interstate at all, or, if the closure was in place, work as quickly as possible to restore as many lanes as possible to aid in evacuation and emergency response during the disaster response period.

2.18.2 Air Quality

Air quality impacts during roadway construction generally consist of fugitive dust and mobile source emissions from construction equipment.

Fugitive dust is airborne particulate matter, of usually large particle size, generated by construction vehicles operating around construction sites and from material blown from uncovered haul trucks, stockpiles, and exposed areas. The emission rate for fugitive dust emissions from construction activities is difficult to estimate accurately because its generation

varies greatly depending upon the type of soil, the amount and type of dirt-disturbing activity, the moisture content of exposed soil, and wind speed.

Frequent watering will control fugitive dust at construction sites. In addition, wind screens may be used in areas near residences and commercial districts, as well as limiting the areas of disturbance at any given time. Landscaping will be re-established as early as possible. To prevent haul trucks from tracking dirt onto paved streets, tire washing or road cleaning may be appropriate. State regulations further stipulate that open-bodied trucks be covered at all times when in motion if they are transporting wind-erodible materials.

Construction vehicles and equipment will emit engine exhaust. The largest of this equipment is usually diesel-powered, which emit relatively high levels of NOx in comparison to gasoline-powered equipment. However, standards for such pollutants are set on an annual basis and will therefore not likely be violated by short-term construction equipment emissions.

2.18.3 Noise

Construction will involve the use of heavy machinery that may cause temporary noise impacts to adjacent noise sensitive land uses. Table 2-12 presents a range of noise levels for various construction equipment anticipated to be used during construction of the proposed project. Equipment noise levels vary depending on the make and model of the equipment, the operation being performed, the condition of the equipment, and other variables. The noise levels listed are based on published measurement taken at a distance of 50 feet from the equipment.

Table 2-12: Construction Equipment Noise Levels

Equipment	Decibels	Equipment	Decibels
Standard Construction Equipment		Light Impact Equipment	
Truck	75 - 90	Jack Hammer	81 - 98
Saw	72 - 81	Jumping Jack	81 - 97
Light Tower	62 - 72	Heavy Impact Equipment	
Cold Planer	79 - 88		
Paving Machine	86 - 88	Hoe rams	95 - 106
Roller	63 - 70	Vibratory Sheetpile driver	90 - 100
Striping machine	75 - 86		
Concrete Truck	75 - 88		
Backhoe/Loader	72 - 83		
Compressor	74 - 87		
Generator	71 - 82		
Crane	75 - 87		

Since HDOH maintains community noise control standards (HAR Section 11-46) that apply to construction noise, these specifications will be followed. A noise permit will be obtained for construction activities performed during standard work hours (Monday through Friday 7:00 a.m. through 6:00 p.m. and Saturday 9:00 a.m. through 6:00 p.m.). A copy of the noise permit application is included in Appendix D.

A noise variance will be obtained to allow construction activities to occur beyond standard work hours. As discussed in Section 2.18.1, construction will occur at night, beyond standard work

hours due to the traffic impacts that would ensue should the work be performed during normal work hours. A copy of the noise variance application is attached in Appendix E.

The noise variance application outlines mitigation measures that will be employed to lessen noise disturbances during night work, including:

- A public information program will be employed prior to and during construction. The program will consist of:
  - The contractor sending an informational flyer to all addresses within 500 feet of the project area roughly two weeks prior to the start of construction. The flyer will include general project information and the name and phone number of a contractor representative to contact.
  - Providing information to the press and emergency service providers on at least a weekly basis.
  - Placing legal advertisements in the newspaper every two weeks identifying the areas where work will occur at night over the next two weeks along with a name and phone number to contact with questions or complaints.
  - ~~Updating of HDOT's~~ A project-specific website will be established by the selected contractor and updated at least every two weeks with information regarding the time and location of night work as well as a name and phone number to contact with questions or complaints.
- Quiet work procedures will be employed to attenuate and control noise emissions emanating from the construction site, such as:
  - Either ambient-sensing backup alarms or ground guides will be used for signaling when equipment backs up at night (8:00 p.m. to 6:00 a.m.).
  - Construction activity constraints for night work, where applicable.
  - The use of temporary noise barriers for both day-time and night-time sensitive receptors, where feasible.
  - The strategic placement of stationary equipment such as compressors and generators.
  - All equipment will be maintained in good working order and with appropriate mufflers.
  - A job-site inspector will be designated to whom immediate complaints can be forwarded for prompt response and who will have the general responsibility of monitoring quiet work procedures.
  - Instructional meetings will be held with construction crews and truck drivers to discuss noise abatement procedures, including the use of engine brakes, loading and unloading cargo, shouting, use of signal callers, and other practices as required.
- The selected contractor will have a corrective action program in place that lays out steps and responsibilities to respond to complaints and correct deficiencies.

2.18.4 Water Resources

The primary potential for construction-phase water resource impacts will be associated with erosion and sedimentation associated with the project's earth disturbing activities. The project will not alter existing drainage patterns.

During construction, best management practices (BMPs) will be implemented to prevent debris and polluted runoff from stream or other natural waters. Storm water runoff and erosion during project construction and landscaping will be mitigated through the use of construction Best Management Practices (BMPs) established and permitted before work begins. The project has already obtained a Notice of General Permit Coverage (NGPC) from the HDOH as part of the National Pollutant Discharge Elimination System (NPDES) program. The Notice of Intent (NOI) submitted to HDOH in order to obtain the NGPC and the NGPC are provided in Appendix G. As outlined in the NOI, generally accepted BMPs such as the following will be used:

- Work area isolation devices, such as diversion dams;
- Perimeter controls and sediment barriers, such as silt fences;
- Minimizing disturbance area;
- Excavated/Stockpiled material protection, including the covering of stockpiles;
- Storm drain inlet and catch basin protection devices will be installed; and
- Proper waste management will occur, including separation of recyclable material.

During the widening of Nu‘uanu Stream bridge, construction methods will be planned to avoid any discharges to Nu‘uanu Stream. It is currently envisioned that bridge widening construction will be done from the roadway and from a temporary scaffold mounted to the existing bridge.

2.18.5 Biological Resources

To avoid impacts to listed seabirds, including the shearwater, during the seabird fledging period, September 15 through December 15, nighttime construction lighting will be shielded and directed toward the ground during this period.

As outlined in Section 2.10.2, some trees along the project corridor may need to be trimmed in order to complete the work, in particular the replacement lighting.

2.18.6 Solid Waste Management and Hazardous Waste

As commitments and conditions of the NPDES permit (Appendix G), good housekeeping BMPs will be required of the contractor, such as ensuring that:

- All waste materials be collected and stored in securely lidded dumpsters that are emptied before becoming overly full and not buried on site;
- Materials stored on-site be stored in a neat, orderly manner in appropriate containers (i.e., per manufacturers recommendations);
- All on-site vehicles be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage;

- A spill cleanup kit be located on-site where petroleum products, paints, or other hazardous materials are stored; and
- All sanitary waste generated during the construction phase will be collected from portable units as required and directed to a HDOH-permitted treatment facility.

As stated in Section 2.8, hazardous materials contamination is not likely to be uncovered during construction. However, to avoid construction delays and ensure protection of human health and the environment, a contingency plan, consistent with HRS 128D, shall be implemented to manage and report should impacted soil be encountered or a release into Nu‘uanu Stream occurs during construction activities. During construction, personnel should be alert for signs of potential petroleum contamination when soil is excavated. The contractor should be aware that petroleum products are stored in underground tanks in the region and undocumented releases could have occurred. If contamination were identified during construction, the contractor would report it immediately to HDOT. Handling of hazardous materials and possible site remediation would be required in accordance with applicable State and federal laws, specifying the handling, treatment, and disposal of contaminated materials.

2.18.7 Historic and Archaeological Resources

Construction activities have the potential to encounter undocumented burial and archaeological sites. As detailed in Section 2.15.5, if such a site were uncovered during construction, work would stop and the appropriate authorities, including SHPD and the police, would immediately be notified. Construction would resume upon approval of the appropriate authorities.

2.18.8 Relationship of Short-Term Uses and Long-Term Productivity

Construction of the proposed project will have short-term effects on the environment as described in this section. These effects will end with the completion of construction. The proposed project will provide improvements to the transportation system as described in Section 1.2.

The long-term benefit that will be provided by the proposed project will be greater than the short-term adverse effects on the human environment. The proposed project does not exclude future opinions, narrow the range of beneficial uses of the environment, or pose long-term risks to health and safety.

2.19 Secondary and Cumulative Impacts

2.19.1 Potential Secondary Impacts

Secondary, or indirect, impacts are defined by Council on Environmental Quality (CEQ) as “effects which are caused by the [proposed] action and are later in time or further removed in distance, but are still reasonably foreseeable. Indirect effect may include growth-inducing effects and other effects related to changes in the pattern of land use, population density, or growth rate…”

No significant secondary impacts are anticipated should the proposed project proceed.

Urban development will proceed in Honolulu regardless of the proposed project. While rehabilitating Interstate Route H-1 from Middle Street to the vicinity of Ward Avenue will help improve the regional roadway network, factors affecting development such as demand, property prices, and disposable income levels are likely to have a far greater effect on development pressures. Given the factors above and the coverage of the existing roadway network, the proposed project is not constraining proposed development, and proceeding with the project will have only a minor effect on overall development trends in Honolulu. Therefore, the proposed project will not induce secondary land uses.

2.19.2 Potential Cumulative Impacts

Cumulative impacts are defined by CEQ as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time." Cumulative impacts include the direct and indirect impacts of a project together with the reasonably foreseeable future actions of others.

Past Actions

O‘ahu experienced major population growth (between 42 and 64 percent per decade) between 1920 and 1950. Much of this growth can be attributed to a military buildup before, during, and after World War II, as well as rapid increases in the tourism industry as air travel became more available. Growth rates decreased steadily in subsequent decades and are projected at a rate of only 4% per decade from 2010 to 2040 (State of Hawaii Department of Business Economic Development and Tourism).

The area immediately surrounding Interstate Route H-1 in the project area, Middle Street to the vicinity of Ward Avenue, has been extensively modified by urban development. The most notable past action was the urban development of the area; the area was built-out in the post-World War II years. Since that time, redevelopment and infill development has occurred in the project area, resulting in increasing population density and an increasing volume of commercial space.

Present and Reasonably Foreseeable Actions

Redevelopment and infill development are anticipated to continue in the project area. Population density will continue to increase and additional commercial space will continue to be developed. Specific planned and foreseeable development in the vicinity of the proposed project include:

- Honolulu Rail Transit Project and related transit oriented development in the vicinity of transit stations.
- Kaka‘ako developments, including Halekauwila Place, 690 Pohukaina, and Kamehameha Schools Kaiāulu ‘o Kaka‘ako Master Plan, among others.
- Hawai‘i Airports Modernization Program.

The proposed project will not change the effects of development in the vicinity of the proposed project. The proposed project is not a pre-requisite for any of the foreseeable actions; planned development is occurring and will continue to occur independent of the proposed project. Consequently, the proposed project will not cumulatively affect the resources discussed below beyond what will occur due to these planned and reasonably foreseeable developments.

Land Use

At a regional level, land use changes associated with past actions have transformed the land from a relatively small town in 1900 to a dense urban center. As redevelopment to higher-density uses continues in the project area, public services and facilities will expand to support such growth. This growth will be consistent with community plans. Improvements to Interstate Route H-1 capacity and the associated reduction in congestion are not anticipated to have a significant impact on land use trends within the City and County of Honolulu. Therefore, the planned project will not cumulatively affect land use because the area is already highly urbanized and is growing consistent with community plans.

Cumulative Summary

This project will not result in commitments to implement other projects or result in significant change to how the surrounding community will develop. The proposed project also will not result in cumulative effects on the environment. Interstate Route H-1 is an existing piece of the transportation network, and its widening has been planned and anticipated by the community, through consideration in the ORTP, among other planning activities.

2.20 Irreversible and Irretrievable Commitments of Resources

A commitment of resources is irreversible when primary or secondary impacts limit the future options for a resource; an irretrievable commitment refers to the use or consumption of resources that are neither renewable nor recoverable for future use.

All the land to be used by the proposed project is within the Interstate Route H-1 ROW and, therefore, has already been committed to a transportation use. No new land will be irreversibly and irretrievably committed as a result of the proposed project.

The proposed project will require the commitment of natural, physical, and human resources to plan, design, and construct. Diesel fuel to power equipment will be used during proposed project construction and building materials, such as concrete and asphalt, will be consumed. Some of those materials could ultimately be recycled for reuse, those that are not will be expended.

2.21 Unavoidable Adverse Impacts

Probable unavoidable adverse impacts related to the proposed project are all considered less than significant and include:

- Increased pollutants in stormwater runoff possible due to increased number of vehicles operating on Interstate Route H-1 (Section 2.9.2).
- Increased quantity of stormwater runoff due to a minor increase in paved area (Section 2.9.2).

- Minor changes in the visual environment for those near the Nu‘uanu Stream Bridge; which is typically limited to the few individuals walking on College Walk between Vineyard Boulevard and ‘A‘ala Street (Section 2.12).
- Minor impacts to the historic Nu‘uanu Stream lava rock and mortar sidewalls where the Nu‘uanu Stream Bridge is widened (Section 2.15.4).

2.22 Unresolved Issues

Unresolved issues include:

- Construction easements have not yet been negotiated with Farrington High School, Kalihi-Pālama Library, or Bishop Museum.
- ~~Consultations are on-going with the USACE and DLNR's CWRM regarding the need for a Section 404 permit and a Stream Channel Alteration Permit (SCAP), respectively.~~
- As discussed in Section 1.7, not all permits and approvals have been obtained. However, as explained in that section, some have been awarded and HDOT is actively pursuing the permits and approvals not yet awarded.

3.0 COMMENTS AND COORDINATION

3.1 Agency and Stakeholder Consultation

3.1.1 Pre-Assessment Consultation

The agencies, organizations, and landowners listed in Table 3-1 were contacted by letter (see Appendix A) and asked if they were aware of any environmental or social issue associated with the proposed project, or if they had any such concerns. Copies of the responses are provided in Appendix A. Section 3.1.3 provides a brief summary of the comments received.

Table 3-1: Pre-Assessment Consultation List

Agency	Date of Response	Follow-up Consultations
State Agencies		
Department of Accounting and General Services (DAGS)	11/15/12	
Department of Agriculture		
Department of Budget and Finance	01/03/13	
Department of Business, Economic Development & Tourism (DBEDT)		
Director		
Office of Planning	11/15/12	
Department of Defense (DoD)	11/28/12	
Department of Education (DOE)		
Department of Health (HDOH)		
Director		
Clean Water Branch (CWB)		
Environmental Planning Office	11/08/12	
Hazard Evaluation and Emergency Response (HEER) Office		
Indoor and Radiological Health (IRH)	11/23/12	
Office of Environmental Quality Control (OEQC)		
Solid and Hazardous Waste Section (SHWB)		
Wastewater Branch	11/26/12	
Department of Hawaiian Homelands (DHHL)		
Department of Land and Natural Resources (DLNR)		
Chairperson		
Commission on Water Resource Management (CWRM)	12/03/12	Yes
Division of Forestry and Wildlife (DOFAW)		
Office of Conservation and Coastal Lands (OCCL)	11/13/12	
University of Hawai‘i		
Environmental Center		
Water Resources Research Center		
Utilities		
The Gas Company		
Hawaiian Telcom		
Hawaiian Electric Company (HECO)	11/27/12	
Oceanic Time Warner Cable		

Additional consultation efforts, particularly those concerning regulatory matters, are described in Section 3.2.

3.1.2 Public Meeting #1

A public information meeting for the general public was held on November 7, 2012, at Farrington High School. A legal notice of the meeting appeared in the Star-Advertiser on October 27, 2012. Press releases concerning the meeting were also provided to a wide variety of media outlets and the chairperson of all neighborhood boards were sent an email informing them of the public meeting. The attendance sign-in sheet is provided in Appendix A.

At the public meeting, the project team made a brief presentation to the public, distributed preliminary information sheets about the project, and solicited public comments, both orally and in writing. No comments were received at the public meeting.

3.1.3 Summary of Agency and Public Comments prior to Draft EA

In response to HDOT's request for comment on the proposed project, the following comments were received:

- DBEDT's Office of Planning indicated in a November 15, 2012 letter to HDOT that the Draft EA should include a discussion of the proposed project's consistency with the objectives and policies of HRS Section 205A-2, which is Hawaii's Coastal Zone Management (CZM) Program. Furthermore, the proposed project will require CZM federal consistency review because project funding involves federal grants.
- HDOH's IRH commented in a November 23, 2012 letter to HDOT that Project activities shall comply with Hawaii Administrative Rules for the Department of Health, Chapter 11-46, Community Noise Control.
- DLNR's CWRM indicated in a December 3, 2012 letter to HDOT that Best Management Practices for stormwater management be implemented to minimize the Project's impact to the existing area's hydrology. In addition, a Stream Channel Alteration Permit (SCAP) is required before any alteration can be made to the bed or banks of a stream channel.

  On January 3. 2013, PB provided additional information (the letter from FHWA to USACE dated October 22, 2012) to the CWRM and requested they evaluate if a SCAP is necessary or not.

3.1.4 Public Meeting #2

A public information meeting for the general public was held on February 6, 2013, at Farrington High School. The meeting was announced as follows: (a) a legal notice of the meeting appeared in the Star-Advertiser on January 23, 2013; (b) was mentioned in the January 23, 2013, edition of the Environmental Notice; (c) in a post card mailed to all valid addresses along the project corridor (16,240 post cards were sent); and (d) in the Draft EA distribution cover letter. The attendance sign-in sheet is provided in Appendix A.

At the public meeting, the project team made a brief presentation to the public, distributed preliminary information sheets about the project, and solicited public comments, both orally and

in writing. A copy of the written comment and a summary of the oral comments are provided in Appendix A.

3.1.5 Summary of Agency and Public Comments on Draft EA and Responses

All comments received during the Draft EA 30-day comment period are provided in Appendix A. Responses to all written substantive comments are also provided in Appendix A. This section summarizes the substantive comments and HDOT's response.

- Paul Viotti commented that noise abatement is insufficient and new abatement technologies should be considered. HDOT responded that Section 2.4 provides details on the noise assessment study and that the noise assessment is bound by state and federal guidance that currently do not approve the use and funding for some of the noise barriers used in other parts of the world.
- The DoD indicated there was a need for the highway to remain open during construction phases to ensure access for emergency vehicles and act as an evacuation route in case of disaster. Section 2.18.1 was modified to address their concerns.
- HDOH-CWB commented that the project needs to comply with various regulations related to water quality. HDOT responded that they are aware of the requirements and will continue to comply.
- Scott David Truesdell commented that Caesar and Eleanor Gomes Park on Pele Street needs to be protected to the same extent as the other parks. HDOT responded that the park would not be impacted.
- The DOE indicated they want to meet regarding the construction easement at Farrington High School. HDOT indicated they will make themselves available to meet with DOE as requested.
- The USACE commented that BMPs should be implemented during construction. HDOT responded that
- The Honolulu Police Department (HPD) commented that they recommend sufficient traffic control measures be implemented and that they be notified of construction activities in advance. HDOT responded that Sections 2.18.1 and 2.18.3 address their concerns.
- The City and County Department of Design and Construction (DDC) expressed concern regarding the location and protection of sewer pipes crossing Interstate Route H-1 in the project area. HDOT indicated that as the design of the project progresses, they will consult with DDC to ensure the sewer lines are protected during construction.
- HDOH-HEER requested that the EA mention compliance with HRS Chapter 128D, related to a contingency plan. A reference has been added to Section 2.18.6. This comment was dated March 4, 2013, which was past the February 22, 2013, deadline for comments.

3.2 Regulatory Coordination

Since the project will require compliance with specific environmental laws and regulations, additional coordination and consultation was conducted as described below. Appendix A contains copies of relevant correspondence.

3.2.1 Section 106 of the National Historic Preservation Act and Hawai‘i Revised Statutes Chapter 6E-8

Section 106 of the NHPA requires that actions that are federally funded, authorized, or carried out consider the effect of such actions on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register of Historic Places. HRS Section 6E-8 is the State’s law protecting historic resources.

The following consultation and coordination activities were conducted on behalf of the project.

- State Historic Preservation Officer / Division (SHPO/SHPD):
  - September 11, 2012, letter from FHWA to DLNR-SHPO indicating that HDOT and Parsons Brinckerhoff have been authorized to conduct NHPA Section 106 consultations.
  - October 22, 2012, letter from FHWA to DLNR-SHPO providing an overview of the undertaking, the APE, the historical background of the APE, historic properties within the APE, consultations being performed, mitigation policies, and requesting their input.
  - December 3, 2012, letter from DLNR-SHPD indicating that SHPD agrees that no archaeological resources are present within the APE. SHPD also recommended that a written and photographic history of the Nu‘uanu Stream sidewall system be produced and that rocks removed as part of the project be recycled for incorporation into other projects.
  - March 12, 2013, HDOT and PB met with SHPD to discuss the project.
- Native Hawaiian Organizations and other stakeholders:
  - October 22, 2012, letter from FHWA informing the following Native Hawaiian Organizations (NHOs) and other potential stakeholders of the proposed project and requesting relevant coordination and comments related historic properties:
    - O‘ahu Island Burial Council
    - Association of Hawaiian Civic Clubs
    - Hawaiian Civic Club of Honolulu
    - Kalihi-Pālama Hawaiian Civic Club
    - Historic Hawai‘i Foundation
    - ‘Aha Wahine
    - Brian Kaniela Naeole Na‘auao
    - Council for Native Hawaiian Advancement
    - ‘Iolani Palace - Friends of Iolani Palace
    - Hawai‘i Maoli

- Hui Hoʻoniho
- Hui Mālama I Na Kūpuna O Hawaiʻi Nei
- Hui Huliau
- Ko'olau Foundation
- Maluʻōhai Residents Association
- Native Hawaiian Church
- Pacific Justice and Reconciliation Center
- Papakōlea Community Development Corporation
- The I Mua Group

- October 27, 2012, a legal advertisement appeared in the Star-Advertiser newspaper requesting that NHOs and Native Hawaiian descendants with ancestral lineal or cultural ties to, cultural knowledge or concerns for, and cultural or religious attachment to the proposed project area contact HDOT by November 23, 2012.
- October 31, 2012, the NHOs ʻOhana Keaweamahi, ʻOhana Medeiros, and ʻOhana Kapu requested to be consulted and participate in discussions regarding the subject undertaking.
- December 7, 2012, the NHOs ʻOhana Keaweamahi, ʻOhana Medeiros, and ʻOhana Kapu were contacted by PB via electronic mail and provided additional information concerning the undertaking and requested to provide information they may have on the historic and cultural sites in the area, among other things.
- December 7, 2012, the NHO ʻOhana Keaweamahi confirmed receipt of email and requested ʻOhana Keliinoi, ʻOhana Kaleikini, and ʻOhana Caceres be added to the list of consulting parties.
- December 9, 2012, the NHO ʻOhana Keaweamahi provided comments on the undertaking.
- December 9, 2012, the NHO ʻOhana Huihui requested they be added to the list of consulting parties (note, ʻOhana Huihui replaces ʻOhana Caceres).
- December 11, 2012, the NHOs were contacted by PB via electronic mail and informed their comments were received and will be addressed.
- January 7, 2013, the NHOs were contacted by PB via electronic mail and provided additional project information to address their comments received on December 9, 2012.
- February 19, 2013, via electronic mail the NHOs ʻOhana Keaweamahi and ʻOhana Keliinoi made requests for additional information.
- February 26, 2013, the NHOs were contacted by PB via electronic mail and provided information related to their input received on February 19, 2013.
- March 3, 2013, via electronic mail the NHOs ʻOhana Keaweamahi and ʻOhana Keliinoi indicated they would like to be kept informed of the mitigation measures, if any, that are recommended by the SHPD for the

undertaking and be notified by HDOT of any significant historic finds during construction.

NHPA Section 106 coordination is on-going with the following NHOs:

NHO Name	Contact Person
‘Ohana Keaweamahi	Ms. Paulette Kaleikini
‘Ohana Kaleikini	Ms. Paulette Kaleikini
‘Ohana Medeiros	Mr. Jim Medeiros Sr.
‘Ohana Kapu	JR Keoneakapu Williams
‘Ohana Keliinoi	Mr. Kalahikiola Keliinoi
‘Ohana Huihui	Mr. Mana Kaleilani Caceres

3.2.2 Section 7 of the Endangered Species Act and Chapter 195D of the Hawai‘i Revised Statutes

Section 7 requires that actions that are federally funded, authorized, or carried out be done in a manner that will not jeopardize the continued existence of any plant or animal species listed as threatened or endangered, or destroy or adversely modify any designated critical habitat. HRS Chapter 195D places similar requirements on State agencies when utilizing state funds. The following consultation and coordination activities were conducted on behalf of the project:

- U.S. Fish and Wildlife Service (Service)
  - September 20, 2012, letter from FHWA to USFWS requesting information on threatened and endangered species and their designated critical habitat in the project area.
  - October 12, 2012, letter from USFWS to FHWA indicated that there are no threatened and endangered species and their designated critical habitat in the project area.
  - February 20, 2013, letter from USFWS to PB provided comments on the Draft EA and suggested best management practicies (BMPs) be implemented during construction.
- State of Hawai‘i Department of Land and Natural Resources, Division of Forestry and Wildlife (DLNR-DOFAW)
  - November 1, 2012, letter from HDOT to DLNR-DOFAW providing an overview of the proposed project and requesting any comments or inputs they may have.

3.2.3 Section 404 of the Clean Water Act

Section 404 of the Clean Water Act prohibits the discharge of dredged materials into the waters of the U.S., which include non-navigable streams, wetlands and mudflats, unless the U.S. Army Corps of Engineers (USACE) provides a permit. The following consultation and coordination activities were conducted on behalf of the project.

- October 22, 2012, letter from FHWA to USACE requested input from USACE regarding the project. The letter outlined how HDOT planned to avoid placing fill in

waters of the U.S. and that, therefore, HDOT believed a Section 404 permit would not be required.

- January 31, 2013, letter from USACE to FHWA indicates that no Section 404 permit will be required for the project.

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4.0 ~~ANTICIPATED~~ FINDING OF NO SIGNIFICANT IMPACT

~~As the proposing agency, HDOT anticipates rendering a Finding of No Significant Impact (FONSI) for the proposed project~~ In accordance with HRS Chapter 343 and Hawai‘i Administrative Rules (HAR), Sections 11-200-9 and 11-200-11.2, HDOT is issuing a Finding of No Significant Impact (FONSI) for the proposed project. The ~~anticipated~~ FONSI is based on an evaluation of project impacts in relation to the "Significance Criteria" specified in HAR 11-200-12(b). The Significance Criteria appear below in *italics*, followed by a discussion of the project in relation to the specific criterion. The nature of the project's potential impacts is discussed in detail in Section 2.0.

This FONSI determination concludes the environmental review process under HRS Chapter 343. However, some of the environmental and construction-related permits listed in Section 1.7 still need to be obtained.

1. *Involves an irrevocable commitment to loss or destruction of any natural or cultural resource* – The proposed project will cause minor loss or destruction of a natural or cultural resource. The area that will be directly affected does not contain important plants, animals, or cultural resources. The proposed project will only affect plants and animals that are common and found throughout the region, island, and State.
2. *Curtails the beneficial uses of the environment* – The proposed project will not curtail beneficial uses of the environment because it will be constructed entirely within current Interstate Route H-1 right-of-way.
3. *Conflicts with the State's long-term environmental policies or goals and guidelines expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders* – The proposed project is consistent with the environmental goals and objectives of the State of Hawai‘i, as demonstrated in this section and in Section 2.6.
4. *Substantially affects the economic or social welfare of the community or State* – The proposed project will support and enhance the island's economy by contributing to regional improvements in the transportation network and helping to address congestion.
5. *Substantially affects public health* – The proposed project will not adversely affect public health.
6. *Involves substantial secondary impacts* – The proposed project is not expected to cause secondary impacts because the area is already a dense urban area with redevelopment occurring as planned. These redevelopments are anticipated to occur regardless of the proposed project. Therefore, the proposed project will not induce secondary land uses, nor will it result in related secondary impacts that would otherwise not occur.
7. *Involves substantial degradation of environmental quality* – The proposed project would not result in a substantial degradation of environmental quality. The project would not result in adverse environmental conditions, as demonstrated in Section 2.0.

The few and minor potential adverse effects of the proposed project are summarized in Section 2.21.

8. *Substantially affects a rare, threatened, or endangered species or its habitat* – There are no rare, threatened, or endangered plant or animal species in the project area, and no designated critical habitats exist in the project area. Coordination and consultation with resource agencies, including an informal consultation with the USFWS in accordance with Section 7 of the Endangered Species Act, indicates that little or no interactions with protected species will occur. As a precaution, mitigation measures such as protective lighting will be implemented to avoid adverse effects to species such as Newell's shearwater and the Hawaiian dark-rumped petrel.

9. *Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions* – The proposed project will not create a commitment for other actions by HDOT, another government agency, or other party. The proposed project is a complete, independent project, with logical termini, and will not result in commitments for other roadway projects, nor result in cumulative, considerable effect on the environment.

10. *Detrimentally affects air or water quality or ambient noise levels* – The proposed project will not detrimentally affect air or water quality or noise levels. The project will comply with State of Hawai‘i and federal environmental regulations and standards. The project will cause no violations of State or National Ambient Air Quality Standards. BMPs will be implemented during project construction in order to minimize water quality impacts from construction site runoff. No adverse noise impacts are anticipated to the extent that the ambient noise levels before and after project construction will be essentially identical.

11. *Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a floodplain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters* – The proposed project is not located in an environmentally sensitive area.

12. *Substantially affects scenic vistas and viewplanes identified in county or state plans or studies* – It is anticipated that the proposed project will not significantly affect any existing scenic views, nor obstruct such views, because it will be predominantly at ground level and occur along an existing roadway alignment.

13. *Requires substantial energy consumption* – The proposed project will not result in substantial energy consumption. While there will be short-term construction-phase energy consumption, it will be offset by the anticipated long-term benefits as vehicular traffic is able to travel more efficiently on Interstate Route H-1 and on the regional transportation network.

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APPENDIX A CORRESPONDENCE

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APPENDIX A-1

PRE-ASSESSMENT CONSULTATION LETTERS

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NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
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JADINE URASAKI

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

IN REPLY REFER TO:
HWY-DD 2.2860

NOV 1 2012

TO: THE HONORABLE DEAN H. SEKI, COMPTROLLER
STATE OF HAWAII DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES

FROM: GLENN M. OKIMOTO, PH.D.
DIRECTOR OF TRANSPORTATION

SUBJECT: INTERSTATE ROUTE H-1 REHABILITATION
MIDDLE STREET TO VICINITY OF WARD AVENUE
ISLAND OF OAHU, STATE OF HAWAII
FEDERAL AID PROJECT NO. IM-H1-1(269)

The State of Hawaii Department of Transportation, Highways Division (HDOT) is planning the Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue project (Figure 1). The Federal Highway Administration (FHWA) will partially fund the project. We will be preparing an Environmental Assessment (EA) in compliance with HRS Chapter 343, Hawaii's environmental impact statement (EIS) law. At this time we request that you (a) take a moment to review the information regarding the proposed project below, and (b) provide any comments or concerns to us within 30 days of the receipt of this letter.

Overview of the Proposed Project

The proposed project includes the following general tasks:

- Pavement rehabilitation, including reconstruction and resurfacing, as necessary, from roughly Likelike Highway to Miller Street, including on and off ramps.
- Replacement of the highway lighting system from roughly Middle Street to the Vineyard Boulevard On-Ramp.
- Restriping the roadway to generate four through lanes in both directions to the extent possible throughout the project area.
- Widening the Nuuanu Stream Bridge roughly 5 feet on the makai (downstream) side in order to accommodate four through lanes and one exit lane in the Diamond Head-bound (east-bound) direction.
- Minor modifications to the storm drain system, primarily inlet modifications.

- Minor grading and structural improvements at select and discrete locations throughout the Project area.

The project does not involve any new areas being paved other than the widened portion of the Nuuanu Stream Bridge.

Request for Input

We welcome any comments you might have on the proposed project. If there are any issues you would like to see addressed in the EA, please inform us of those.

We would appreciate a written response within 30 days from date of receipt, to Ross Hironaka via email at Ross.Hironaka@hawaii.gov, or by US Postal Service to Department of Transportation, Design Branch, Design Section, Highways Division, 601 Kamokila Boulevard, Room 609, Kapolei, Hawaii 96707.

If you have many or specific concerns we could meet with you. HDOT will also be holding a public meeting regarding the project at 6 P.M. on November 7, 2012, at the Farrington High School Cafeteria, and you are welcome to attend that meeting in order to get more information regarding the proposed project.

Please feel free to contact Ross Hironaka by telephone at (808) 692-7575, if you have any questions. We look forward to working with you on the proposed project.

Enclosure:

c: Jim Hayes (Parsons Brinckerhoff)

bc: HWY-DD (RH)
HWY-DE (TN)

RH:amk

The following **Letter No. HWY-DD 2.2860** was sent to the following:

1. Mr. Russel S. Kokubun, Chairperson
   State of Hawaii Department of Agriculture
   1428 South King Street
   Honolulu, Hawaii 96814

2. Mr. Kalbert K. Young, Director
   State of Hawaii Department of Budget and Finance
   P.O. Box 150
   Honolulu, Hawaii 96810

3. Mr. Richard C. Lim, Director
   State of Hawaii Department of Business,
   Economic Development & Tourism
   P.O. Box 2359
   Honolulu, Hawaii 96804

4. Mr. Richard C. Lim, Director
   State of Hawaii Department of Business, Economic
   Development & Tourism
   P.O. Box 2359
   Honolulu, Hawaii 96804
   Attn: John Nakagawa,
   Office of Planning

5. Major General Darryll Wong, Adjutant General
   State of Hawaii Department of Defense
   3949 Diamond Head Road
   Honolulu, Hawaii 96816

6. Ms. Kathryn Matayoshi, Superintendent
   State of Hawaii Department of Education
   P.O. Box 2360
   Honolulu, Hawaii 96804

7. Ms. Jobie Masagatani, Chair-Designate
   State of Hawaii Department of Hawaiian Home Lands
   P.O. Box 1879
   Honolulu, Hawaii 96805

8. Ms. Loretta J. Fuddy, Director
   State of Hawaii Department of Health
   P.O. Box 3378
   Honolulu, Hawaii 96801
   Attn: Gary Gill, Deputy Director

Cont. Letter **No. HWY-DD 2.2860** was also sent to the following:

9. Ms. Loretta J. Fuddy, Director
   State of Hawaii Department of Health
   P.O. Box 3378
   Honolulu, Hawaii 96801
   Attn: Alec Wong, Administrator
   Clean Water Branch

10. Loretta J. Fuddy, Director
    State of Hawaii Department of Health
    591 Ala Moana Boulevard
    Honolulu, Hawaii 96813
    Attn: Daryn Yamada, Noise Section Supervisor
    Noise, Radiation, and Indoor Air Quality

11. Ms. Loretta J. Fuddy, Director
    State of Hawaii Department of Health
    919 Ala Moana Boulevard
    Room 212
    Honolulu, Hawaii 96814
    Attn: Solid and Hazardous Waste Section

12. Ms. Loretta J. Fuddy, Director
    State of Hawaii Department of Health
    919 Ala Moana Boulevard
    RPP 206
    Honolulu, Hawaii 96814
    Attn: Fenix Grange, Administrator
    Hazard Evaluation and Emergency Response Office

13. Ms. Loretta J. Fuddy, Director
    State of Hawaii Department of Health
    235 S. Beretania Street
    Suite 702
    Honolulu, Hawaii 96813
    Attn: Gary Gill, Deputy Director
    Office of Environmental Quality Control

14. Mr. William J. Aila Jr., Chairperson
    Department of Land and Natural Resources
    1151 Punchbowl Street
    Room 310
    Honolulu, Hawaii 96813

Continuation of **Letter No. HWY-DD 2.2860** also sent to the following:

15. Mr. William J. Aila Jr., Chairperson
    State of Hawaii Department of Land and Natural Resources
    1151 Punchbowl Street
    Room 325
    Honolulu, Hawaii 96813
    Attn: Paul Conry, Administrator
    Division of Forestry and Wildlife

16. Mr. William J. Aila Jr., Chairperson
    State of Hawaii Department of Land and Natural Resources
    P.O. Box 621
    Honolulu, Hawaii 96809
    Attn: Sam Lemmo, Administrator
    Office of Conservation and Coastal Lands

17. William J. Aila Jr., Chairperson
    State of Hawaii Department of Land and Natural Resources
    1151 Punchbowl Street
    Room 227
    Honolulu, Hawaii 96813
    Attn: William Tam, Deputy Director
    Commissiion on Water Resource Management

18. Mr. Chittaranjan Ray, Director
    Universty of Hawaii at Manoa Environmental Center
    2500 Dole Street, Krauss Annex 19
    Honolulu, Hawaii 96822
    Attn: Dave Penn, Environmental Review Coordinator

19. Mr. Chittaranjan Ray, Director
    Universty of Hawaii at Mānoa
    Water Resources Research Center
    2540 Dole Street, Holmes Hall 283
    Honolulu, Hawaii 96822
    Attn: Dave Penn, Environmental Review Coordinator

NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

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

IN REPLY REFER TO:
HWY-DD 2.2860

NOV 1 - 2012

Mr. Charles E. Calvet, P.E.
Manager of Engineering
The Gas Company
P.O. Box 3000
Honolulu, Hawaii 96802

Dear Mr. Calvert:

Subject: InterState Route H-1 Rehabilitation
Middle Street to Vicinity of Ward Avenue
Island of Oahu, State of Hawaii
Federal Aid Project No. IM-H1-1 (269)

The State of Hawaii Department of Transportation, Highways Division (HDOT) is planning the Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue project (Figure 1). The Federal Highway Administration (FHWA) will partially fund the project. We will be preparing an Environmental Assessment (EA) in compliance with HRS Chapter 343, Hawaii's environmental impact statement (EIS) law. At this time we request that you (a) take a moment to review the information regarding the proposed project below, and (b) provide any comments or concerns to us within 30 days of the receipt of this letter.

Overview of the Proposed Project

The proposed project includes the following general tasks:

- Pavement rehabilitation, including reconstruction and resurfacing, as necessary, from roughly Likelike Highway to Miller Street, including on and off ramps.
- Replacement of the highway lighting system from roughly Middle Street to the Vineyard Boulevard On-Ramp.
- Restriping the roadway to generate four through lanes in both directions to the extent possible throughout the project area.
- Widening the Nuuanu Stream Bridge roughly 5 feet on the makai (downstream) side in order to accommodate four through lanes and one exit lane in the Diamond Head-bound (east-bound) direction.
- Minor modifications to the storm drain system, primarily inlet modifications.

- Minor grading and structural improvements at select and discrete locations throughout the Project area.

The project does not involve any new areas being paved other than the widened portion of the Nuuanu Stream Bridge.

Request for Input

We welcome any comments you might have on the proposed project. If there are any issues you would like to see addressed in the EA, please inform us of those.

We would appreciate a written response within 30 days from date of receipt, to Ross Hironaka via email at Ross.Hironaka@hawaii.gov, or by US Postal Service to Department of Transportation, Design Branch, Design Section, Highways Division, 601 Kamokila Boulevard, Room 609, Kapolei, Hawaii 96707.

If you have many or specific concerns we could meet with you. HDOT will also be holding a public meeting regarding the project at 6 P.M. on November 7, 2012, at the Farrington High School Cafeteria, and you are welcome to attend that meeting in order to get more information regarding the proposed project.

Please feel free to contact Ross Hironaka by telephone at (808) 692-7575, if you have any questions. We look forward to working with you on the proposed project.

Very truly yours,

GLENN M. OKIMOTO, PH.D.
Director of Transportation

Enclosure:

c: Jim Hayes (Parsons Brinckerhoff)

bc: HWY-DD (RH)
HWY-DE (TN)

BJ:amk

The letter No. **HWY-DD 2.2860** was sent to the following:

1. Ms. Lynette Yoshida, Senior Manager
   Hawaiian Telcom
   Engineering and Planning
   1177 Bishop Street
   Honolulu, Hawaii 96813

2. Ms. Sherri-Ann Loo, Manager
   Hawaiian Electric Company
   Environmental Department
   P.O. Box 2750
   Honolulu, Hawaii 96740

3. Mr. Kerick Fujimara, Engineer
   Oceanic Time Warner Cable
   OSP Environmental
   200 Akamainui Street
   Mililani, Hawaii 96789

APPENDIX A-2

RESPONSES TO PRE-ASSESSMENT CONSULTATION

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NEIL ABERCROMBIE
GOVERNOR

Dean H. Seki
Comptroller

Maria E. Zielinski
Deputy Comptroller

NOV 19 2012

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810-0119

NOV 15 2012

(P)1263.2

MEMORANDUM

TO: Mr. Ross Hironaka
Design Branch, Design Section, Highways Division
Department of Transportation

FROM: Dean H. Seki
Comptroller

SUBJECT: Interstate Route H-1 Rehabilitation
Middle Street to Vicinity of Ward Avenue
Island of Oahu, State of Hawaii
Federal Aid Project No. IM-H1-1(269)

Thank you for the opportunity to provide comments for the Pre-Environmental Assessment for the subject project. The subject project does not impact any of the Department of Accounting and General Services' projects or existing facilities, and we have no comments to offer at this time.

If you have any questions, please call me at 586-0400 or have your staff call Ms. Gayle Takasaki of the Public Works Division at 586-0500.

From: HI_BudgetandFinance/DBF/StateHiUS@STATEHIUS
To: Ross Hironaka/HWY/HIDOT@HIDOT,
Date: 01/03/2013 05:45 PM
Subject: Route H-1 Rehabilitation EA (Middle Street to Ward Avenue)
Sent by: Shirley M Kawamoto@STATEHIUS

Dear Mr. Hironaka:

This is to acknowledge receipt of a letter from the Department of Transportation, dated November 1, 2012, which is soliciting comments on the Draft Environmental Assessment (EA) for the Proposed Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue, Island of Oahu project.

We have no comments at this time.

Sincerely,

/s/

KALBERT K. YOUNG
Director of Finance

NEIL ABERCROMBIE
GOVERNOR
RICHARD C. LIM
DIRECTOR
MARY ALICE EVANS
DEPUTY DIRECTOR
JESSE K. SOUKI
DIRECTOR
OFFICE OF PLANNING

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

Telephone: (808) 587-2846
Fax: (808) 587-2824

OFFICE OF PLANNING
235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

RECEIVED
NOV 19 2012

Ref. No. P-13783

November 15, 2012

To: Ross Hironaka
Design Branch, Design Section, Highways Division
Department of Transportation

From: Jesse K. Souki, Director

Subject: Interstate Route H-1 Rehabilitation
Middle Street to Vicinity of Ward Avenue, Island of Oahu
Federal Aid Project No. IM-H1-1(269)

Thank you for the opportunity to provide comments on the Environmental Assessment - Early Consultation for the subject project. It is our understanding that the subject project will include the following general tasks: pavement rehabilitation, including reconstruction and resurfacing; replacement of highway lighting system; restriping of roadway to generate four through lanes in both directions; widening of Nuuanu Stream Bridge; minor modifications to the storm drain system; and minor grading and structural improvements at selected and discrete locations throughout the project area.

The Office of Planning (OP) has reviewed the information provided in a letter dated November 1, 2012, from your department and has the following comments to offer:

1. The entire state is defined to be within the Coastal Zone Management Area (Hawaii Revised Statutes (HRS) Section 205A-1 - definition of "coastal zone management area"). The Draft Environmental Assessment should include a discussion of the proposed project's consistency with the objectives and policies set forth in HRS Section 205A-2.

2. The proposed project will require Coastal Zone Management (CZM) federal consistency review for the receipt and use of Federal Highway Administration (FHWA) funds. FHWA grants are identified on the Hawaii CZM Program list of federal assistance programs subject to federal consistency review.

   CZM federal consistency review may also be required for the widening of Nuuanu Stream Bridge in conjunction with the U.S. Army Corps of Engineers permit, if applicable to the project.

Thank you for the opportunity to comment on the Environmental Assessment – Early Consultation for the proposed project.

Should you have questions or require clarification on the above comments, please contact Leo Asuncion, CZM Program Manager, at 587-2875.

DIR 1787

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ESTHER KIA'AINA
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

OFFICE OF CONSERVATION AND COASTAL LANDS
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

REF: OCCL: AJR

COR: OA-13-49

NOV 13 2012

MEMORANDUM

TO: Glenn M. Okimoto, Ph.D.
Director of Transportation

FROM: Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

SUBJECT: **Request for Consultation on Interstate Route H1 Rehabilitation, Federal Aid Project No. IM-H1-1(269)**
TMKs: (1) various
Various Locations of Interstate H1, between Middle Street and Ward Avenue, Honolulu, Hawai'i

The Department of Land and Natural Resources, Office of Conservation and Coastal Lands (OCCL) is in receipt of your letter dated *November 1, 2012* regarding a proposal to conduct highway rehabilitation on the H1 between Middle Street and Ward Avenue in Honolulu. We have reviewed your information and the various project work sites are not located in the Conservation District and therefore are not regulated by this office.

Should you have any questions, please feel free to contact Alex J. Roy of the Office of Conservation and Coastal Lands at 808-587-0316 or via email at alex.j.roy@hawaii.gov

cc: Chairperson

DIRECTOR'S OFFICE
DEPT. OF
TRANSPORTATION
2012 NOV 14 A 9:55

DEPT OF TRANSPORTATION
2012 NOV 14 A 8:44
HIGHWAYS DIVISION

DIR 1888

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

GOVERNOR'S OFFICE
DEPT. OF
TRANSPORTATION

2012 DEC -5 A 9:15

WILLIAM J. AILA, JR.
CHAIRPERSON

WILLIAM D. BALFOUR, JR.
SUMNER ERDMAN
LORETTA J. FUDDY, A.C.S.W., M.P.H.
NEAL S. FUJIWARA
JONATHAN STARR
TED YAMAMURA

WILLIAM M. TAM
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

December 3, 2012

REF: RFD.3706.3

TO: Glenn M. Okimoto, Director
Department of Transportation

FROM: William M. Tam, Deputy Director
Commission on Water Resource Management

SUBJECT: Interstate Route H-1 Rehabilitation Miiddle Street to Vicinity of Ward Avenue

FILE NO.: IM-H1-1(269)
TMK NO.:

Thank you for the opportunity to review the subject document. The Commission on Water Resource Management (CWRM) is the agency responsible for administering the State Water Code (Code). Under the Code, all waters of the State are held in trust for the benefit of the citizens of the State, therefore, all water use is subject to legally protected water rights. CWRM strongly promotes the efficient use of Hawaii's water resources through conservation measures and appropriate resource management. For more information, please refer to the State Water Code, Chapter 174C, Hawaii Revised Statutes, and Hawaii Administrative Rules, Chapters 13-167 to 13-171. These documents are available via the Internet at http://www.hawaii.gov/dlnr/cwrm.

Our comments related to water resources are checked off below.

☐ 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.

☐ 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

☐ 3. We recommend coordination with the Hawaii Department of Agriculture (HDOA) to incorporate the reclassification of agricultural zoned land and the redistribution of agricultural resources into the State's Agricultural Water Use and Development Plan (AWUDP). Please contact the HDOA for more information.

☐ 4. We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at http://www.usgbc.org/leed. A listing of fixtures certified by the EPA as having high water efficiency can be found at http://www.epa.gov/watersense/pp/index.htm.

☒ 5. We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at http://hawaii.gov/dbedt/czm/initiative/lid.php.

☐ 6. We recommend the use of alternative water sources, wherever practicable.

☐ 7. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

Permits required by CWRM:
Additional information and forms are available at http://hawaii.gov/dlnr/cwrm/resources_permits.htm.

☐ 8. The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit is required prior to use of water. The Water Use Permit may be conditioned on the requirement to use dual line water supply systems for new industrial and commercial developments.

☐ 9. A Well Construction Permit(s) is (are) required before any well construction work begins.

☐ 10. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.

☐ 11. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.

☐ 12. Ground water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

☒ 13. A Stream Channel Alteration Permit(s) is (are) required before any alteration(s) can be made to the bed and/or banks of a stream channel.

☐ 14. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is (are) constructed or altered.

☐ 15. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.

☐ 16. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.

☐ OTHER:

If there are any questions, please contact Robert Chong at 587-0266.

NEIL ABERCROMBIE
GOVERNOR

MAJOR GENERAL DARRYLL D. M. WONG
DIRECTOR OF CIVIL DEFENSE

DOUG MAYNE
VICE DIRECTOR OF CIVIL DEFENSE

PHONE (808) 733-4300
FAX (808) 733-4287

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE DIRECTOR OF CIVIL DEFENSE
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495

November 28, 2012

GHR 11/29/12

Mr. Ross Hironaka
Department of Transportation
Design Branch, Design Section
Highways Division
601 Kamokila Boulevard, Room 609
Kapolei, Hawaii 96707

Dear Mr. Hironaka:

Interstate Route H-1 Rehabilitation Middle Street to Vicinity of Ward Avenue
Island of Oahu, State of Hawaii, Federal Aid Project No. IM-H1-1(269)

Thank you for the opportunity to comment on this proposed project. After review of the documents you have sent for this project, the area is currently covered by the arc of existing warning sirens.

We strongly recommend that portions of the highway remain accessible during all construction phases to ensure access for emergency vehicles and act as an evacuation route in case of a disaster.

If you have any questions, please call Ms. Havinne Okamura, Hazard Mitigation Planner, at 733-4300, extension 556.

Sincerely,

DOUG MAYNE
Vice Director of Civil Defense

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

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

In reply, please refer to:
File:

NOV 30 2012

November 23, 2012

Mr. Ross Hironaka
Department of Transportation
Design Branch/Design Section
601 Kamokila Boulevard. Room 609
Kapolei, HI 96707

Dear Mr. Hironaka:

This correspondence is in response to your request for comments regarding interstate route H-1 rehabilitation Middle Street to vicinity of Ward Avenue.

Project activities shall comply with the following Administrative Rules of the Department of Health:

- Chapter 11-46 Community Noise Control

Should you have any questions, please contact me at (808) 586-4701.

Sincerely,

Jeffrey M. Eckerd
Program Manager
Indoor and Radiological Health Branch

D|R 1806

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

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

In reply, please refer to:
File:

12-206
H-1 Rehabilitation

November 8, 2012

DIRECTOR'S OFFICE
DEPT. OF
TRANSPORTATION
2012 NOV 19 A 8:55

TO: The Honorable Glenn M. Okimoto, Ph.D.
Director of Transportation
Department of Transportation

FROM: Laura McIntyre, A.I.C.P.
Manager, Environmental Planning Office
Department of Health

SUBJECT: **Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue Island of Oahu, State of Hawaii, Federal Aid Project No. IM-H1-1(269)**

The Department of Health (DOH), Environmental Planning Office (EPO), acknowledges receipt of your letter, dated November 1, 2012. Thank you for allowing us to review and comment on the subject document. The document was routed to the various branches of the Environmental Health Administration. We have no comments at this time, but reserve the right to future comments. We strongly recommend that you review all of the Standard Comments on our website: www.hawaii.gov/health/environmental/env-planning/landuse/landuse.html. Any comments specifically applicable to this application should be adhered to.

The United States Environmental Protection Agency (EPA) provides a wealth of information on their website including strategies to help protect our natural environment and build sustainable communities at: http://water.epa.gov/infrastructure/sustain/ . The DOH encourages State and county planning departments, developers, planners, engineers and other interested parties to apply these strategies and environment principles whenever they plan or review new developments or redevelopments projects. We also ask you to share this information with others to increase community awareness on healthy, sustainable community design. If there are any questions about these comments please contact me.

Laura Leialoha Phillips McIntyre, AICP
Environmental Planning Office Manager
Environmental Health Administration
Department of Heath
919 Ala Moana Blvd., Ste. 312
Honolulu, Hawaii 96814
Phone: 586-4337
laura.mcintyre@doh.hawaii.gov

DIR 1855 ✓ NR

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

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

In reply, please refer to:
File:

LUD-1 1 2 015 002-ID1136
Rehab Middle St to Ward Ave

November 26, 2012

DIRECTOR'S OFFICE
DEPT. OF
TRANSPORTATION
2012 NOV 28 P 1:22

Mr. Glenn M. Okimoto, Ph.D.
Director of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Dear Mr. Okimoto:

Subject: Interstate Route H-1 Rehabilitation
Middle Street to Vicinity of Ward Avenue
Island of Oahu, State of Hawaii
Federal Aid Project No. IM-H1-1(269)

Thank you for the opportunity to provide comments on the subject project. We have no comments to provide at this time since the project scope does not involve the design and construction of a domestic wastewater treatment system.

Should you have any questions, please contact the Planning & Design Section of our branch at phone 586-4294 or fax to 586-4300.

Sincerely,

SINA PRUDER, P.E., ACTING CHIEF
Wastewater Branch

LM:mt

c: DOH-Environmental Planning Office (12-206), Ms. Laura McIntyre
City & County of Honolulu-Planning & Permitting Office, Mr. Jiro Sumada
Parsons Brinckerhoff, Mr. Jim Hayes

DIR 1850

Hawaiian Electric Company
Engineering Department
PO Box 2750 • Honolulu, HI 96840

November 27, 2012

DIRECTOR'S OFFICE
DEPT. OF
TRANSPORTATION
2012 NOV 28 P 1:34

Dr. Glenn M. Okimoto
Director of Transportation
Department of Transportation
869 Punchbowl Street
Honolulu, HI 96813-5097

Dear Dr. Okimoto:

Subject: **Environmental Assessment**
Interstate Route H-1 Rehabilitation
Middle Street to Vicinity of Ward Avenue
Federal Aid Project No. IM-H1-1(269)
HWY-DD 2.2860

Thank you for the opportunity to comment on the proposed project. Hawaiian Electric Company (HECO) has no objections at this time to the proposed project. We would like to comment that the Nuuanu stream bridge expansion may involve rerouting of HECO ducts. If the expansion does involve relocating the ducts, it should be disclosed in the environmental assessment (EA). Separately, should HECO have facilities along the subject right-of-way, we request the Department of Transportation allow continued access for maintenance of our facilities.

We appreciate your efforts to keep us apprised of the subject project in the planning process. As the H-1 Rehabilitation project comes to fruition, please continue to keep us informed.

If you have any questions, please call me at 543-7245.

Sincerely,

Rouen Q. W. Liu
Permits Engineer

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APPENDIX A-3

NOVEMBER 7, 2012 PUBLIC INFORMATIONAL MEETING SIGN-IN SHEET

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INTERSTATE ROUTE H-1 REHABILITATION, MIDDLE STREET TO VICINITY OF WARD AVENUE
MEETING SIGN-IN SHEET

Date: November 7, 2012
Time: 6:00
Place: Farrington High School

Name	Add Me to Mailing List	Section 106 Request	Organization	Email	Phone	Address
Paulette Kaanohi Kaleikini	☑	☑	'Ohana Keaveamahi NHO	pkaleikini@hawaii.rr.com		89-107 Nanaikala Waianae 96792
JR Keoneakapu Williams	☑	☑	'ohana Kapu NHO	JRKeoneakapu@gmail.com		85-1029 Mahi aina Waianae 96792
	☐	☐				
	☐	☐				
	☐	☐				
	☐	☐				
	☐	☐				
	☐	☐				
	☐	☐				
	☐	☐				

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APPENDIX A-4

FEBRUARY 6, 2013 PUBLIC INFORMATIONAL MEETING SIGN-IN SHEETS

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INTERSTATE ROUTE H-1 REHABILITATION, MIDDLE STREET TO VICINITY OF WARD AVENUE
MEETING SIGN-IN SHEET

Date: February 6, 2013
Time: 6:00
Place: Farrington High School

Name	Add Me to Mailing List	Section 106 Request	Organization	Email	Phone	Address
Nani Vierra	☒	☐	Retired		247-5505	46-152 Huemu St Kaneohe, HI 96744
Mark Benson	☒	☐	Honolulu Ford	MBenson@HonoluluFord.com	532-1700	1370 N. King Honolulu HI 96817
Carl Mimura	☐	☐	Sen. Wakai	mimura@capitol.hawaii.gov	586 8585	State Capitol Honolulu HI 96828
	☐	☐				
	☐	☐				
	☐	☐				
	☐	☐				
	☐	☐				
	☐	☐				
	☐	☐				

INTERSTATE ROUTE H-1 REHABILITATION, MIDDLE STREET TO VICINITY OF WARD AVENUE
MEETING SIGN-IN SHEET

Date: February 6, 2013
Time: 6:00
Place: Farrington High School

Name	Add Me to Mailing List	Section 106 Request	Organization	Email	Phone	Address
Bert Kaiuk	☑	☐		btkaiuka@hotmail.com	845-8152	1238 Hone Ln. Hon. 96817
Patricia Hoopii	☑	☐		patriciahoopii@gmail.com	354-6253	253 Mokauea St. Apt #1 Hon. Hi 96819
Paulette Kaleikini	☑	☐		pkaleikini@hawaii.rr.com		
Philip WONG	☐	☐	STATE OF HAWAII DEPT OF HEALTH		586-4700	
(MIKE DAU) Mike Dau	☐	☐	Kipapa Gulch Estates	dau@mail.at Hawaii.rr.com	722-632	94-500 Ka Uka Blvd Waipahu, Hi 96797
KELVIN AKAZAWA	☐	☐	STATE DOT	Kelvin.Akazawa@hawaii.gov		
Vernamay Dabbs	☐	☐			216-2413	1454 Middle St. Hon, Hi 96819
Terry Saito	☐	☐		(PRVIOTTI@gmail.com)	2475505	45-801 Anoi Road Kaneohe, Hi 96744
PAUL VIOTTI	☒	☒	Queen Emma Gardens	prviotti@gmail.com		1519 Nuuanu Ave #139 Honolulu HI 96817
	☐	☐				

INTERSTATE ROUTE H-1 REHABILITATION, MIDDLE STREET TO VICINITY OF WARD AVENUE

DRAFT EA, SECTION 106, AND NOISE VARIANCE PUBLIC INFORMATIONAL MEETING
FEBRUARY 6, 2013
FARRINGTON HIGH SCHOOL

SUMMARY OF QUESTIONS, COMMENTS, AND RESPONSES

Comment:	Mr. Paul Viotti from Queen Emma Gardens expressed concern that the noise from the additional lanes would upset the normal atmosphere for Queen Emma Gardens. He is concerned about noise in general and would like research done to explore options for noise abatement. The Japanese have good technology to address this issue. He feels that these measures should've been implemented during initial Interstate construction. In follow-up to response below, Mr. Viotti indicated appreciation for the lower speed limit but was skeptical that driver behavior would change much. He asked that research be done on noise abatement technology.
Response:	Mr. Jim Hayes acknowledged that the Draft EA addresses the issue of noise and that a noise study was conducted to see if barriers were feasible and prudent. Mainly due to cost, none of noise barriers passed this test. However, because the project would lower the speed limit, there is potential for noise reduction.
Comment:	Mr. Michael Dow expressed concern over the narrow shoulder widths, specifically in the event of a stall or flat tire. His primary concern was that disabled vehicles would be rear-ended by other drivers because the disabled vehicles would be sticking into travel lanes. Also, what do drivers do when you need to pull-over for the Honolulu Police Department?
Answer:	Mr. Alvin Takeshita responded that because the lanes are narrow, the Honolulu Police Department are less likely to pull people over in this area. Police are more likely to pull folks over at the ramps where there is more room. The shoulder is currently roughly 6 feet, but should be 10 feet according to current standards. Yes, the shoulder will get smaller, but the concern (disabled vehicles not being able to get clear of the travel lanes) is not different from the existing condition. However, with the proposed project, if a vehicle is stopped in a lane, you still have 3 lanes to go through. Today, if you stall, then there are only two lanes left available.

Comment:	In follow-up, Mr. Dow indicated that as he was travelling near Bishop Museum, a car was pulled over, and he only saw it at the last minute. There was little room to move over.
Answer:	Mr. Takeshita responded that the Freeway Service Patrol (FSP) will be increased in the area. The Pali – Punahou Demonstration Project opened around the end of July. Between July and November, there were only 3 accidents, which were rear-ends. They found that with the perception of a narrower road, people slow down. It gets their attention, and it has been safe.
Comment:	Ms. Terry Saito asked how will emergency vehicles get through?
Answer:	Mr. Jim Hayes indicated that the traffic is expected to be less congested and condensed, so the emergency vehicles can get through a little bit easier. There have been no issues reported in the demonstration project area related to emergency vehicle access.
Comment:	Ms. Paulette Kaleikini asked why Nuuanu Stream will be widened?
Answer:	Mr. Jim Hayes responded that the area by Nuuanu Stream was previously restriped to four lanes, in order to create the auxillary lane between the Liliha on-ramp and Pali off-ramp. The lanes are roughly 11 feet wide there now. In order to maintain the highway geometry in this segment, the bridge would need to accommodate five lanes. There is insufficient space to have five 10-foot wide lanes across the bridge. Therefore, we are proposing to widen the bridge by 5 feet.
Comment:	Ms. Paulette Kaleikini asked if any property would be condemned to make way for the Nuuanu Stream Bridge widening?
Answer:	Mr. Jim Hayes responded that there would be NO condemnation.
Comment:	Ms. Paulette Kaleikini indicated that for tractor-trailers on the freeway, could there be a law that tractor-trailers be required to drive in the right lane? Does that law exist? Will HDOT sign accordingly?
Answer:	Mr. Alvin Takeshita responded that at this time a law does not exist, but HDOT has the authority to restrict tractor-trailers to the right lane. HDOT will consider it, although a final analysis has not been done.

APPENDIX A-5

SUBTANTIVE COMMENTS ON THE DRAFT EA RECEIVED AND RESPONSES TO THOSE COMMENTS

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01/23/2013, 4:00 PM
From: Francis Perez
808-264-8229

Comment: adding a 4th lane is a good idea, but priority should be given to maintain the existing 10-foot lane section in town. If maintenance is not done in a timely manner, cars will tend to weave to avoid potholes creating a hazardous condition since the lanes are narrowed. Not too much of an issue in stop and go traffic or when traffic is light and cars are moving fairly fast but more so at medium speeds when cars may be more bunched together.

DEPARTMENT OF PARKS & RECREATION

CITY AND COUNTY OF HONOLULU

1000 Uluohia Street, Suite 309, Kapolei, Hawaii 96707
Phone: (808) 768-3003 • Fax: (808) 768-3053
Website: www.honolulu.gov

KIRK CALDWELL
MAYOR

ALBERT TUFONO
ACTING DIRECTOR

January 28, 2013

Mr. Ross Hironaka
State of Hawaii
Department of Transportation
Highways Division
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Hironaka:

Subject: Draft Environmental Assessment
Interstate Route H-1 Rehabilitation
Middle Street to Vicinity of Ward Avenue
Honolulu, Hawaii
Federal Aid Project No. IM-H1-1(269)

Thank you for the opportunity to review and comment on the subject draft environmental assessment.

The Department of Parks and Recreation has no comment, as the proposed project will have no impact on any program or facility of the Department. You may remove us as a consulted party to the balance of the EIS process.

Should you have any questions please contact Mr. John Reid, Planner at 768-3017.

Sincerely,

ALBERT TUFONO
Acting Director

AT:jr
(499120)

cc: Mr. James Hayes, Parsons Brinkerhoff

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

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

In reply, please refer to:
File:

13-023
DEA H-1

RECEIVED
FEB - 8 2013
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

January 31, 2013

TO: Ross Hironaka
Department of Transportation, Highways Division

FROM: Laura McIntyre, Program Manager
Department of Health, Environmental Planning Office

SUBJECT: **Draft Environmental Assessment for Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue, Honolulu, Hawaii Federal Aid Project No. IM-H1-1(269)**

The Department of Health (DOH), Environmental Planning Office (EPO), acknowledges receipt of your document dated January 22, 2013. Thank you for allowing us to review and comment on the subject document. The document was routed to the relevant Environmental Health divisions and offices. They will provide specific comments to you if necessary. EPO recommends that you review the Standard Comments (www.hawaii.gov/health/epo under the land use tab). You are required to adhere to all Standard Comments specifically applicable to this application.

EPO suggests that you examine the many sources available on strategies to support the sustainable design of communities, including the:
U.S. Environmental Protection Agency's sustainability programs: www.epa.gov/sustainability
U.S. Green Building Council's LEED program: www.new.usgbc.org/leed

The DOH encourages everyone to apply these sustainability strategies and principles early in the planning and review of projects. We also request that for future projects you consider conducting a Health Impact Assessment (HIA). More information is available at www.cdc.gov/healthyplaces/hia.htm. We request you share all of this information with others to increase community awareness on sustainable, innovative, inspirational, and healthy community design.

We request a written response confirming receipt of this letter and any other letters you receive from DOH in regards to this submission. You may mail your response to 919 Ala Moana Blvd., Ste. 312, Honolulu, Hawaii 96814. However, we would prefer an email submission to epo@doh.hawaii.gov. We anticipate that our letter(s) and your response(s) will be included in the final document. If you have any questions, please contact me at (808) 586-4337.

c: James Hayes, Parsons Brinckerhoff

NEIL ABERCROMBIE
GOVERNOR
RICHARD C. LIM
DIRECTOR
MARY ALICE EVANS
DEPUTY DIRECTOR
JESSE K. SOUKI
DIRECTOR
OFFICE OF PLANNING

DEPARTMENT OF BUSINESS, ECONOMIC DEVELOPMENT & TOURISM

OFFICE OF PLANNING
235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 587-2846
Fax: (808) 587-2824

Ref. No. P-13863

February 4, 2013

RECEIVED
FEB - 6 2013
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

To: Glenn M. Okimoto, Ph.D., Director
Department of Transportation

Attention: Ross Hironaka, Highways Division

From: Jesse K. Souki, Director

Subject: Draft Environmental Assessment (EA) for Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue, Honolulu, Oahu;
Federal Aid Project No. IM-H1-1(269)

The proposed project, "Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue," will require Coastal Zone Management (CZM) Act federal consistency review by the Hawaii CZM Program, as correctly identified in the Draft EA. The federal consistency review is required for the receipt and use of Federal Highway Administration funds for the project. Additional federal consistency review may be required for the widening of Nuuanu Stream Bridge in conjunction with the U.S. Army Corps of Engineers permit, if applicable.

Thank you for the opportunity to comment on the Draft EA. If you have any questions, please call John Nakagawa of our CZM Program at 587-2878.

c: Mr. James Hayes, Parsons Brinckerhoff

NEIL ABERCROMBIE
GOVERNOR

KALBERT K. YOUNG
DIRECTOR

LUIS P. SALAVERIA
DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF BUDGET AND FINANCE
P.O. BOX 150
HONOLULU, HAWAII 96810-0150

EMPLOYEES' RETIREMENT SYSTEM
HAWAII EMPLOYER-UNION HEALTH BENEFITS TRUST FUND
OFFICE OF THE PUBLIC DEFENDER
PUBLIC UTILITIES COMMISSION

ADMINISTRATIVE AND RESEARCH OFFICE
BUDGET, PROGRAM PLANNING AND MANAGEMENT DIVISION
FINANCIAL ADMINISTRATION DIVISION
OFFICE OF ECONOMIC RECOVERY AND REINVESTMENT (ARRA)

February 4, 2013

RECEIVED
FEB - 8 2013
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

Mr. James Hayes
Parsons Brinckerhoff
1001 Bishop Street
American Savings Bank Tower, Suite 2400
Honolulu, Hawaii 96813

Dear Mr. Hayes:

This is to acknowledge receipt of your letter dated January 22, 2013, which is soliciting comments on the Draft Environmental Assessment for the Proposed Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue, Island of Oahu project.

We have no comments at this time.

Aloha,

KALBERT K. YOUNG
Director of Finance

c: Mr. Ross Hironaka

HONOLULU FIRE DEPARTMENT

CITY AND COUNTY OF HONOLULU

636 South Street
Honolulu, Hawaii 96813-5007
Phone: 808-723-7139 Fax: 808-723-7111 Internet: www.honolulu.gov/hfd

KIRK CALDWELL
MAYOR

EMMIT A. KANE
ACTING FIRE CHIEF

ROLLAND J. HARVEST
ACTING DEPUTY FIRE CHIEF

RECEIVED
FEB - 8 2013
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

February 5, 2013

Mr. Ross Hironaka
Highways Division
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Hironaka:

Subject: Draft Environmental Assessment
Interstate Route H-1 Rehabilitation
Middle Street to Vicinity of Ward Avenue
Federal Aid Project No. IM-H1-1(269)

In response to a letter from Mr. James Hayes of Parsons Brinckerhoff dated January 22, 2013, regarding the above-mentioned subject, the Honolulu Fire Department determined that there will be no significant impact to fire department services.

Should you have questions, please contact Battalion Chief Socrates Bratakos of our Fire Prevention Bureau at 723-7151 or sbratakos@honolulu.gov.

Sincerely,

EMMIT A. KANE
Acting Fire Chief

EAK/SY:jl

cc: Parsons Brinckerhoff

NEIL ABERCROMBIE
GOVERNOR

Dean H. Seki
Comptroller

Maria E. Zielinski
Deputy Comptroller

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810-0119

(P)1027.3

FEB 5 2013

RECEIVED
FEB - 6 2013
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

Mr. James Hayes
Parsons Brinckerhoff
1001 Bishop Street, Suite 2400
American Savings Bank Tower
Honolulu, Hawaii 96813

Dear Mr. Hayes:

Subject: Draft EA Interstate Route H-1 Rehabilitation
Middle Street to Vicinity of Ward Avenue
Island of Oahu, State of Hawaii
Federal Aid Project No. IM-H1-1(269)

Thank you for the opportunity to provide comments for the Draft Environmental Assessment for the subject project. This project does not impact any of the Department of Accounting and General Services' projects or existing facilities, and we have no comments to offer at this time.

If you have any questions, please call me at 586-0400 or your staff may call Ms. Gayle Takasaki of the Public Works Division at 586-0500.

Sincerely,

DEAN H. SEKI
Comptroller

c: Mr. Ross Hironaka, DOT Highways

PUBLIC COMMENT FORM
INTERSTATE ROUTE H-1 REHABILITATION, MIDDLE STREET TO VICINITY OF WARD AVENUE

The State of Hawai'i Department of Transportation, Highways Division, and Federal Highway Administration encourage all interested individuals and organizations to comment on the project and the Draft Environmental Assessment (EA), which is available for review. Your comments and suggestions will assist in the responsible development of the roadway project being discussed at this public meeting and detailed in the Draft EA. Space is provided below to write out any comment you may wish to make. Please hand in your comment during this meeting, or, if you prefer, mail it to the address printed below on or before February 22, 2013.

Comment: Noise abatement is insufficient. Newer technologies developed in Japan and elsewhere should be included. A study of the entire H-1 passageway through Honolulu should assess (1) adverse human effects to include hearing damage to ears with sustained roar over time; (2) ways to address this issue, including technologies studied from work done elsewhere not just in the US, but globally.

Notice: Copies of all comments provided will be available to the public under the Freedom of Information Act and will be included in the Final EA. This will include names, address, and other personal information provided with the comments. Your comments will be considered with or without the following optional information (please print):

Name: PAUL VIOTTI

Phone:

E-mail: prviotti@gmail.com

Representing: Queen Emma Gardens

Address: 1519 Nuuanu Ave #139
Honolulu HI 96817

HDOT Mailing Address: State of Hawai'i
Department of Transportation
Highways Division, Design Branch
601 Kamokila Blvd., Room 609
Kapolei, HI 96707
Attn: Ross Hironaka
808-692-7575

NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

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

IN REPLY REFER TO:
HWY-DD 2.4176

March 8, 2013

Mr. Paul Viotti
1519 Nuuanu Avenue, #139
Honolulu, Hawaii 96817

Dear Mr. Viotti:

Subject: Final Environmental Assessment and Finding of No Significant Impact
Interstate Route H-1 Rehabilitation
Middle Street to Vicinity of Ward Avenue
Honolulu, Island of Oahu, Hawaii
Federal-Aid Interstate Project No. IM-H1-1(269)

The State of Hawaii Department of Transportation (HDOT) issued a Draft Environmental Assessment (DEA) on January 23, 2013. This letter provides you with a copy of the Final Environmental Assessment / Finding of No Significant Impact (FEA-FONSI) and a response to substantive comments received from you at the public informational meeting held on February 6, 2013.

Your comment stated that "Noise abatement is insufficient. Newer technologies developed in Japan and elsewhere should be included. A study of the entire H-1 passage through Honolulu should assess (1) adverse human effect to include hearing damage to ears with sustained roar over time; (2) ways to address this issue, including technologies studied work done elsewhere not just in the U.S., but globally."

It is well understood the long-term exposure to any noise is potentially damaging to human health. In recognition of this risk, various agencies have developed noise exposure guidelines or limits. For instance, the Occupational Safety and Health Administration (OSHA) has set a permissible noise exposure level of 90 dBA over an eight-hour work day. And, as discussed in the DEA, the Federal Highway Administration (FHWA) has established a noise abatement criteria (NAC) of 67 decibal (dBA) in residential areas. However, exceeding the NAC does not necessarily require the level of noise to be abated.

Section 2.4 of the DEA and FEA-FONSI provide details concerning the level of traffic noise present today (roughly an average of 68 dBA) in the project corridor and the level of traffic noise anticipated once the project is implemented. The findings of that work indicate there will be very little, if any, change in the maximum level of traffic noise before and after the project. In addition, the study explains that while noise barriers are feasible to reduce noise levels for some nearby receptors, the capital cost of those noise barriers make them unreasonable to construct.

Our noise assessment is bound by state and federal guidance that currently do not approve the use and funding for some of the noise barriers used in other parts of the world. Some new barrier types used elsewhere are more expensive than typical concrete noise barriers and many others do not have long track records available for us to determine how long they will effectively reduce noise levels. Newer technologies are regularly tested and more materials have been approved for use in the U.S. in recent years, but the cost of many of the newer materials is not drastically different than typical concrete noise barriers and some do not provide the necessary long-term noise reduction.

A standardized cost-benefit analysis is used in determining if noise barriers are reasonable to place, given the benefit to the number of noise-sensitive uses located behind each barrier to ensure that all communities are treated equal while not creating noise barrier costs so high that prevent needed improvements to infrastructure.

If there are any questions, please contact our project manager, Mr. Ross Hironaka at (808) 692-7575 or ross.hironaka@hawaii.gov., Design Section, Design Branch, Highways Division and reference letter number HWY-DD 2.4176 as noted above.

Very truly yours,

GLENN M. OKIMOTO, PH.D.
Director of Transportation

Enclosure: CD with FEA-FONSI in PDF format

c: Jim Hayes (PB)

NEIL ABERCROMBIE
GOVERNOR

MAJOR GENERAL DARRYLL D. M. WONG
DIRECTOR OF CIVIL DEFENSE

DOUG MAYNE
VICE DIRECTOR OF CIVIL DEFENSE

PHONE (808) 733-4300
FAX (808) 733-4287

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE DIRECTOR OF CIVIL DEFENSE
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495

February 7, 2013

Mr. Ross Hironaka
Department of Transportation
Highway Division
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Hironaka:

Draft Environmental Assessment, Interstate Route H-1 Rehabilitation,
Middle Street to Vicinity of Ward Avenue, Honolulu, Hawaii
Federal Aid Project No. IM-H1-1(269)

Thank you for the opportunity to comment on this Draft Environmental Assessment. As per our initial response letter dated November 28, 2012, we reiterate the need for the highway to remain open during construction phases to ensure access for emergency vehicles and act as an evacuation route in case of disaster.

If you have any questions of concerns, please have your staff contact Ms. Havinne Okamura at 733-4300, extension 556.

Sincerely,

DOUG MAYNE
Vice Director of Civil Defense

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 3RD FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8305 • Fax: (808) 768-4730 • Internet: www.honolulu.gov

RECEIVED
FEB 18 2013
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

KIRK CALDWELL
MAYOR

MICHAEL D. FORMBY
DIRECTOR DESIGNATE

MARK N. GARRITY, AICP
DEPUTY DIRECTOR

TP1/13-499302R
TP1/13-499046R

February 12, 2013

Mr. Ross Hironaka
State of Hawaii
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Hironaka:

Subject: Draft Environmental Assessment (DEA) Interstate Route H-1 Rehabilitation, Middle Street to Ward Avenue, Honolulu, Hawaii

The letter dated January 22, 2013, from Parsons Brinkerhoff to Mayor Kirk Caldwell, was referred to the Department of Transportation Services.

We have no comments to offer at this time.

Thank you for the opportunity to review this matter. Should you have any further questions, please contact Michael Murphy of my staff at 768-8359.

Very truly yours,

MICHAEL D. FORMBY
Director Designate

cc: Mayor Kirk Caldwell
Mr. James Hayes
Parsons Brinkerhoff

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

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

In reply, please refer to:
EMD/CWB

02033PMR.13

February 12, 2013

RECEIVED
FEB 14 2013
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

Mr. Ross Hironaka
Highways Division
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813

Dear Mr. Hironaka:

SUBJECT: Comments on the Draft Environmental Assessment for the Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue, Federal Aid Project No. IM-H1-1(269) Honolulu, Island of Oahu, Hawaii TMK: 1-6-021:005, 1-6-024:001, and 1-6-024:003

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of your letter, dated January 22, 2013, requesting comments on your project. The DOH-CWB has reviewed the subject document and offers these comments. Please note that our review is based solely on the information provided in the subject document and its compliance with the Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at: http://www.hawaii.gov/health/environmental/env-planning/landuse/CWB-standardcomment.pdf.

1. Any project and its potential impacts to State waters must meet the following criteria:

   a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.

   b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.

   c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).

2. You may be required to obtain a National Pollutant Discharge Elimination System

(NPDES) permit for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55). An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. The NPDES application forms may be picked up at our office or downloaded from our website at http://hawaii.gov/health/environmental/water/cleanwater/forms/environmental/water/cleanwater/forms/indiv-index.html.

3. If your project involves work in, over, or under waters of the United States, it is highly recommend that you contact the Army Corp of Engineers, Regulatory Branch (Tel: 438-9258) regarding their permitting requirements.

   Pursuant to Federal Water Pollution Control Act [commonly known as the "Clean Water Act" (CWA)], Paragraph 401(a)(1), a Section 401 Water Quality Certification (WQC) is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may **result** in any discharge into the navigable waters..." (emphasis added). The term "discharge" is defined in CWA, Subsections 502(16), 502(12), and 502(6); Title 40 of the Code of Federal Regulations, Section 122.2; and Hawaii Administrative Rules (HAR), Chapter 11-54.

4. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 WQC are required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.

If you have any questions, please visit our website at: http://www.hawaii.gov/health/environmental/water/cleanwater/index.html, or contact the Engineering Section, CWB, at (808) 586-4309.

Sincerely,

ALEC WONG, P.E., CHIEF
Clean Water Branch

MR:jst

c: Mr. James Hayes, Parsons Brinckerhoff
DOH-EPO [via email only]

Scott David Truesdell

1509 Pele Street
Honolulu, Hawaii 96813
(808) 294 - 1506

RECEIVED
FEB 13 2013
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

February 12, 2013

Mr. Ross Hironaka, Project Manager
Department of Transportation
Highways Division, Design Branch
601 Kamokila Boulevard, Room 609
Kapolei, Hawaii 96707

Re Draft Environmental Assessment Interstate Route H-1 Rehabilitation (Draft EA) / Caesar and Eleanor Gomes Park at Pele Street

Dear Mr. Hironaka,

I write to provide comment on the Draft EA for the Interstate Route H-1 Rehabilitation. Thank you for the opportunity to provide these comments.

The Draft EA does not include reference to the Caesar and Eleanor Gomes Park at Pele Street, a City and County of Honolulu park. The Park is located along the makai side of H-1 and the ewa side of Pele Street.

I understand that the Draft EA provides that "[n]one of the parks would be directly affected by the project. The only indirect affects to the parks would be minor changes to noise levels." And also that "the proposed project would not require the acquisition of any new right of way." Section 2.16 and "Discussiion" under "Recreational Resources."

I request that you kindly amend the Draft EA and final Environmental Assessment to include Caesar and Eleanor Gomes Park at Pele Street to ensure that it will be protected, or otherwise not impacted, to the same extent as the other parks currently included in the Draft EA.

If you require any thing else to get the Caesar and Eleanor Gomes Park included with the other parks, please let me know as soon as practicable.

Mahalo,

Scott David Truesdell

cc: Office of Environmental Quality Control
Jim Hayes, Parsons Brinckerhoff, Inc.

NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

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

IN REPLY REFER TO:
HWY-DD 2.4179

March 9, 2013

Mr. Scott David Truesdell
1509 Pele Street
Honolulu, Hawaii 96813

Dear Mr. Truesdell:

Subject: Final Environmental Assessment and Finding of No Significant Impact
Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue
Honolulu, Island of Oahu, Hawaii
Federal-Aid Interstate, Project No. IM-H1-1(269)

The State of Hawaii Department of Transportation (HDOT) issued a Draft Environmental Assessment (DEA) on, January 23, 2013. This letter provides you with a copy of the Final Environmental Assessment / Finding of No Significant Impact (FEA-FONSI) and a response to substantive comments received in your letter dated, February 12, 2013.

Your comment stated that "I request that you kindly amend the Draft EA and final Environmental Assessment to include Caesar and Eleanor Gomes Park at Pele Street to ensure that it will be protected, or otherwise not impacted, to the same extent as the other parks currently included in the Draft EA."

Although the Caesar and Eleanor Gomes Park is not specifically mentioned in the Draft EA, it is illustrated as a park on Figure 2-5c of the Draft EA. Even though only certain parks are specifically identified in the Draft EA, the Caesar and Eleanor Gomes Park was included in the impact assessment presented in the Draft EA. The Draft EA states in Section 2.16 that "no direct impacts to parks and recreational resources in the project corridor are anticipated." Because the Caesar and Eleanor Gomes Park was not excluded from the impact analysis, it is not necessary to issue an "amended" Draft EA.

The Final EA (enclosed CD) identifies the location of Caesar and Eleanor Gomes Park, which has been called out on Figure 2-4, Figure 2-5 (was hatched as a park on this figure in the Draft EA), Figure 2-6 (note: the parcel is zoned A-2, not as a park), and Figure 2-12. As with the other parks along the project corridor, the Caesar and Eleanor Gomes Park will not be directly affected by the project; no new right-of-way will be acquired as part of the project. Section 2.4 of the Draft and Final EA discuss potential project noise impacts. Noise modeling site "G" is near Caesar and Eleanor Gomes Park (Figure 2-4) and our modeling indicates that the worst-hour noise level (the "Leq(h)" – the average noise level of a one-hour period) will drop from a current level of 68 dBA to a level of 67 dBA after the project is complete. This decline in the noise level will be imperceptible. Therefore, we can confirm that Caesar and Eleanor Gomes Park is not anticipated to be impacted by the project.

If there are any questions, please contact our project manager, Mr. Ross Hironaka at (808) 692-7575 or ross.hironaka@hawaii.gov., Design Section, Design Branch, Highways Division and reference letter number HWY-DD 2.4179 as noted above.

Very truly yours,

GLENN M. OKIMOTO, PH.D.
Director of Transportation

Enclosure: CD with FEA-FONSI in PDF format

c: Jim Hayes (Parsons Brinkerhoff)

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 7TH FLOOR • HONOLULU, HAWAII 96813
PHONE: (808) 768-8000 • FAX: (808) 768-6041
DEPT. WEB SITE: www.honoluludpp.org • CITY WEB SITE: www.honolulu.gov

KIRK CALDWELL
MAYOR

GEORGE I. ATTA
FAICP, LEED AP, CEI
DIRECTOR DESIGNATE

JIRO A. SUMADA
DEPUTY DIRECTOR

2013/ELOG-145 (mt)

February 19, 2013

Mr. James Hayes
Parsons Brinckerhoff
1001 Bishop Street, Suite 2400
American Savings Bank Tower
Honolulu, Hawaii 96813

RECEIVED
FEB 28 2013
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

Dear Mr. Hayes:

Subject: Draft Environmental Assessment Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue, Honolulu, Hawaii
TMK: 1-6-021: 005, 1-6-024: 001, 1-6-024: 003

This is in response to your letter of January 22, 2013, regarding the subject matter.

Our Department has reviewed the Draft Environmental Assessment and has no comments to offer.

If there are any questions, please contact Mel Takakura of the Site Development Division at 768-8104.

Very truly yours,

George I. Atta, FAICP, LEED AP, CEI
Director Designate
Department of Planning and Permitting

GIA:ky

cc: LUPD
PD

HART

HONOLULU AUTHORITY for RAPID TRANSPORTATION

IN REPLY REFER TO:
CMS-ENV00209

Daniel A. Grabauskas
EXECUTIVE DIRECTOR AND CEO

BOARD OF DIRECTORS

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Glenn M. Okimoto, Ph.D.
Jiro Sumada

February 13, 2013

The Honorable Glenn M. Okimoto, Ph.D.
Director
Department of Transportation
State of Hawaii
869 Punchbowl Street
Honolulu, Hawaii 96813

Attention: Mr. Ross Hironaka

Dear Dr. Okimoto:

Subject: Draft Environmental Assessment
H1 Highway Rehabilitation Project
Middle Street to Ward Avenue

This responds to the January 22, 2013 request from Parsons Brinkerhoff to review the Draft Environmental Assessment for rehabilitating Interstate Route H-1, with work to include widening of Nuuanu Stream Bridge and adding a fourth travel lane in both directions.

Based on the project schedule showing work commencing in summer of 2013 and being completed by the fall of 2014, and occurring mainly during the off-peak night-time hours, HART anticipates no traffic conflicts as the design work and pre-construction activities for the guideway and transit stations in the 'City Center' segment of the alignment, from Middle Street along Dillingham Boulevard, Nimitz Highway and Halekauwila, Queen and Kona Streets, will be occurring at this time.

Should you have any questions on the matter, please contact Bruce Nagao at 768-8351 or bnagao@honolulu.gov.

Sincerely,

Daniel A. Grabauskas
Executive Director and CEO

cc: Mr. James Hayes, PB

CITY AND COUNTY OF HONOLULU, Alii Place, Suite 1700, 1099 Alakea Street, Honolulu, Hawaii 96813
Phone: (808)768-6159 Fax: (808)768-5110 www.honolulutransit.org

NEIL ABERCROMBIE
GOVERNOR

KATHRYN S. MATAYOSHI
SUPERINTENDENT

STATE OF HAWAI`I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI`I 96804

OFFICE OF SCHOOL FACILITIES AND SUPPORT SERVICES

RECEIVED
FEB 25 2013
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

February 20, 2013

TO: Mr. Ross Hironaka, Project Manager
Highways Division
Department of Transportation

FROM: Duane Y. Kashiwai, Public Works Administrator
Facilities Development Branch

SUBJECT: **Draft Environmental Assessment, Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue, Honolulu, Island of O`ahu, Hawai`i**

In response to your correspondence dated January 22, 2013 to Superintendent Kathryn Matayoshi, the Department of Education (DOE) has reviewed the Draft Environmental Assessment (DEA) for the Interstate Route H-1 Rehabilitation project. The DEA identifies an area on the north-west corner of the Farrington High School campus that will be needed as a 15-foot wide construction easement for the duration of the project.

The DOE requests a meeting be scheduled to discuss potential impacts of the proposed construction easement may impose on Farrington High School.

Thank you for the opportunity to provide comments. If you have any questions, please call Roy Ikeda of the Facilities Development Branch at 377-8301.

DYK:jmb

c: Office of Environmental Quality Control
✓Jim Hayes, Parsons Brinckerhoff, Inc.
Kathryn S. Matayoshi, Superintendent

NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

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

IN REPLY REFER TO:
HWY-DD 2.3400

March 8, 2013

TO: MS. KATHRYN MATAYOSHI, SUPERINTENDENT
DEPARTMENT OF EDUCATION

ATTN: DUANE Y. KASHIWAI, PUBLIC WORKS ADMINISTRATOR
FACILITIES DEVELOPMENT BRANCH

FROM: GLENN M. OKIMOTO, PH.D.
DIRECTOR OF TRANSPORTATION

SUBJECT: FINAL ENVIRONMENTAL ASSESSMENT
AND FINDING OF NO SIGNIFICANT IMPACT
INTERSTATE ROUTE H-1 REHABILITATION
MIDDLE STREET TO VICINITY OF WARD AVENUE
HONOLULU, ISLAND OF OAHU, HAWAII
FEDERAL-AID INTERSTATE PROJECT NO. IM-H1-1(269)

The State of Hawaii Department of Transportation (HDOT) issued a Draft Environmental Assessment (DEA) on January 23, 2013. This letter provides you with a copy of the Final Environmental Assessment / Finding of No Significant Impact (FEA-FONSI) and a response to substantive comments received from your office during the DEA comment period.

In your letter dated February 20, 2013, you requested a meeting be scheduled to discuss potential impacts of the proposed construction easement may impose on Farrington High School. We would be happy to meet with you and representatives of Farrington High School to discuss the construction easement and how best to perform the lighting replacement in the area with minimal impacts to school operation, maintenance, and improvements. We will be contacting you by telephone soon to schedule the meeting.

If there are any questions, please contact our project manager, Mr. Ross Hironaka at (808) 692-7575 or ross.hironaka@hawaii.gov., Design Section, Design Branch, Highways Division and reference letter number HWY-DD 2.3400 as noted above.

Enclosure: CD with FEA-FONSI in PDF format

c: Jim Hayes, Parsons Brinckerhoff

Hawaiian Electric Company
Engineering Department
PO Box 2750 • Honolulu, HI 96840

RECEIVED
FEB 21 2013
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

February 20, 2013

Mr. James Hayes
Parsons Brinkerhoff
1001 Bishop St., Suite 2400
Honolulu, Hawaii 96813

Dear Mr. Hayes:

Subject: **Draft Environmental Assessment**
Interstate Route H-1 Rehabilitation, Middle St. to Vicinity of Ward Ave.
Federal Aid Project No. IM-H1-1(269).

Thank you for the opportunity to comment on the subject project. Hawaiian Electric Company (HECO) has no objections to the project. Should HECO have existing easements and facilities on the subject property, we will need continued access for maintenance of our facilities.

We appreciate your efforts to keep us apprised of the proposed project in the planning process. As the H-1 rehabilitation project comes to fruition, please continue to keep us informed. Further along in the design, we will be better able to evaluate the effects on our system facilities.

If you have any questions, please call me at 543-7245.

Sincerely,

Rouen Q. W. Liu
Permits Engineer

RECEIVED
FEB 22 2013
PARSONS BRINCKERHOFF

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

In Reply Refer To:
2013-TA-0103

FEB 20 2013

Mr. James Hayes
Parsons Brinckerhoff
1001 Bishop Street,
American Savings Bank Tower, Suite 2400
Honolulu, Hawaii 96813

Subject: Technical Assistance for the Proposed Route H-1 Rehabilitation Project, Oahu

Dear Mr. Hayes:

The U.S. Fish and Wildlife Service (Service) received your letter on January 23, 2013, requesting review and comments on the Draft Environmental Assessment (EA) for the proposed Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue project on the island of Oahu [Federal-Aid Project Number IM-H1-1 (269)]. The project consists of pavement rehabilitation and resurfacing between Likelike Highway and Miller Street, replacement of the highway lighting system, installation of glare screens, widening of Nuuanu Stream Bridge by approximately five feet, and minor structural and grading modifications. We understand that the Federal Highway Administration plans to partially fund the proposed project.

We have previously provided a species list under the authorities of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) for the proposed project in a letter dated October 12, 2012 (Service File 2013-SL-0009). In that letter we informed you that no federally listed species or designated critical habitat occur within the immediate vicinity of the proposed project. To our knowledge, conditions at the site have not changed.

We have reviewed the Draft EA that you provided with your January 23, 2013, letter and pertinent information in our files. In response to this review, we are providing additional comments under the authority of and in accordance with the provisions of the Fish and Wildlife Coordination Act of 1934 (16 U.S.C. 1531 *et. seq.*; 48 Stat. 401), as amended (FWCA); the National Environmental Policy Act of 1969 [42 U.S.C. 4321 et seq.; 83 Stat. 852], as amended, and other authorities mandating the Service's review of projects and provision of technical assistance to conserve trust resources.

We appreciate your effort to incorporate extensive measures into the project design that avoid and minimize impacts to the aquatic environment. We recommend the following best management practices to further avoid impacts to aquatic resources.

TAKE PRIDE® IN AMERICA

- We recommend that the Nuuanu Stream bridge widening activities not be performed during periods of high flood risk.

- Turbidity and siltation from project-related work shall be minimized and contained within the vicinity of the site through the appropriate use of effective silt containment devices and the curtailment of work during adverse tidal and weather conditions.

- No project-related materials (fill, revetment rock, pipe, etc.) should be stockpiled in the water (intertidal zones, reef flats, stream channels, wetlands, etc.) or on beach habitats.

- No contamination (trash or debris disposal, non-native species introductions, attraction of non-native pests, etc.) of adjacent habitats (reef flats, channels, open ocean, stream channels, wetlands, beaches, forests, etc.) shall result from project-related activities. This shall be accomplished by implementing a litter-control plan and developing a Hazard Analysis and Critical Control Point Plan (HACCP – see http://www.haccp-nrm.org/Wizard/default.asp) to prevent attraction and introduction of non-native species or comparable plans.

- Fueling of project-related vehicles and equipment should take place away from the water and a contingency plan to control petroleum products accidentally spilled during the project shall be developed. Absorbent pads and containment booms shall be stored on-site, if appropriate, to facilitate the clean-up of accidental petroleum releases.

- Any soil exposed near water as part of the project shall be protected from erosion (with plastic sheeting, filter fabric etc.) after exposure and stabilized as soon as practicable (with native or non-invasive vegetation matting, hydro-seeding, etc.).

Should project plans change or new information regarding the presence of listed species become available, we recommend you coordinate with our office.

We appreciate your efforts to conserve listed species and to avoid and minimize impacts to aquatic habitat. If you have questions, please contact Diane Sether, Wildlife Biologist, at 808-792-9458.

Sincerely,

for Loyal Mehrhoff
Field Supervisor

cc: Mr. Ross Hironaka, Hawaii Department of Transportation

NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

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

IN REPLY REFER TO:
HWY-DD 2.4177

March 11, 2013

Mr. Loyal Mehrhoff, Field Supervisor
Pacific Islands Fish and Wildlife Office
U.S. Fish and Wildlife Service
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

Attention: Ms. Diane Sether, Wildlife Biologist

Dear Mr. Mehrhoff:

Subject: Final Environmental Assessment and Finding of No Significant Impact and Endangered Species Act Section 7 Consultation
Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue
Honolulu, Island of Oahu, Hawaii
Federal-Aid Interstate Project No. IM-H1-1(269)

The State of Hawaii Department of Transportation (HDOT) issued a Draft Environmental Assessment (DEA) on, January 23, 2013. This letter provides you with a copy of the Final Environmental Assessment / Finding of No Significant Impact (FEA-FONSI) and a response to substantive comments received from you in a letter dated, February 20 2013.

Your comment stated in part that "We recommend the following best management practices to further avoid impacts to aquatic resources." A list of six best management practices (BMPs) were provided, including items related to minimizing turbidity and siltation during work on the Nuuanu Stream Bridge widening, management of debris and non-native species, vehicle fueling and maintenance, and erosion prevention.

As stated in the DEA and FEA-FONSI, Section 1.7, HDOT will obtain a National Pollutant Discharge Elimination System permit and Section 2.18.4, HDOT will implement BMPs during construction. Those BMPs will be consistent with those listed in your letter dated, February 20, 2013.

If there are any questions, please contact our project manager, Mr. Ross Hironaka at (808) 692-7575 or ross.hironaka@hawaii.gov., Design Section, Design Branch, Highways Division, and reference letter number HWY-DD 2.4177 as noted above.

Very truly yours,

GLENN M. OKIMOTO, PH..D.
Director of Transportation

Enclosure: CD with FEA-FONSI in PDF format

c: Jim Hayes (Parsons Brinkerhoff)

DEPARTMENT OF ENVIRONMENTAL SERVICES
CITY AND COUNTY OF HONOLULU
1000 ULUOHIA STREET, SUITE 308, KAPOLEI, HAWAII 96707
TELEPHONE: (808) 768-3486 • FAX: (808) 768-3487 • WEBSITE: http://envhonolulu.org

KIRK CALDWELL
MAYOR

LORI M.K. KAHIKINA, P.E.
DIRECTOR

EDUARDO P. MANGLALLAN
DEPUTY DIRECTOR

ROSS S. TANIMOTO, P.E.
DEPUTY DIRECTOR

IN REPLY REFER TO
PRO 13-005

February 22, 2013

Mr. Ross Hironaka
Parsons Brinckerhoff
1001 Bishop Street, Suite 2400
Honolulu, Hawaii 96813

Dear Mr. Hironaka:

Subject: Draft Environmental Assessment (EA) Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue Honolulu, Hawaii
Federal Aid Project No. IM-H1-1(269)

We have reviewed the subject report as transmitted to us by your letter dated January 22, 2013, and we have no comments or objections at this time.

We do not need to be included in the review of future submittals on this subject, and can be removed from your distribution.

Should you have any questions, please call Liz Lau, Civil Engineer, at 768-3470.

Sincerely,

Lori M.K. Kahikina, P.E.
Director

POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

801 SOUTH BERETANIA STREET · HONOLULU, HAWAII 96813
TELEPHONE: (808) 529-3111 · INTERNET: www.honolulupd.org

KIRK W. CALDWELL
MAYOR

LOUIS M. KEALOHA
CHIEF

DAVE M. KAJIHIRO
MARIE A. McCAULEY
DEPUTY CHIEFS

OUR REFERENCE EO-WS

February 22, 2013

RECEIVED
FEB 27 2013
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

Mr. Ross Hironaka, Project Manager
Design Branch, Highways Division
Department of Transportation
601 Kamokila Boulevard
Kapolei, Hawaii 96707

Dear Mr. Hironaka:

This is in response to a letter from Parsons Brinckerhoff requesting comments on the Draft Environmental Assessment for the Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue, project.

The Honolulu Police Department (HPD) anticipates that normal traffic patterns and volume and delays in travel time in the project area will be affected. This could result in delays for the HPD to respond to service calls as alternate routes would have to be taken.

We recommend adequate personnel be hired to conduct traffic control and that necessary signs, lights, barricades, cones, and other safety equipment be installed and maintained by the contractor when the project construction commences. Furthermore, the public and the HPD should be provided with advanced notification regarding the project schedule, road inaccessibility, and potential delays.

If there are any questions, please call Major Roy Sugimoto of District 1 (Honolulu) at 723-3323.

Sincerely,

LOUIS M. KEALOHA
Chief of Police

By Clayton G. Kau
CLAYTON G. KAU
Assistant Chief
Support Services Bureau

cc: Mr. James Hayes, Parsons Brinckerhoff

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 11TH FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8480 • Fax: (808) 768-4567
Web site: www.honolulu.gov

KIRK CALDWELL
MAYOR

CHRIS T. TAKASHIGE, P.E., CCM
DIRECTOR

MARK YONAMINE, P.E.
DEPUTY DIRECTOR

RECEIVED
FEB 27 2013
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

February 25, 2013

Parsons Brinckerhoff
1001 Bishop Street, Suite 2400
American Savings Bank Tower
Honolulu, Hawaii 96813

Attn: James Hayes

Dear Mr. Hayes:

Subject: Draft Environmental Assessment for Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue Honolulu, Hawaii

Thank you for inviting us to review the above study. The Department of Design and Construction has the following comments from our Wastewater Division:

1. Existing sewer lines are crossing the portions of H-1 to be rehabilitated.

    a. In pavement areas to be rehabilitated, an 18" thick layer of existing AC and AC base will be removed. Is there adequate cover over the existing sewer lines to prevent damages by compaction and paving equipments installing the new pavement?
    b. Are there any existing sewer manholes located in the resurfacing pavement areas? If the finish surface of the resurface pavement does not match the existing pavement surface, identify existing sewer manholes that might require reconstruction to its top.

2. Will the widening of the bridge over Nuuanu Stream impact the nearby sewer lines crossing the H-1? If required, new additional foundations should avoid conflicts with the crossing sewer lines.

3. Existing sewer lines within any frontage roads and/or ramps that will require grade adjustment walls or curbing should be shown and verbiage added concerning the impact of the new improvements on the existing sewer lines.

    a. In areas where grade adjustment walls or curbing would be constructed or existing walls extended, is there adequate cover to prevent damages on the existing sewer lines?

    b. If the finish surface of the grade adjusted areas do not match the existing pavement surface, identify existing sewer manholes that might require reconstruction to its top.

4. Construction plans for the rehabilitation project should show the existing sewer lines and top of manhole and invert elevations within the H-1 right of way and within any frontage roads and/or ramps that will require grade adjustment walls or curbing.

5. Construction plans should also show all improvements to the sewer lines. The new sewer improvements should be designed to the standards of the City and County Honolulu.

6. Construction plans should be submitted to the City for its review and approval.

Should you have any questions, please contact Ed Miyashiro at 768-8792 or Terry Chan at 768-8757.

Sincerely,

for M. Yamamoto

Chris T. Takashige, P.E., CCM
Director

CTT: cf (499040)

Neil Abercrombie
GOVERNOR OF HAWAII

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

LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

Note, comment was received after the Draft EA comment period closed (February 22, 2013).

In reply, please refer to:
File: EHA/HEER Office
13-117-JN

March 4, 2013

RECEIVED
MAR - 6 2013
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

Mr. Ross Hironaka
State of Hawaii Department of Transportation
Design Branch, Design Section, Highways Division
601 Kamokila Boulevard, Room 609
Kapolei, HI 96707

Facility/Site: Interstate H-I Rehabilitation

Subject: Comments for Interstate H-I Rehabilitation, Middle Street to Vicinity of Ward Avenue, Honolulu, Oahu, "Draft Environmental Assessment" dated January 23, 2013 by Parsons Brinckerhoff

Dear Mr. Hironaka:

The Hawaii Department of Health (HDOH) Hazard Evaluation and Emergency Response (HEER) Office has reviewed the above referenced document and has the following comments:

Section 2.6: Include a subsection stating: "To avoid construction delays and ensure protection of human health and the environment, a contingency plan, consistent with HRS 128D, shall be implemented to manage and report should impacted soils be encountered or a release into Nuuanu stream occurs during construction activities".

The HDOH kindly asks that you address the above comments. Should you have any questions, please contact me at 586-4697 or at jordan.nakayama@doh.hawaii.gov.

Sincerely,

Jordan Nakayama, Project Manager
Site Discovery, Assessment, and Remediation Section
Hazard Evaluation and Emergency Response Office

C: Mr. Jim Hayes, Parsons Brinckerhoff

APPENDIX A-6

SECTION 106 HISTORIC PRESERVATION COORDINATION

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U.S. Department of Transportation
Federal Highway Administration

Hawaii Federal-Aid Division

300 Ala Moana Blvd, Rm 3-306
Box 50206
Honolulu, Hawaii 96850
Phone: (808) 541-2700
Fax: (808) 541-2704

September 11, 2012

In Reply Refer To:
HDA-HI

Mr. William J. Aila, Jr.
State Historic Preservation Officer
Department of Land and Natural Resources
601 Kamokila Boulevard, Suite 555
Kapolei, HI 96707

Subject: National Historic Preservation Act Section 106 Consultation
Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue
O'ahu Island, Kalihi to Honolulu Ahupua'a
Federal-aid Project No. IM-H1-1(269)

Dear Mr. Aila:

The Federal Highway Administration (FHWA) intends to fund the State of Hawai'i Department of Transportation's (HDOT) Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue project . The FHWA would like to inform the State Historic Preservation Division (SHPD) that it is working cooperatively with the HDOT to advance the project.

Pursuant to Section 106 of the National Historic Preservation Act (NHPA) and 36 CFR Section 800.2(c)(4), the FHWA authorizes the HDOT and its consultant, Parsons Brinckerhoff (PB), to conduct NHPA Section 106 consultations with the SHPD, Native Hawaiian organizations (NHO), and other parties as required. However, the FHWA remains responsible for all findings and determinations charged to the agency during the Section 106 process.

The proposed project is located on the Island of O'ahu along Interstate H-1 between Middle Street and Ward Avenue (~ 3.4 miles long). Please see the enclosed location map. The planned project includes the following general tasks:

- Pavement rehabilitation, including reconstruction and repaving, as necessary, from approximately Likelike Highway to Miller Street
- Replacement of highway lighting system from Middle Street to Vineyard Boulevard on-ramp
- Restriping the roadway to generate four through lanes in both directions to the extent possible throughout the project area
- Widening the Nu'uanu Stream Bridge roughly 5 feet on the makai (downstream) side in order to accommodate four through lanes and one exit lane in the east-bound (Diamond Head) direction

- Minor modifications to the storm drain system, primarily inlet modifications
- Minor grading and structural improvements at select and discrete locations throughout the project area

The project does not involve any new areas being paved other than the widened portion of the Nu'uanu Stream Bridge. All project components will be within the existing Interstate Route H-1 right-of-way.

In agreement with the HDOT, all official letters to the SHPD and consulting parties shall be transmitted under the HDOT letterhead. All determination letters regarding the findings will be transmitted under the FHWA letterhead. The HDOT project manager for the project is Ross Hironaka and he can be contacted for additional project information by phone at (808) 692-7575, or by e-mail at ross.hironaka@hawaii.gov.

Should you have any questions, please do not hesitate to contact me at (808) 541-2314, or by e-mail at roy.siegel@dot.gov. Thank you for your assistance.

Sincerely yours,

Roy Siegel, P.E.
Transportation Engineer

Enclosure

cc: Jim Hayes (PB)
Ross Hironaka and Todd Nishioka (HDOT)

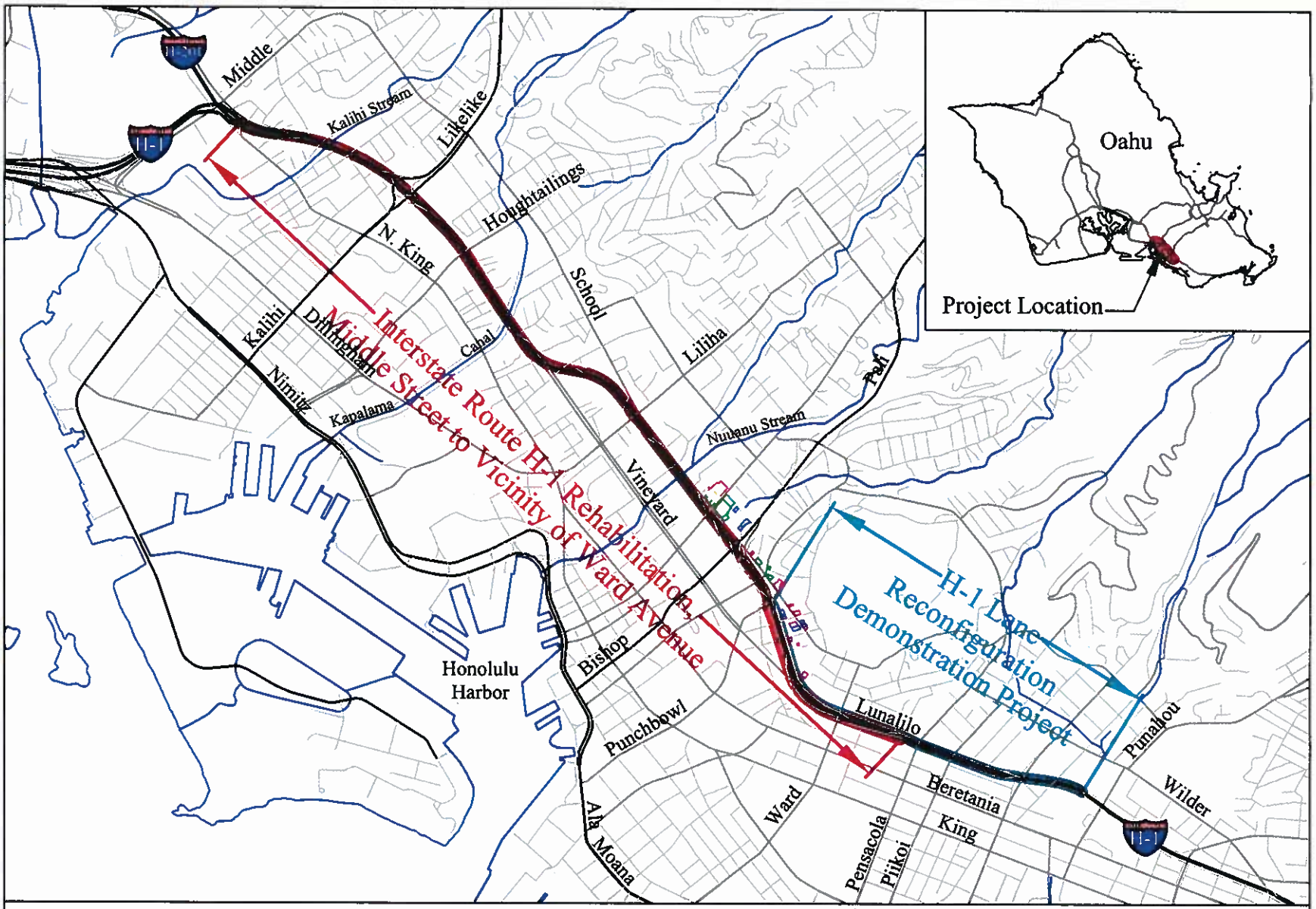

Figure 1: Project Location

Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue
State of Hawaii Department of Transportation, Highways Division

U.S. Department of Transportation
Federal Highway Administration

Hawaii Federal-Aid Division
300 Ala Moana Blvd, Rm 3-306
Box 50206
Honolulu, Hawaii 96850
Phone: (808) 541-2700
Fax: (808) 541-2704

October 22, 2012

In Reply Refer To:
HDA-HI

Mr. William J. Aila Jr.
State Historic Preservation Officer
Department of Land and Natural Resourses
State Historic Preservation Division
601 Kamokila Blvd., Rm.555
Kapolei, Hawaii 96707

Subject: National Historic Preservation Act, Section 106 Consultation
Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue
Traditional District of Kona, Oahu, Ahupuaa of Kalihi, Kapalama and Honolulu
Federal Aid Project No. IM-H1-1(269)
TMK: [1] 1, 2

Dear Mr. Aila;

The Federal Highway Administration (FHWA) would like to invite you to participate in consultation for the proposed State of Hawaii Department of Transportation (HDOT) rehabilitation project. The proposed project is utilizing federal funding and will be considered a federal action and undertaking, as defined by Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended (2006). Therefore, the FHWA will require compliance with the National Environmental Policy Act, NHPA, and other federal requirements. The FHWA has authorized the HDOT and its consultant, Parsons Brinckerhoff, to act on behalf of the FHWA regarding the NHPA Section 106 notification and consultation. This letter is to initiate Section 106 consultation with the State Historic Preservation Division (SHPD) in accordance with Title 36 of the *Code of Federal Regulations*, Section 800.3.

Overview of the Undertaking

The location of the project (Figure 1) is the Interstate Route H-1 freeway through downtown with the limits depending on whether the task being performed is related to rehabilitation of the pavement, or is other work. The project limits are Middle Street to Vicinity of Ward Avenue with paving and lighting having lesser limits as described below.

The planned undertaking includes the following general tasks:

- Pavement rehabilitation, including reconstruction and repaving, as necessary, from roughly Likelike Highway to Miller Street, including ramps
- Replacement of highway lighting system from roughly Middle Street to Vineyard Boulevard On-Ramp
- Restriping the roadway to generate four through lanes in both directions to the extent possible throughout the Project area
- Widening the Nuuanu Stream Bridge roughly 5 feet on the makai (downstream) side in order to accommodate four through lanes and one exit lane in the Diamond Head-bound (east-bound) direction
- Minor modifications to the storm drain system, primarily inlet modifications
- Minor grading and structural improvements at select and discrete locations throughout the Project area

The project does not involve any new areas being paved other than the widened portion of the Nuuanu Stream bridge, and all work is within the existing highway right-of-way (ROW).

A set of preliminary roadway plans is enclosed for your use. Please note that these plans were prepared with the intent of paving just the freeway itself. Since then it has been decided to include paving the on and off ramps to near the freeway ROW.

Area of Potential Effect

The area of potential effect (APE) for the project is proposed to be the ROW limits of the H-1 interstate freeway within the project area (see enclosed Roadway Plan). The width of the ROW varies from 120 to 300 feet wide in the area. The project is roughly 3.4 miles long. The total APE is estimated to be 91 acres.

Historical, Cultural, and Archaeological Background

Reports available at the SHPD library (see references below) provide detailed information concerning historical, cultural, and archaeological background. Those reports indicate that the area had, in pre-contact traditional Hawaiian times, an expansive network of irrigated taro fields with associated habitation sites that extended from Kou, the settlement area focused around present Honolulu Harbor. The taro fields, or loi, extended from near the shoreline, where fish ponds were present, through the project area, and to the foothills of the Koolau Mountains.

During the second half of the nineteenth century (1850 – 1900) the taro field loi were converted to rice fields, especially in the Kapalama ahupuaa. Urbanization of Honolulu ahupuaa, including Nuuanu Valley and the Thomas Square area, was occurring during this period as well. Many of today's main streets were present and western homes were being built. Chinatown was also being established during this time period and suffered a fire in 1900.

By the middle of the twentieth century (1950) most of the streets present today had been established and the entire area urbanized.

Interstate Route H-1 in the project area was built in the late 1950s and early 1960s. The construction of the interstate significantly changed the landscape in the project area. Since that time development in the area has continued, primarily as redevelopment of parcels to higher/more dense uses.

Information from other projects in the vicinity of the APE indicate that the last roughly 150 years of intensive development in the project area has altered and/or destroyed evidence of the pre-contact Native Hawaiian developments, such as the loi and related habitations. Archaeological monitoring has been performed for utility and roadway projects nearby Interstate Route H-1 and the projects have encountered modern and historic debris and artifacts such as glass bottles, ceramics, and metallic items. However, reports associated with those monitoring efforts indicate that no significant cultural resources have been encountered. Human burials have been discovered during development in the Kapalama, Downtown, and Nuuanu Valley areas; however, these discoveries were determined to be post-contact burials.

Summary of Archaeological Sites within the APE

The primary structure in the APE is the Interstate Route H-1. In the project area, Interstate Route H-1 was built in the late 1950s to early 1960s; therefore, it is over 50 years old. The Advisory Council on Historic Preservation adopted the "Section 106 Exemption Regarding Effects to the Interstate Highway System" on March 10, 2005. The exemption states that all components of the interstate highway system, which includes Interstate Route H-1, are not to be considered eligible for the National Registry, except for a select list of interstate highway system facilities. Interstate Route H-1 is not on the "Final List of Nationally and Exceptionally Significant Features of the Federal Interstate Highway System," the select list of interstate highway system facilities that can be considered eligible for the National Registry once they are 50 years old. Therefore, features of Interstate Route H-1 older than 50 years old in the APE are exempt from consideration as historic properties.

The only other known potentially historic properties within the APE are structures related to the streams crossed by Interstate Route H-1 in the project area. Nuuanu Stream, Kapalama Canal, and Kalihi Stream are channelized where H-1 crosses them and the channel sidewalls are composed of quarried lava rock and mortar (Figure 2). These stream sidewalls generally extend a relatively short distance upstream from Interstate Route H-1, but extend a significant distance downstream. Where Interstate Route H-1 crosses the streams, the lava rock and mortar stream sidewalls have been replaced by concrete bridge abutments. The exact age of the lava rock and mortar sidewalls is unknown, but they do appear in photographs dating to the Chinatown fire in 1900, indicating that at least the Nuuanu Stream sidewalls are more than 110 years old.

Related to archaeological resources and the potential for subsurface finds, similar conditions to those encountered by recent nearby projects are predicted in the project area as described in the previous section. Based on review of historical records, archaeological monitoring performed for utility and roadway projects nearby Interstate Route H-1, photographs, and viewing the APE from Interstate Route H-1 and parallel city streets, no archaeological resources are present within the APE except the stream sidewall rock walls described above.

Consultations

A Section 106 newspaper notice/advertisement will be included in the Star-Advertiser and *Ka Wai Ola* (Office of Hawaiian Affairs publication). Native Hawaiian organizations and Native Hawaiian descendants with ancestral lineal or cultural ties to, cultural knowledge or concerns for, and cultural or religious attachment to the proposed project area are asked to provide a response within 30 days of notification.

Section 106 consultation letters have also been sent to the following organizations and individuals:

- Aha Wahine
- Association of Hawaiian Civic Clubs
- Brian Kaniela Naeole Naauao
- Council for Native Hawaiian Advancement
- Friends of Iolani Palace
- Hawaii Maoli
- Hawaiian Civic Club of Honolulu
- Historic Hawaii Foundation
- Hui Hooniho
- Hui Huliau
- Hui Malama I Na Kūpuna O Hawaii Nei
- Kalihi-Palama Hawaiian Civic Club
- Koolau Foundation
- Maluohai Residents Association
- Native Hawaiian Church
- Oahu Island Burial Council
- Office of Hawaiian Affairs (OHA)
- Pacific Justice and Reconciliation Center
- Papakōlea Community Development Corporation
- The I Mua Group

The consultations sent to these groups include an overview of the undertaking, a summary of the proposed area of potential effect, historical background information, an overview of potential historic resources, and a request for a response.

Public meetings will also be held during the course of the project to collect comments from the public.

All initial consultations also invite the consulted parties to identify others that might have knowledge of and interest in the project area so that they may participate in the consultation process.

Mitigation Policies

Mitigation measures during the construction of the proposed undertaking will be implemented to minimize and avoid potential impacts to archaeological, cultural, and historic resources. Although the Section 106 process has not been completed and additional mitigation measures may be identified through the process, the following mitigation measures will be implemented at a minimum:

- If cultural materials are discovered during construction, all earth-moving activity within and around the immediate discovery area will be diverted until a qualified archaeologist can assess the nature and significance of the find
- If human remains are discovered, Hawaii Administrative Rules Title 13, Subtitle 13, Chapter 300 states that all activities shall cease in the immediate area of the human skeletal remains, that appropriate action to protect the integrity and character of the burial site from damage is undertaken, and SHPD and Police Department will be contacted. The appropriate process would then proceed in conformance with Hawaii Administrative Rules §13-300 Subchapter 4 "Procedures for Proper Treatment of Burial Sites and Human Skeletal Remains"

HDOT and FHWA will prevent the disturbance or taking of any historic property or resource to the extent possible by instituting these mitigation measures and enforcing their implementation.

Request for Response

We welcome any comments you might have on the project's proposed improvements. We're particularly interested in any information you may have on the historic and cultural sites that have been recorded in the area or any other historic or cultural sites about which you may have knowledge. In addition, if you are acquainted with any persons or organization that is knowledgeable about the proposed project area, or any descendants with ancestral lineal or cultural ties to or cultural knowledge or concerns for, and cultural or religious attachment to the proposed project area, we would appreciate receiving their names and contact information.

We would appreciate a written response within 30 days from date of receipt, to me (Roy Siegel, FHWA Transportation Engineer), via email at Roy.Siegel@dot.gov, or by US Postal Service to Attn: Roy Siegel, FHWA, 300 Ala Moana Boulevard, Room 3-306, Box 50206, Honolulu, Hawaii 96850.

Please feel free to contact me by telephone at (808) 541-2314 if you have any questions. We look forward to working with the SHPD on these needed improvements.

Sincerely yours,

Roy Siegel, P. E.
Transportation Engineer

Enclosures:
Figure 1 – Site Location
Figure 2 – Photograph, Nuuanu Stream Bridge Makai-Ewa Corner
Roadway Plan

cc: Jim Hayes (Parsons Brinckerhoff) (without attachments)
DIR (HDOT) (without attachments)
HWY-DD (RH) (HDOT) (without attachments)
HWY-DE (HDOT) (without attachments)

REFERENCES:

Aki Sinoto Consulting, 1994. An Archaeological Assessment of a Parcel of Land in Kapālama on the Corner of North King and Houghtailing Streets, Kapālama Ahupuaʻa, Kona District Oʻahu Island (TMK 1-6-03:42-46, 49, 51-53, 79-81, 87, and 89). February 1994.

Cultural Surveys Hawaiʻi, Inc. (CSH), 2006. Archaeological Monitoring Report for the Board of Water Supply Improvement Project, Makiki Ahupuaʻa, Kona District, Oʻahu Island, Oʻahu. July 2009.

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CSH, 2009. Kalihi-Kapālama Portion of the Kalihi/Nuʻuanu Sewer Rehabilitation Project Field Inspection and Literature Review Report, Kalihi and Kapālama Ahupuaʻa, Kona District, al Monitoring Report for the Queen's Medical Center Redevelopment Project, Honolulu (Kona) District, Honolulu Ahupuaʻa, Island of Oʻahu, TMK 2-1-018:048; 2-1-035:1, 3-8; 2-1-037:002. August 2009.

CSH, 2010. Archaeological Monitoring Report for the Traffic Management System PH1 Project, Houghtailing Street by the H-1, Kapālama Ahupuaʻa, Honolulu (Kona) District, Oʻahu Island, TMK 1-6-023:066. October 2010.

CSH, 2011. Archaeological Monitoring Report for Utility Upgrades at The Pacific Club, Honolulu Ahupuaʻa, Kona District, Island of Oʻahu, TMK 2-1-019:014. February 2011.

CSH, 2012. Archaeological Monitoring Plan for a Clubhouse Renovation Construction Project at The Pacific Club, Honolulu Ahupuaʻa, Honolulu District, Island of Oʻahu, TMK 2-1-019:014. May 2012.

Scientific Consultants, Inc., 2009. An Archaeological Monitoring Report for Kalihi Water System Improvements, TMK 1-2-015 and 016; 1-3-001, various parcels. December 2009.

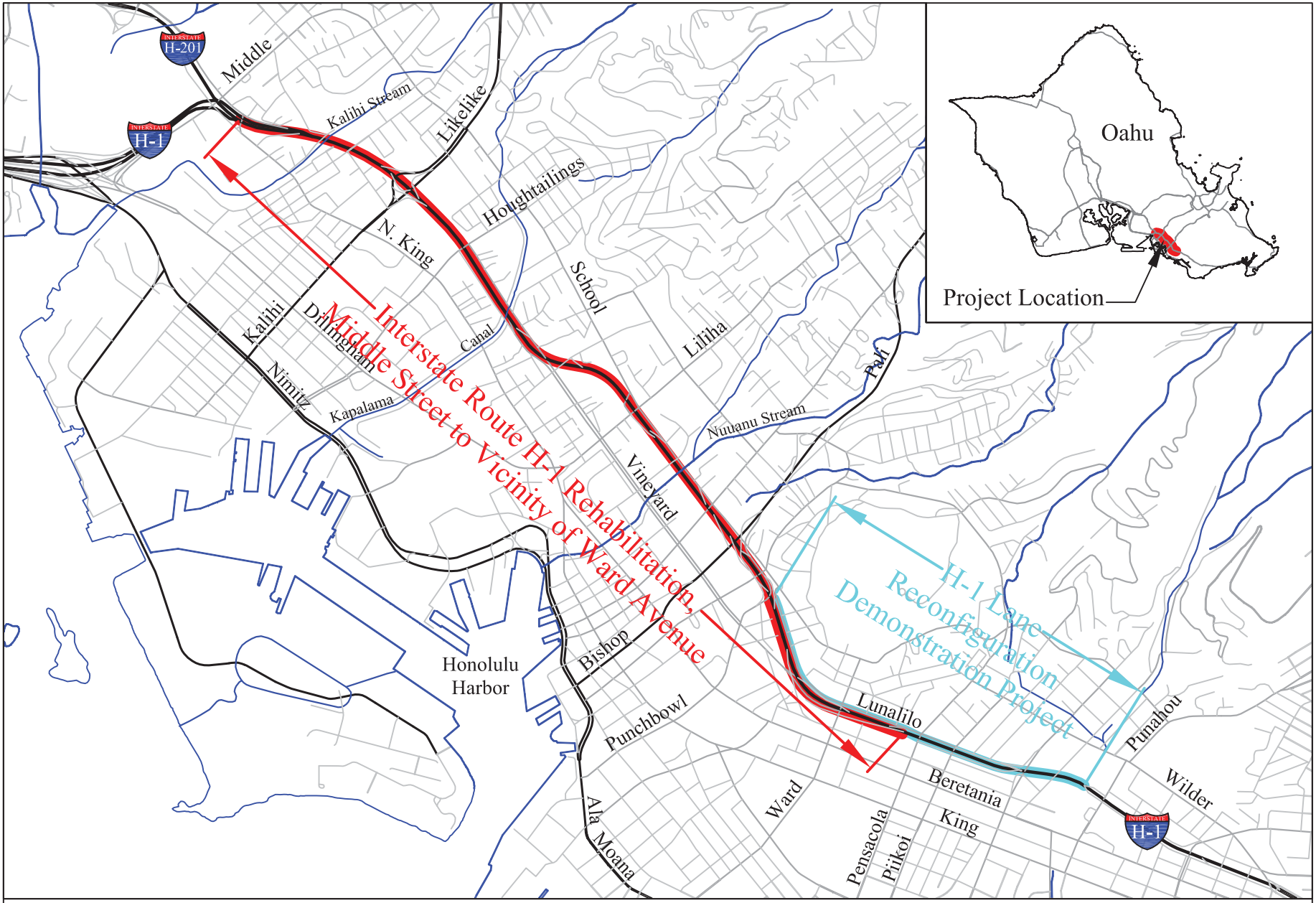
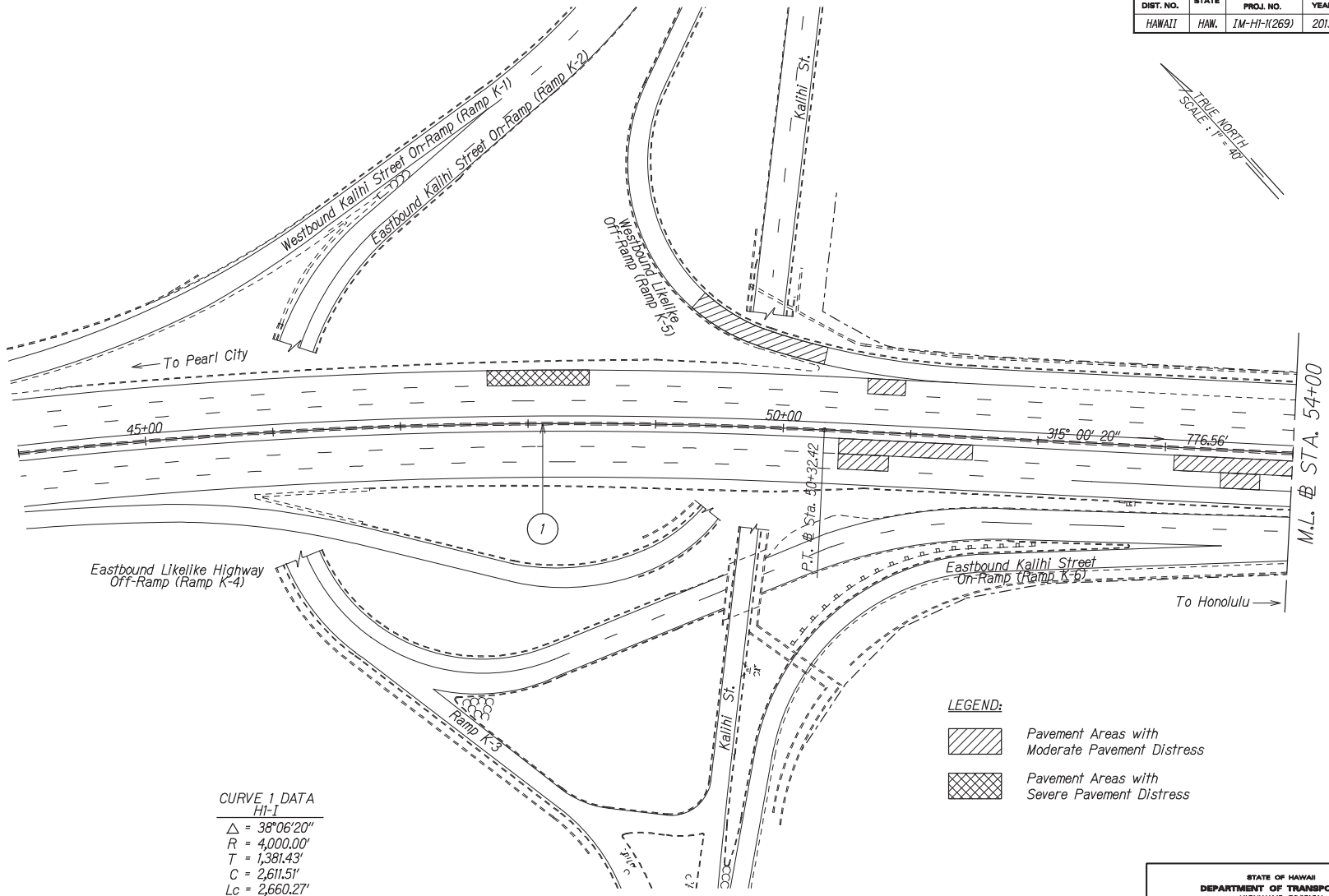


Figure 1: Project Location

Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue
State of Hawaii Department of Transportation, Highways Division

Figure 2: Photograph, Nuuanu Stream Bridge Makai-Ewa Corner
Photograph shows lava rock and mortar stream sidewall in area. Bridge widening has not been thoroughly designed yet; it is likely that the widening will extent to roughly the far side of the drain pipe and the drain pipe will be realigned to be beyond the bridge.

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	IM-H1-1(269)	2013	B1	12



CURVE 1 DATA
H1-I

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T = 1,381.43'
C = 2,611.51'
Lc = 2,660.27'

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN - 1
STA. 44+00 TO STA. 54+00

INTERSTATE ROUTE H-1 RESURFACING
VICINITY OF LIKELIKE INTERCHANGE OT PUNCHBOWL STREET OFF-RAMP

Scale: 1"=40' Date: Sept. 2012

SHEET No. 1 OF 12 SHEETS

B1

GENERAL PLAN | SURVEY PLOTTED BY | PLAN PLOTTED BY | PLAN DRAWN BY | NOTE BOOK | DESIGNED BY | QUANTITIES BY | CHECKED BY | DATE | No.

J:/16459A IDIQ PAVMT PREVENTIVE MAINTENANCE/H1-LIKELIKE TO PUNCHBOWL/CADD/SHEETS/ROAD-01.dgn

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
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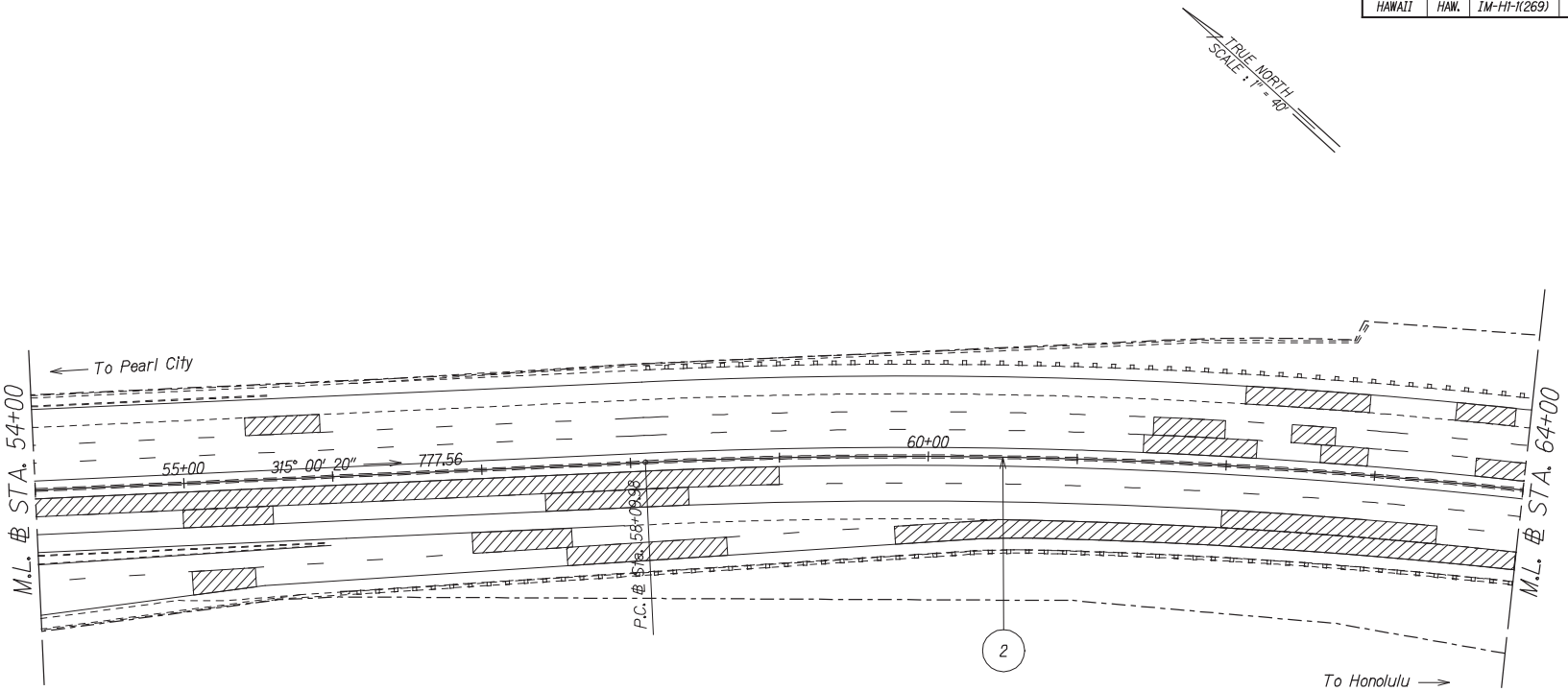

CURVE 2 DATA
H1-1

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C = 864.44'
Lc = 866.30'

LEGEND:

Pavement Areas with Moderate Pavement Distress

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN - 2
STA. 54+00 TO STA. 64+00

INTERSTATE ROUTE H-1 RESURFACING
VICINITY OF LIKELIKE INTERCHANGE OT PUNCHBOWL STREET OFF-RAMP

Scale: 1"=40' Date: Sept. 2012

SHEET No. 2 OF 12 SHEETS

B2

GENERAL PLAN | SURVEY PLOTTED BY ___ DATE | PLAN PLOTTED BY ___ | PLAN REVIEWED BY ___ | NOTE BOOK ___ | DESIGNED BY ___ | CALCULATED BY ___ | CHECKED BY ___ | No. ___

J:/16459A IDIQ PAVMT PREVENTIVE MAINTENANCE/H1-LIKELIKE TO PUNCHBOWL/CADD/SHEETS/ROAD-02.dgn

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
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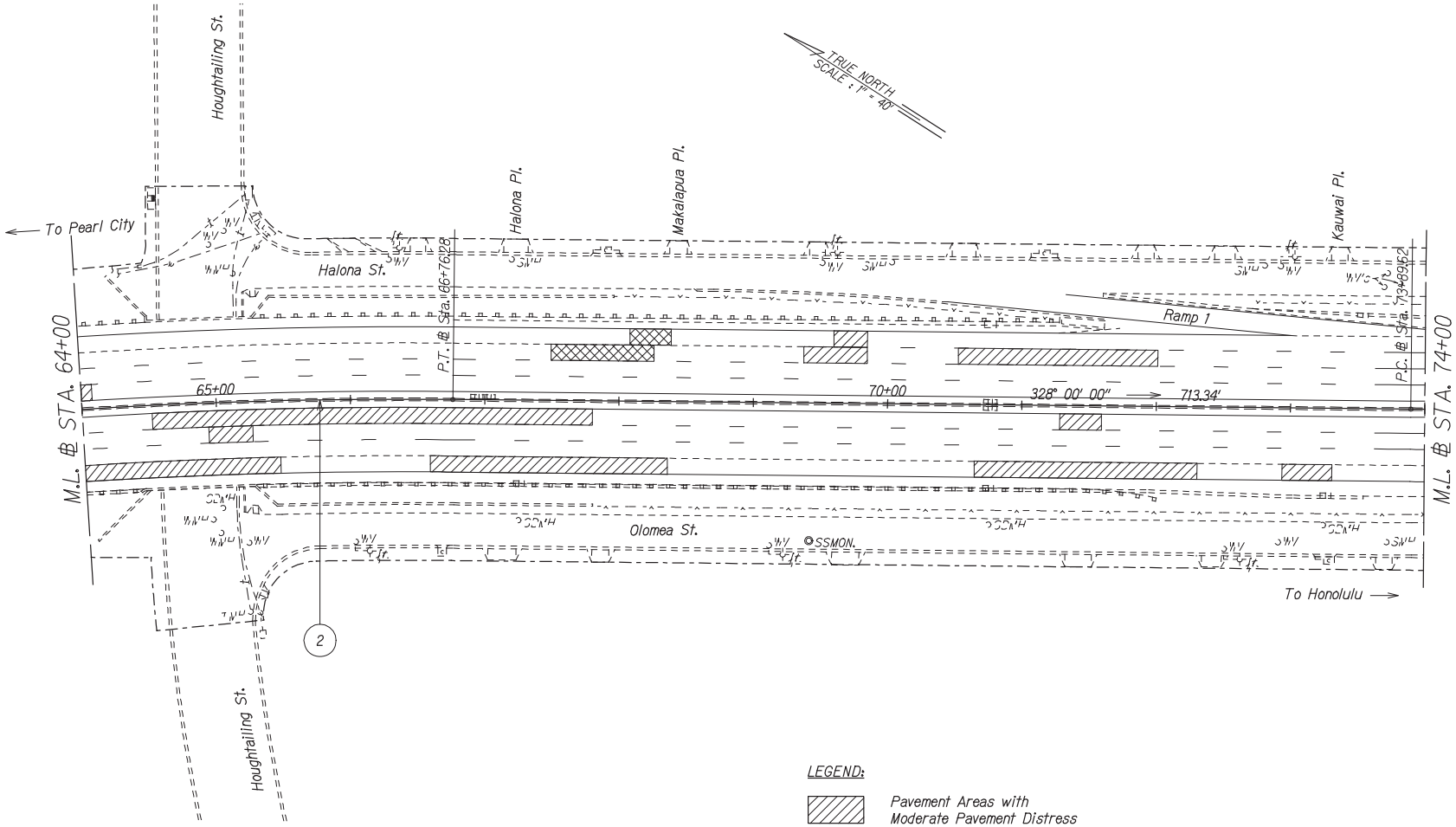

CURVE 2 DATA
H1-1

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T = 435.01'
C = 864.44'
Lc = 866.30'

LEGEND:

Pavement Areas with Moderate Pavement Distress

Pavement Areas with Severe Pavement Distress

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN - 3
STA. 64+00 TO STA. 74+00

INTERSTATE ROUTE H-1 RESURFACING
VICINITY OF LIKELIKE INTERCHANGE OT PUNCHBOWL STREET OFF-RAMP

Scale: 1"=40' Date: Sept. 2012

SHEET No. 3 OF 12 SHEETS

B3

GENERAL PLAN | SURVEY PLOTTED BY | DRAWN BY | TRACED BY | DESIGNED BY | NOTE BOOK | QUANTITIES BY | CHECKED BY | DATE | No.

J:/16459A IDIQ PAVMT PREVENTIVE MAINTENANCE/H1-LIKELIKE TO PUNCHBOWL/CADD/SHEETS/ROAD-03.dgn

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
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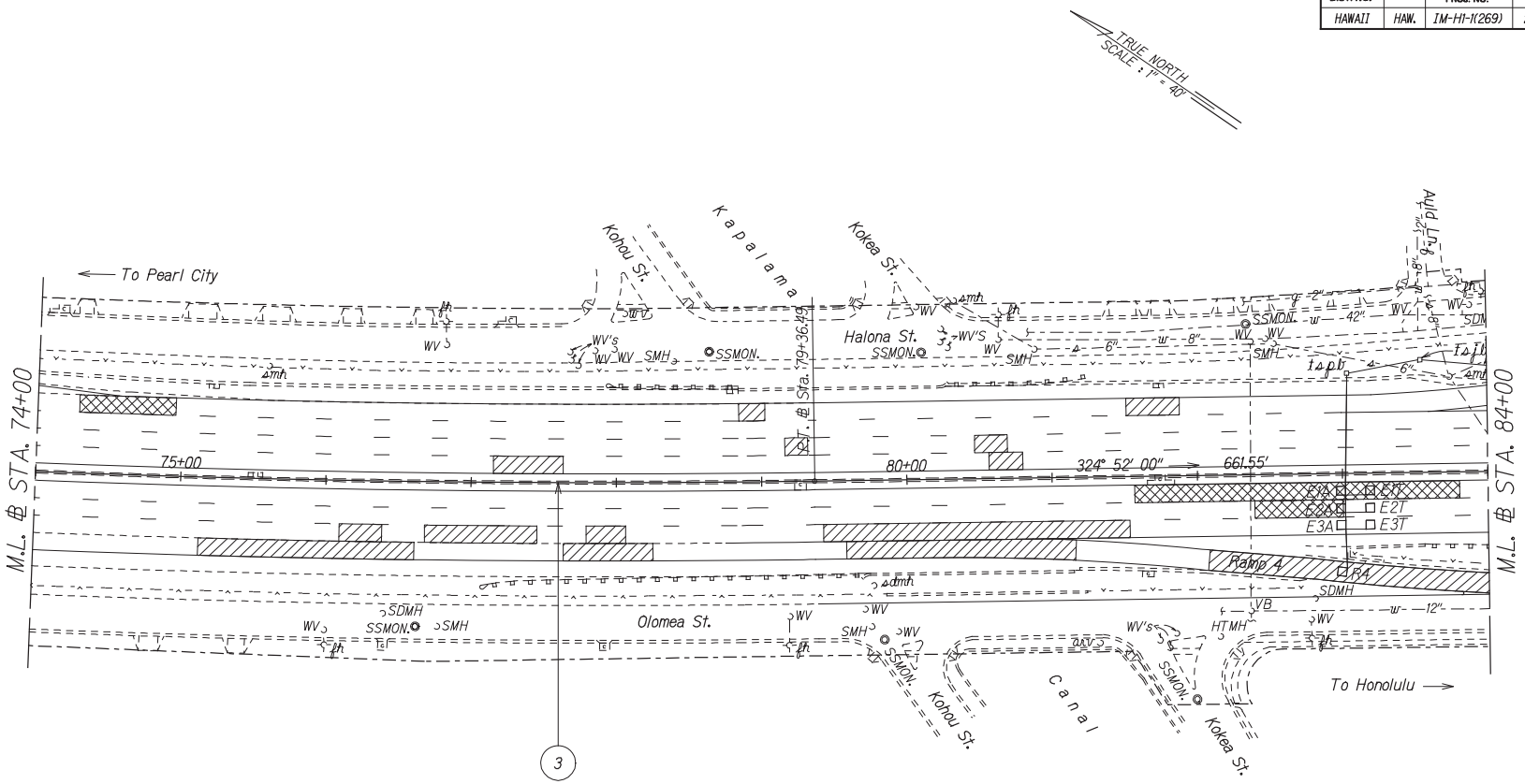

CURVE 3 DATA
H1-I

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T = 273.50'
C = 546.80'
Lc = 546.87'

LEGEND:

Pavement Areas with Moderate Pavement Distress

Pavement Areas with Severe Pavement Distress

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN - 4
STA. 74+00 TO STA. 84+00

INTERSTATE ROUTE H-1 RESURFACING
VICINITY OF LIKELIKE INTERCHANGE OT PUNCHBOWL STREET OFF-RAMP

Scale: 1"=40' Date: Sept. 2012

SHEET No. 4 OF 12 SHEETS

B4

GENERAL PLAN | SURVEY PLOTTED BY | PLAN BY | PLANS BY | NOTE BOOK | DESIGNED BY | REVIEWED BY | CHECKED BY | DATE

J:/16459A IDIQ PAVMT PREVENTIVE MAINTENANCE/H1-LIKELIKE TO PUNCHBOWL/CADD/SHEETS/ROAD04.dgn

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
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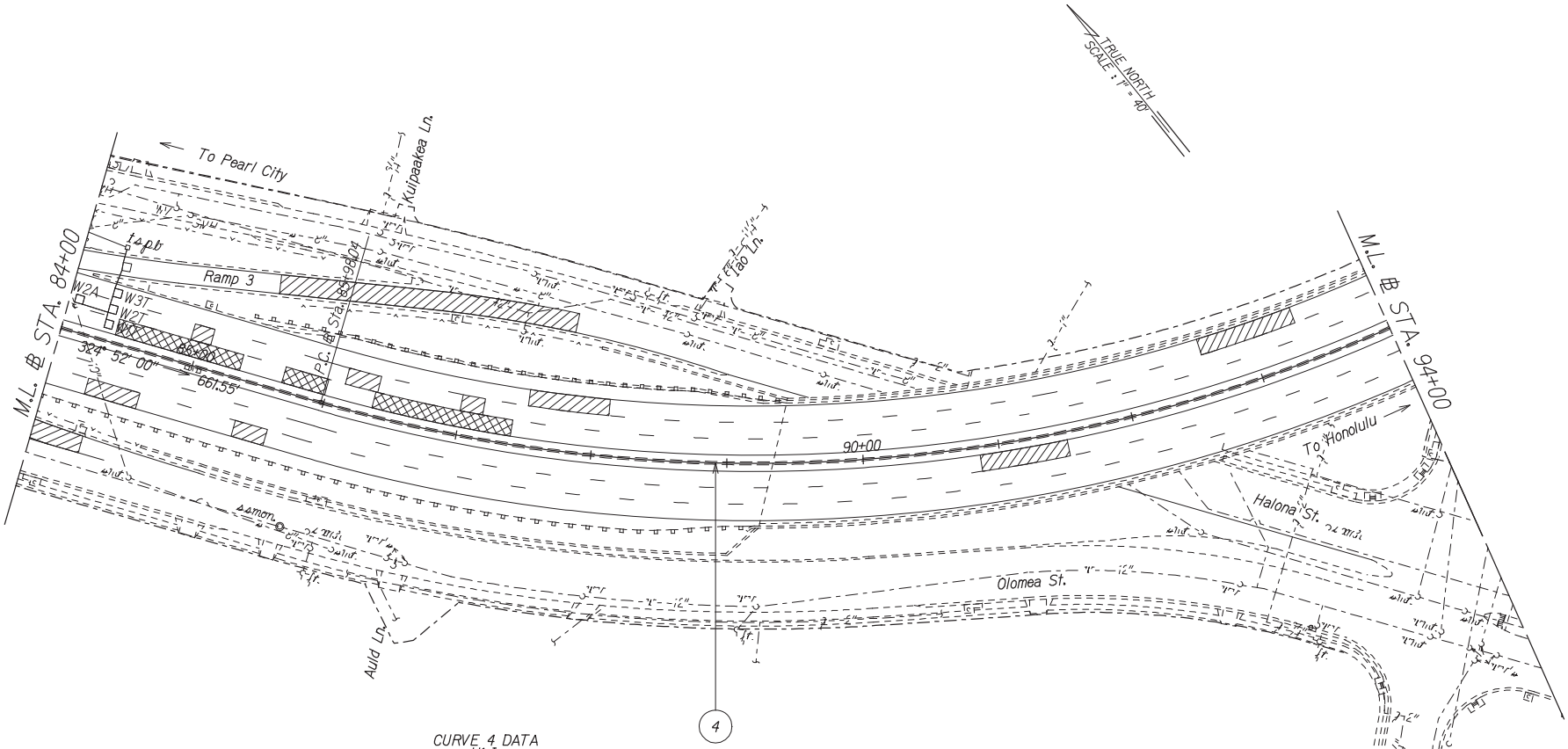

CURVE 4 DATA
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C = 877.05'
Lc = 900.00'

LEGEND:

Pavement Areas with Moderate Pavement Distress

Pavement Areas with Severe Pavement Distress

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN - 5
STA. 84+00 TO STA. 94+00

INTERSTATE ROUTE H-1 RESURFACING
VICINITY OF LIKELIKE INTERCHANGE OT PUNCHBOWL STREET OFF-RAMP

Scale: 1"=40' Date: Sept. 2012

SHEET No. 5 OF 12 SHEETS

B5

GENERAL PLAN	SURVEY PLOTTED BY	DATE
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	PLANS BY	
	NOTE BOOK	DESIGNED BY
		DRAWN BY
	No.	CHECKED BY

J:/16459A IDIQ PAVMT PREVENTIVE MAINTENANCE/H1-LIKELIKE TO PUNCHBOWL/CADD/SHEETS/ROAD-05.dgn

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
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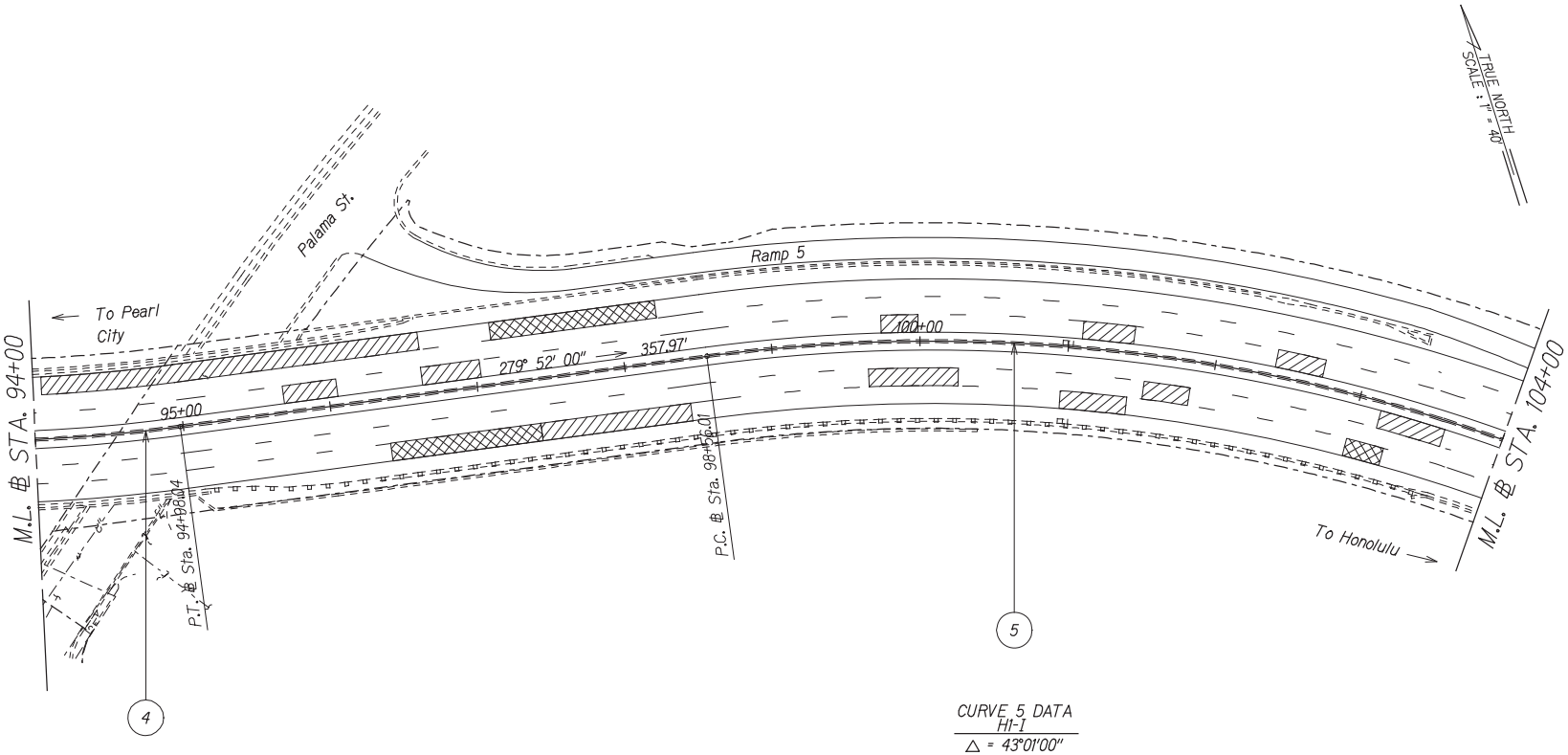

CURVE 4 DATA
H1-1

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T = 474.66'
C = 877.05'
Lc = 900.00'

CURVE 5 DATA
H1-1

△ = 43°01'00"
R = 1,145.92'
T = 451.58'
C = 840.27'
Lc = 860.33'

LEGEND:

Pavement Areas with Moderate Pavement Distress

Pavement Areas with Severe Pavement Distress

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN - 6
STA. 94+00 TO STA. 104+00

INTERSTATE ROUTE H-1 RESURFACING
VICINITY OF LIKELIKE INTERCHANGE OT PUNCHBOWL STREET OFF-RAMP

Scale: 1"=40' Date: Sept. 2012

SHEET No. 6 OF 12 SHEETS

B6

GENERAL PLAN | SURVEY PLOTTED BY | PLOTTED BY | PLANS BY | NOTE BOOK | DESIGNED BY | CALCULATED BY | CHECKED BY | DATE | No.

J:/16459A IDIQ PAVMT PREVENTIVE MAINTENANCE/H1-LIKELIKE TO PUNCHBOWL/CADD/SHEETS/ROAD-06.dgn

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
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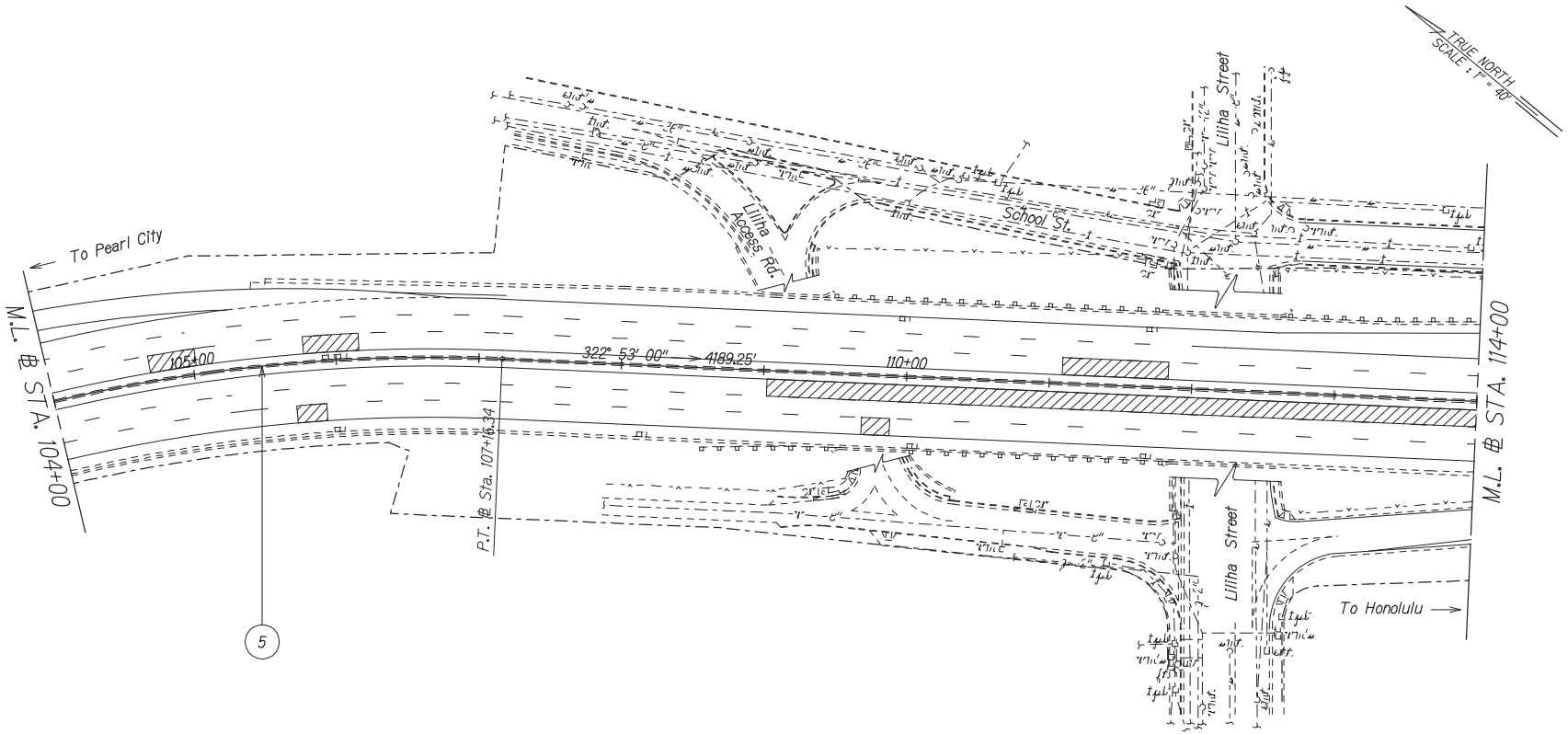

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H1-I

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R = 1,145.92'
T = 451.58'
C = 840.27'
Lc = 860.33'

LEGEND:

Pavement Areas with Moderate Pavement Distress

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN - 7
STA. 104+00 TO STA. 114+00

INTERSTATE ROUTE H-1 RESURFACING
VICINITY OF LIKELIKE INTERCHANGE OT PUNCHBOWL STREET OFF-RAMP

Scale: 1"=40' Date: Sept. 2012

SHEET No. 7 OF 12 SHEETS

B7

GENERAL PLAN
SURVEY PLOTTED BY
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NOTE BOOK
DESIGNED BY
QUANTITIES BY
CHECKED BY
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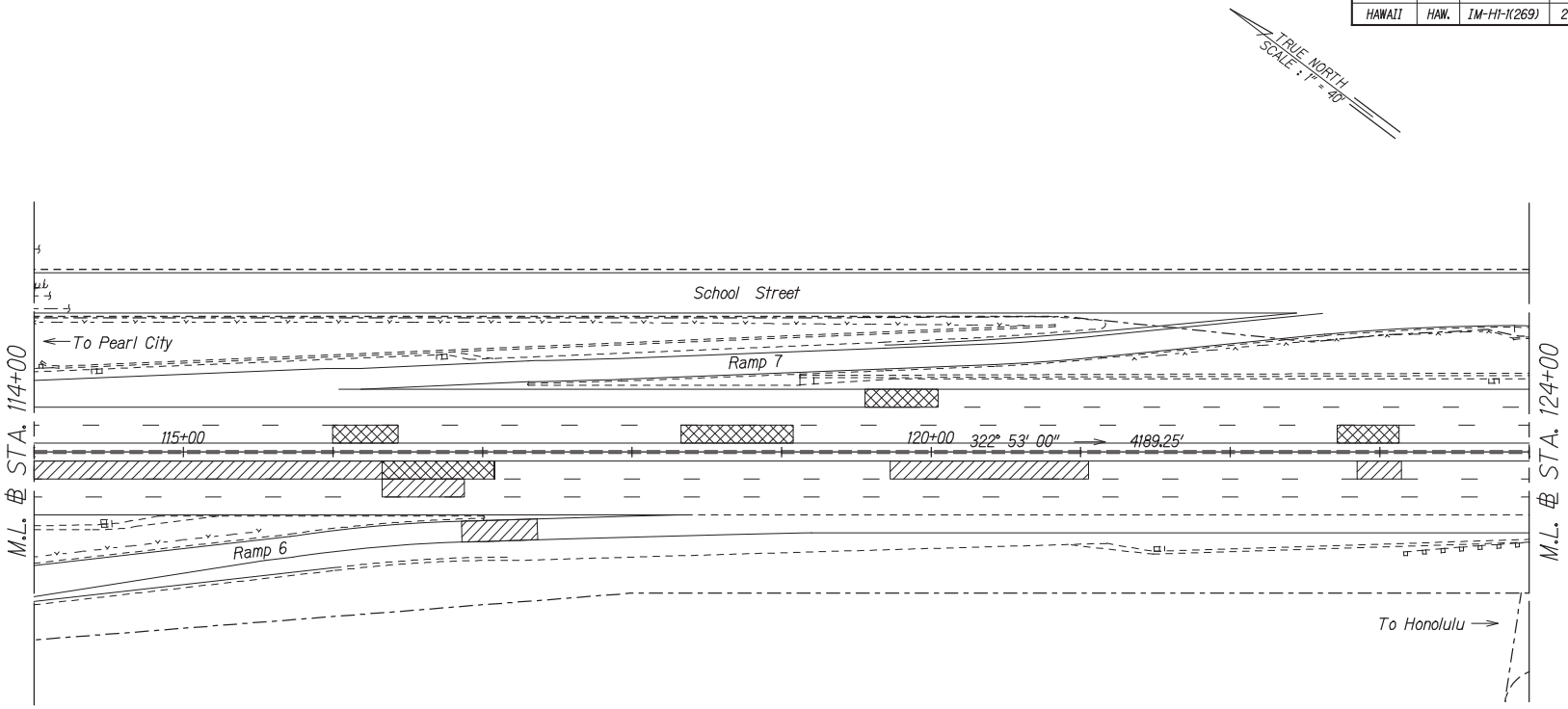
DATE

J:/16459A IDIQ PAVMT PREVENTIVE MAINTENANCE/H1-LIKELIKE TO PUNCHBOWL/CADD/SHEETS/ROAD-07.dgn

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	IM-H1-1(269)	2013	B8	12



LEGEND:

Pavement Areas with Moderate Pavement Distress

Pavement Areas with Severe Pavement Distress

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN - 8
STA. 114+00 TO STA. 124+00

INTERSTATE ROUTE H-1 RESURFACING
VICINITY OF LIKELIKE INTERCHANGE OT PUNCHBOWL STREET OFF-RAMP

Scale: 1"=40' Date: Sept. 2012

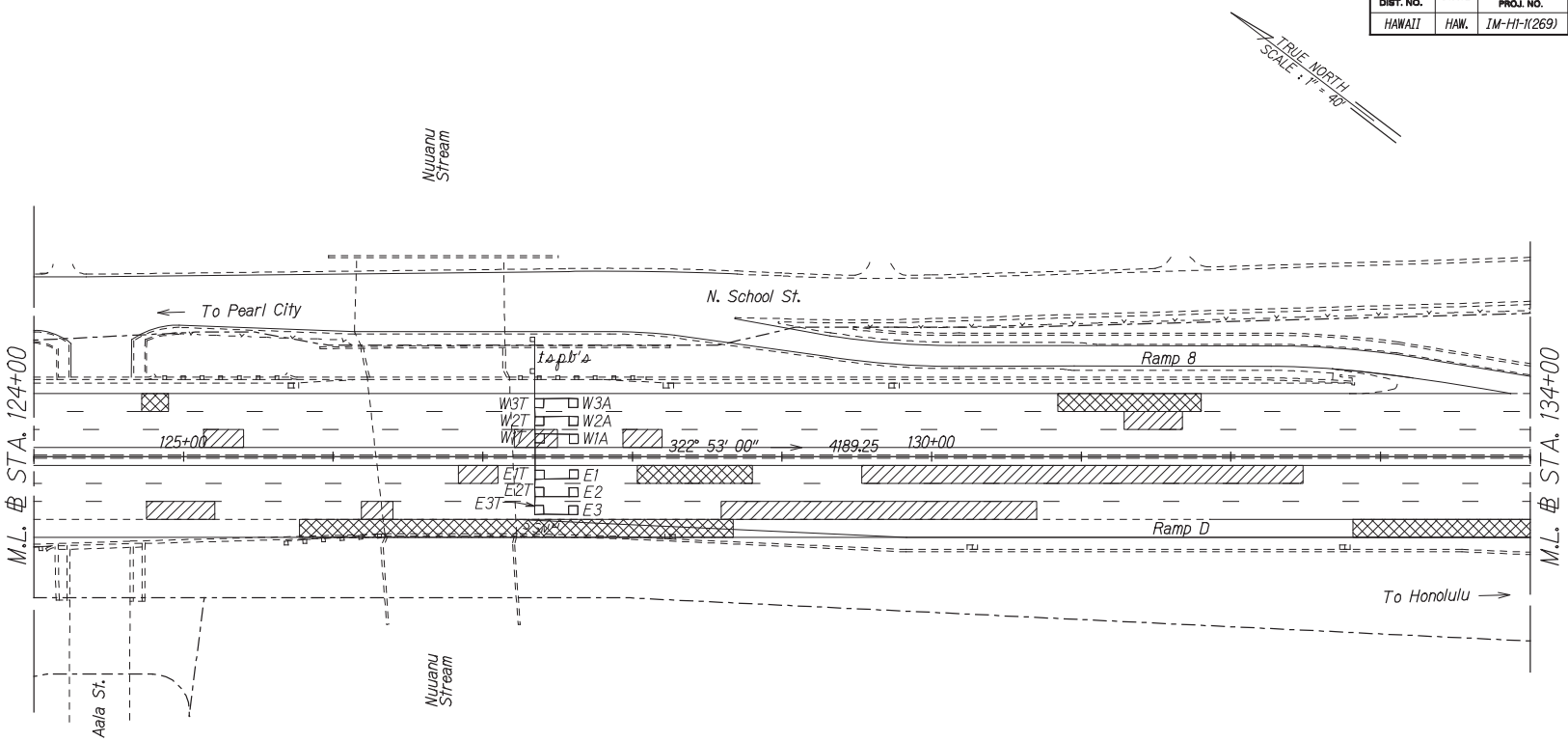
SHEET No. 8 OF 12 SHEETS

B8

GENERAL PLAN | SURVEY PLOTTED BY | PLOT BY | PLANS BY | NOTE BOOK | DESIGNED BY | CHECKED BY | DATE | No.

J:/16459A IDIQ PAVMT PREVENTIVE MAINTENANCE/H1-LIKELIKE TO PUNCHBOWL/CADD/SHEETS/ROAD-08.dgn

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	IM-H1-1(269)	2013	B9	12



LEGEND:

Pavement Areas with Moderate Pavement Distress

Pavement Areas with Severe Pavement Distress

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN - 9
STA. 124+00 TO STA. 134+00

INTERSTATE ROUTE H-1 RESURFACING
VICINITY OF LIKELIKE INTERCHANGE OT PUNCHBOWL STREET OFF-RAMP

Scale: 1"=40' Date: Sept. 2012

SHEET No. 9 OF 12 SHEETS

B9

GENERAL PLAN | SURVEY PLOTTED BY | PLAN BY | NOTE BOOK | DESIGNED BY | DRAWN BY | CHECKED BY | DATE

J:/16459A IDIQ PAVMT PREVENTIVE MAINTENANCE/H1-LIKELIKE TO PUNCHBOWL/CADD/SHEETS/ROAD-09.dgn

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
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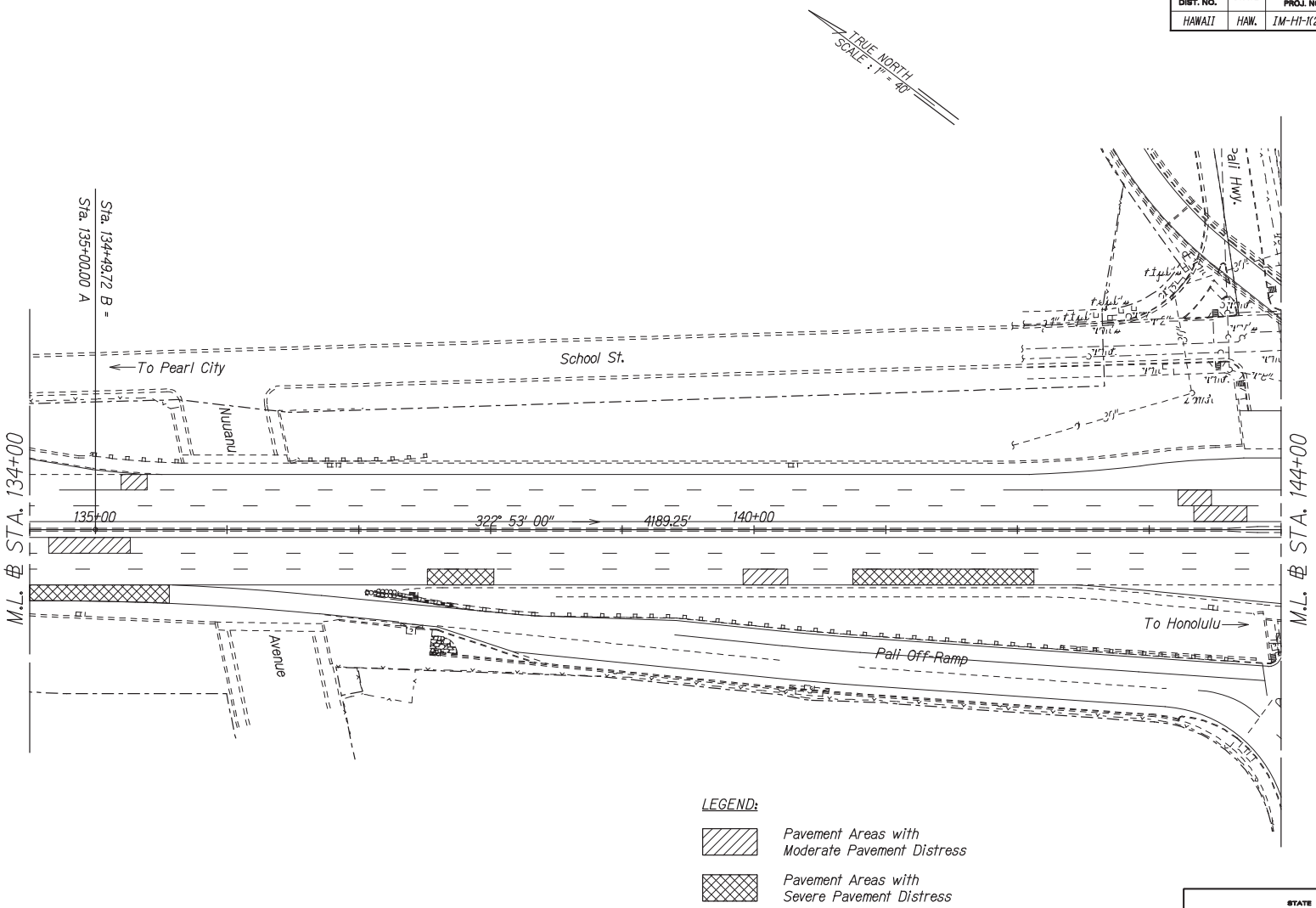


LEGEND:

Pavement Areas with Moderate Pavement Distress

Pavement Areas with Severe Pavement Distress

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN - 10
STA. 134+00 TO STA. 144+00

INTERSTATE ROUTE H-1 RESURFACING
VICINITY OF LIKELIKE INTERCHANGE OT PUNCHBOWL STREET OFF-RAMP

Scale: 1"=40' Date: Sept. 2012

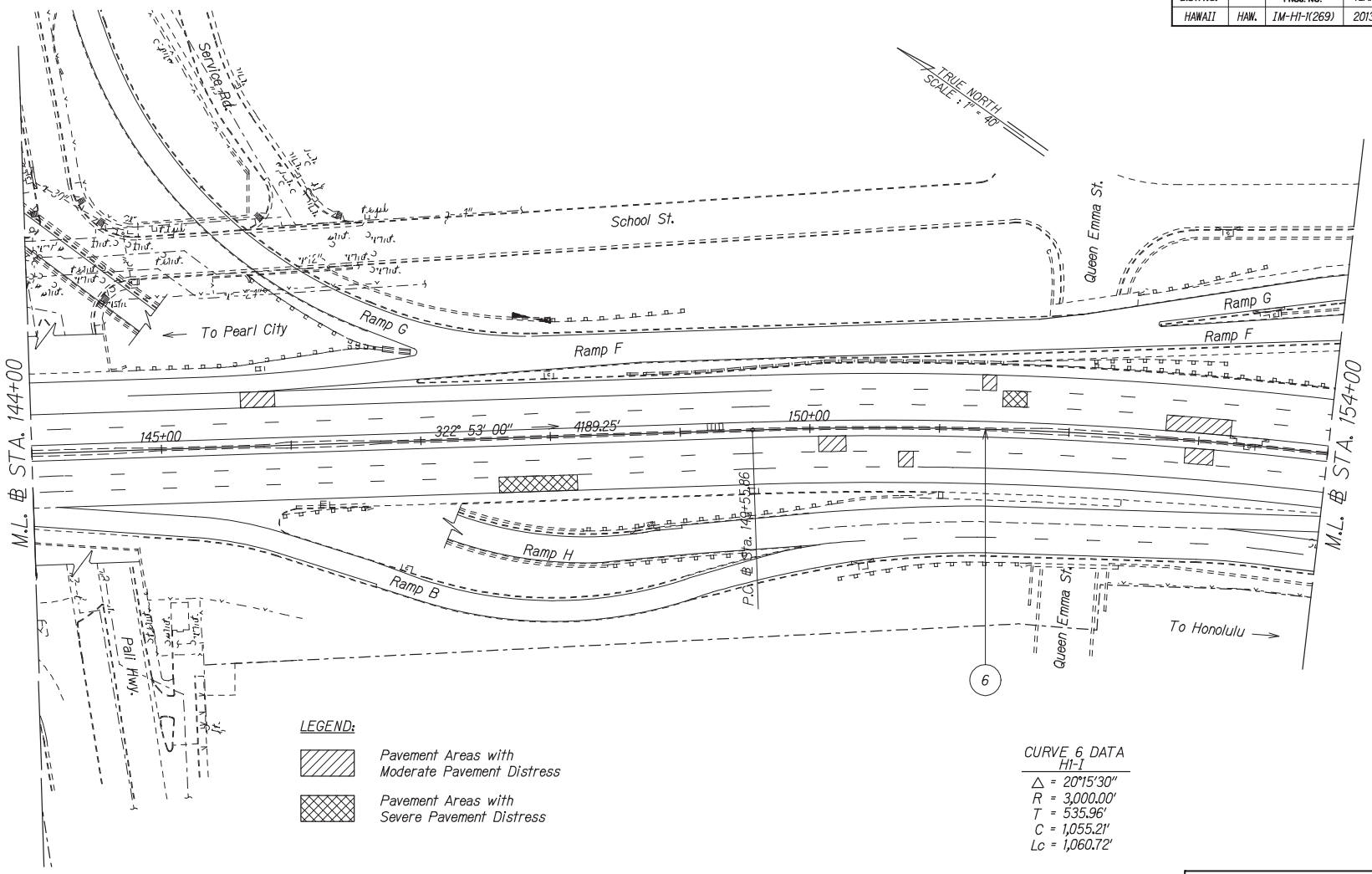
SHEET No. 10 OF 12 SHEETS

B10

GENERAL PLAN | SURVEY PLOTTED BY | PLAN PREPARED BY | NOTE BOOK | DESIGNED BY | CHECKED BY | DATE

J:/16459A IDIQ PAVMT PREVENTIVE MAINTENANCE/H1-LIKELIKE TO PUNCHBOWL/CADD/SHEETS/ROAD10.dgn

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	IM-H1-1(269)	2013	B11	12



LEGEND:

Pavement Areas with Moderate Pavement Distress

Pavement Areas with Severe Pavement Distress

CURVE 6 DATA
H1-I

Δ = 20°15'30"
R = 3,000.00'
T = 535.96'
C = 1,055.21'
Lc = 1,060.72'

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN - 11
STA. 144+00 TO STA. 154+00

INTERSTATE ROUTE H-1 RESURFACING
VICINITY OF LIKELIKE INTERCHANGE OT PUNCHBOWL STREET OFF-RAMP

Scale: 1"=40' Date: Sept. 2012

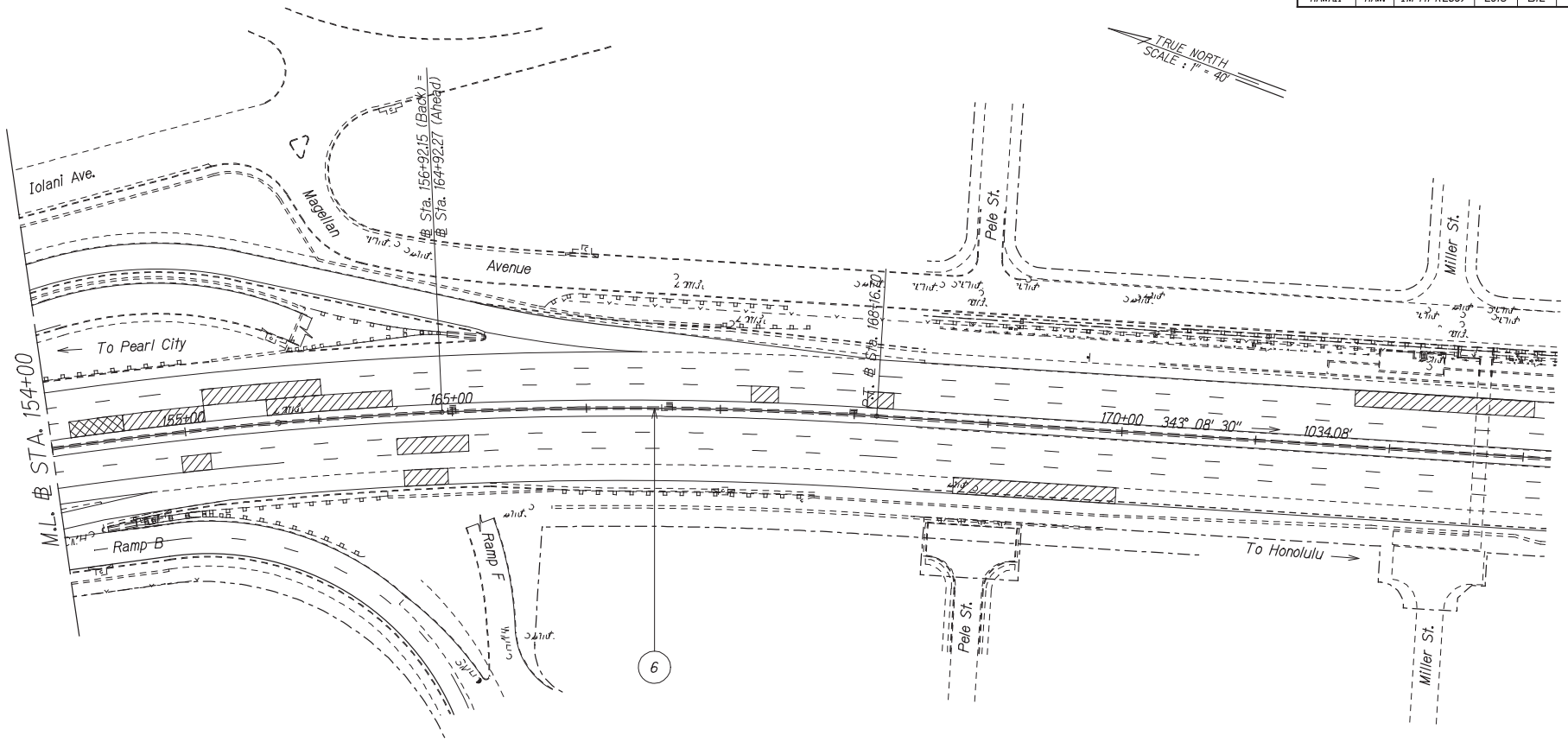
SHEET No. 11 OF 12 SHEETS

B11

GENERAL PLAN | SURVEY PLOTTED BY | PLOTTED BY | NOTE BOOK | DESIGNED BY | CHECKED BY | DATE | No.

J:/16459A IDIQ PAVMT PREVENTIVE MAINTENANCE/H1-LIKELIKE TO PUNCHBOWL/CADD/SHEETS/ROAD11.dgn

FED. ROAD DIST. NO.	STATE	FEDERAL AID PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
HAWAII	HAW.	IM-H1-1(269)	2013	B12	12



CURVE 6 DATA
H1-1

Δ = 20°15'30"
R = 3,000.00'
T = 535.96'
C = 1,055.21'
Lc = 1060.72'

LEGEND:

Pavement Areas with Moderate Pavement Distress

Pavement Areas with Severe Pavement Distress

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION

ROADWAY PLAN - 12
STA. 154+00 TO STA. 172+00

INTERSTATE ROUTE H-1 RESURFACING
VICINITY OF LIKELIKE INTERCHANGE OT PUNCHBOWL STREET OFF-RAMP

Scale: 1"=40' Date: Sept. 2012

SHEET No. 12 OF 12 SHEETS

B12

GENERAL PLAN | SURVEY PLOTTED BY | PLANS BY | NOTE BOOK | DESIGNED BY | CHECKED BY | DATE

J:/16459A IDIQ PAVMT PREVENTIVE MAINTENANCE/H1-LIKELIKE TO PUNCHBOWL/CADD/SHEETS/ROAD12.dgn

U.S. Department of Transportation
Federal Highway Administration

Hawaii Federal-Aid Division

300 Ala Moana Blvd, Rm 3-306
Box 50206
Honolulu, Hawaii 96850
Phone: (808) 541-2700
Fax: (808) 541-2704

October 22, 2012

In Reply Refer To:
HDA-HI

Ms. Linda Kaleo Paik
Aha Wahine
98-070 Lokowai Street
Aiea, Hawaii 96701

Subject: National Historic Preservation Act Section 106 Consultation
Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue
Traditional District of Kona, Oahu, Ahupuaa of Kalihi, Kapalama, and Honolulu
Federal Aid Project No. IM-H1-1(269)
TMK: [1] 1, 2

Dear Ms Paik:

The Federal Highway Administration (FHWA) would like to invite you to participate in consultation for the proposed State of Hawaii Department of Transportation (HDOT) rehabilitation project. The proposed project is utilizing federal funding and will be considered a federal action and undertaking, as defined by Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended (2006). Therefore, the FHWA will require compliance with the National Environmental Policy Act, NHPA, and other federal requirements. The FHWA has authorized the HDOT and its consultant, Parsons Brinckerhoff, to act on behalf of the FHWA regarding the NHPA Section 106 notification and consultation. We would like to invite you to participate in the Section 106 consultation for the proposed project in accordance with Title 36 of the *Code of Federal Regulations*, Section 800.3.

Overview of the Undertaking

The location of the project (Figure 1) is the Interstate Route H-1 freeway through downtown with the limits depending on whether the task being performed is related to rehabilitation of the pavement, or is other work. The project limits are Middle Street to Vicinity of Ward Avenue with paving and lighting having lesser limits as described below.

The planned undertaking includes the following general tasks:

- Pavement rehabilitation, including reconstruction and repaving, as necessary, from roughly Likelike Highway to Miller Street, including ramps.
- Replacement of highway lighting system from roughly Middle Street to Vineyard Boulevard On-Ramp.

- Restriping the roadway to generate four through lanes in both directions to the extent possible throughout the Project area.
- Widening the Nuuanu Stream Bridge roughly 5 feet on the makai (downstream) side in order to accommodate four through lanes and one exit lane in the Diamond Head-bound (east-bound) direction.
- Minor modifications to the storm drain system, primarily inlet modifications.
- Minor grading and structural improvements at select and discrete locations throughout the Project area.

The project does not involve any new areas being paved other than the widened portion of the Nuuanu Stream Bridge, and all work is within the existing highway right-of-way (ROW).

Area of Potential Effect

The area of potential effect (APE) for the project is proposed to be the ROW limits of the H-1 interstate freeway within the project area (Figure 1). The width of the ROW varies from 120 to 300 feet wide in the area. The project is roughly 3.4 miles long. The total APE is estimated to be 91 acres.

Historical, Cultural, and Archaeological Background

Reports available at the SHPD library provide detailed information concerning historical, cultural, and archaeological background. Those reports indicate that the area had, in pre-contact traditional Hawaiian times, an expansive network of irrigated taro fields with associated habitation sites that extended from Kou, the settlement area focused around present Honolulu Harbor. The taro fields, or loi, extended from near the shoreline, where fish ponds were present, through the project area, and to the foothills of the Koolau Mountains.

During the second half of the nineteenth century (1850 – 1900) the taro field loi were converted to rice fields, especially in the Kapalama ahupuaa. Urbanization of Honolulu ahupuaa, including Nuuanu Valley and the Thomas Square area, was occurring during this period as well. Many of today's main streets were present and western homes were being built. Chinatown was also being established during this time period and suffered a fire in 1900.

By the middle of the twentieth century (1950) most of the streets present today had been established and the entire area urbanized.

Interstate Route H-1 in the project area was built in the late 1950s and early 1960s. The construction of the interstate significantly changed the landscape in the project area. Since that time development in the area has continued, primarily as redevelopment of parcels to higher/more dense uses.

Information from other projects in the vicinity of the APE indicate that the last roughly 150 years of intensive development in the project area has altered and/or destroyed evidence of the pre-contact Native Hawaiian developments, such as the loi and related habitations. Archaeological monitoring has been performed for utility and roadway projects nearby Interstate Route H-1 and

the projects have encountered modern and historic debris and artifacts such as glass bottles, ceramics, and metallic items. However, reports associated with those monitoring efforts indicate that no significant cultural resources have been encountered. Human burials have been discovered during development in the Kapalama, Downtown, and Nuuanu Valley areas; however, these discoveries were determined to be post-contact burials.

Summary of Archaeological Sites within the APE

The primary structure in the APE is the Interstate Route H-1. In the project area, Interstate Route H-1 was built in the late 1950s to early 1960s; therefore, it is over 50 years old. The Advisory Council on Historic Preservation adopted the "Section 106 Exemption Regarding Effects to the Interstate Highway System" on March 10, 2005. The exemption states that all components of the interstate highway system, which includes Interstate Route H-1, are not to be considered eligible for the National Registry, except for a select list of interstate highway system facilities. Interstate Route H-1 is not on the "Final List of Nationally and Exceptionally Significant Features of the Federal Interstate Highway System," the select list of interstate highway system facilities that can be considered eligible for the National Registry once they are 50 years old. Therefore, features of Interstate Route H-1 older than 50 years old in the APE are exempt from consideration as historic properties.

The only other known potentially historic properties within the APE are structures related to the streams crossed by Interstate Route H-1 in the project area. Nuuanu Stream, Kapalama Canal, and Kalihi Stream are channelized where H-1 crosses them and the channel sidewalls are composed of quarried lava rock and mortar (Figure 2). These stream sidewalls generally extend a relatively short distance upstream from Interstate Route H-1, but extend a significant distance downstream. Where Interstate Route H-1 crosses the streams, the lava rock and mortar stream sidewalls have been replaced by concrete bridge abutments. The exact age of the lava rock and mortar sidewalls is unknown, but they do appear in photographs dating to the Chinatown fire in 1900, indicating that at least the Nuuanu Stream sidewalls are more than 110 years old.

Related to archaeological resources and the potential for subsurface finds, similar conditions to those encountered by recent nearby projects are predicted in the project area as described in the previous section. Based on review of historical records, archaeological monitoring performed for utility and roadway projects nearby Interstate Route H-1, photographs, and viewing the APE from Interstate Route H-1 and parallel city streets, no archaeological resources are present within the APE except the stream sidewall rock walls described above.

Consultations

A Section 106 newspaper notice/advertisement will be included in the Star-Advertiser and *Ka Wai Ola* (Office of Hawaiian Affairs publication). Native Hawaiian Organizations and Native Hawaiian descendants with ancestral lineal or cultural ties to, cultural knowledge or concerns for, and cultural or religious attachment to the proposed project area are asked to provide a response within 30 days of notification.

Section 106 consultation letters have also been sent to the other organizations or individuals that might attach significance to this area and we invited them to participate in the process.

Public meetings will also be held during the course of the project to collect comments from the public.

All initial consultations also invite the consulted parties to identify others that might have knowledge of and interest in the project area so that they may participate in the consultation process.

Mitigation Policies

Mitigation measures during the construction of the proposed undertaking will be implemented to minimize and avoid potential impacts to archaeological, cultural, and historic resources. Although the Section 106 process has not been completed and additional mitigation measures may be identified through the process, the following mitigation measures will be implemented at a minimum:

- If cultural materials are discovered during construction, all earth-moving activity within and around the immediate discovery area will be diverted until a qualified archaeologist can assess the nature and significance of the find.
- If human remains are discovered, Hawaii Administrative Rules Title 13. Subtitle 13, Chapter 300 states that all activities shall cease in the immediate area of the human skeletal remains, that appropriate action to protect the integrity and character of the burial site from damage is undertaken, and SHPD and Police Department will be contacted. The appropriate process would then proceed in conformance with Hawaii Administrative Rules §13-300 Subchapter 4 "Procedures for Proper Treatment of Burial Sites and Human Skeletal Remains."

HDOT and FHWA will prevent the disturbance or taking of any historic property or resource to the extent possible by instituting these mitigation measures and enforcing their implementation by contractors.

Request for Response

We welcome any comments you might have on the project's proposed improvements. We're particularly interested in any information you may have on the historic and cultural sites that have been recorded in the area or any other historic or cultural sites about which you may have knowledge. In addition, if you are acquainted with any persons or organization that is knowledgeable about the proposed project area, or any descendants with ancestral lineal or cultural ties to or cultural knowledge or concerns for, and cultural or religious attachment to the proposed project area, we would appreciate receiving their names and contact information.

We would appreciate a written response within 30 days from date of receipt, to me (Roy Siegel, FHWA Transportation Engineer), via email at Roy.Siegel@dot.gov, or by US Postal Service to Attn: Roy Siegel, FHWA, 300 Ala Moana Boulevard, Room 3-306, Box 50206, Honolulu, Hawaii 96850.

Please feel free to contact me by telephone at (808) 541-2314 if you have any questions. We look forward to working with you and the SHPD on these needed improvements.

Sincerely yours,

Roy Siegel, P. E.
Transportation Engineer

Enclosure:

Figure 1 – Project Location
Figure 2 – Photograph, Nuuanu Stream Bridge Makai-Ewa Corner

cc: Jim Hayes (Parsons Brinckerhoff) (without attachments)
DIR (HDOT) (without attachments)
HWY-DD (RH) (HDOT) (without attachments)
HWY-DE (HDOT) (without attachments)

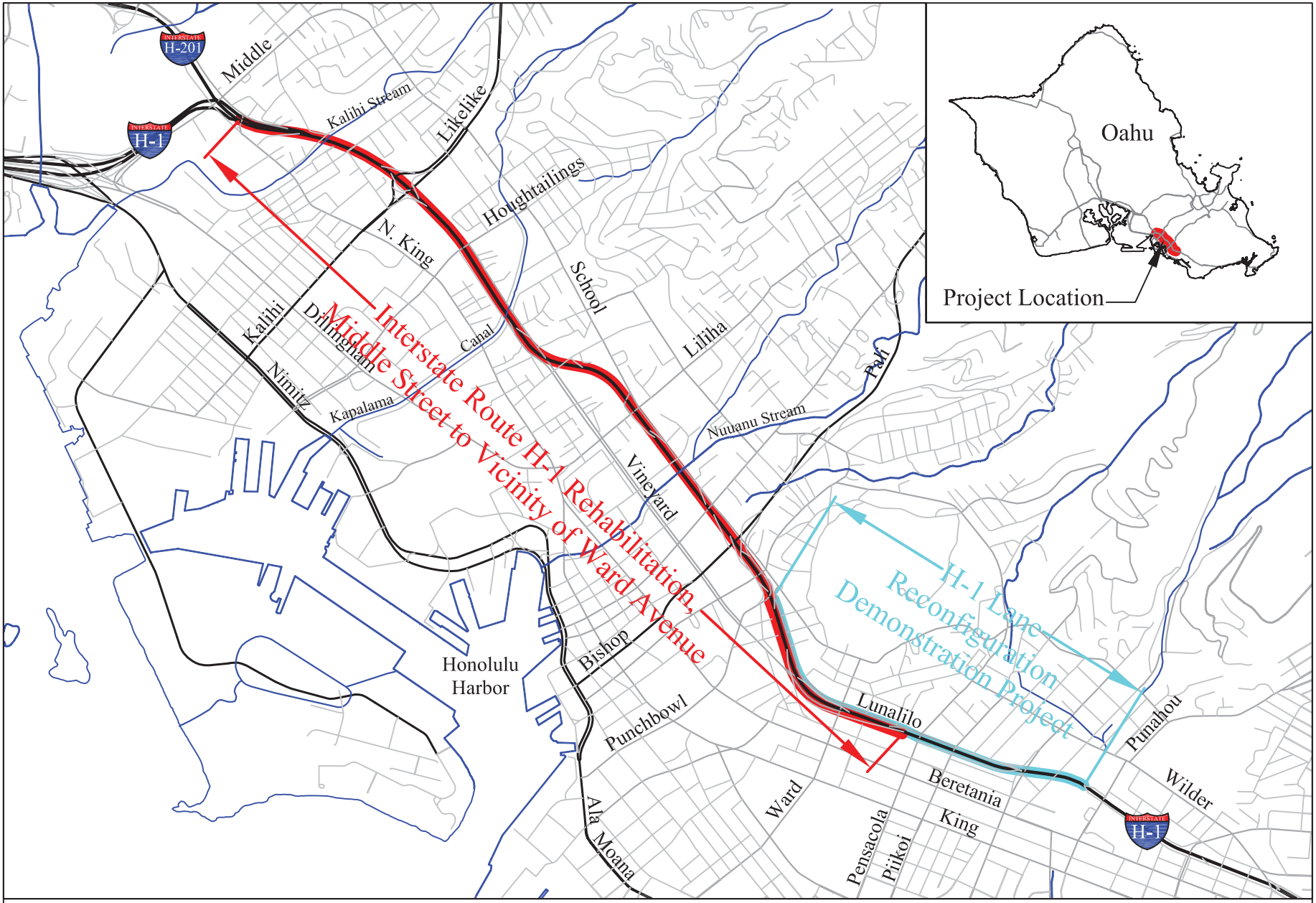


Figure 1: Project Location

Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue
State of Hawaii Department of Transportation, Highways Division

Figure 2: Photograph, Nuuanu Stream Bridge Makai-Ewa Corner
Photograph shows lava rock and mortar stream sidewall in area. Bridge widening has not been thoroughly designed yet; it is likely that the widening will extent to roughly the far side of the drain pipe and the drain pipe will be realigned to be beyond the bridge.

The preceding letter was also sent to the following organizations and individuals:

- Aha Wahine
- Association of Hawaiian Civic Clubs
- Brian Kaniela Naeole Naauao
- Council for Native Hawaiian Advancement
- Friends of Iolani Palace
- Hawaii Maoli
- Hawaiian Civic Club of Honolulu
- Historic Hawaii Foundation
- Hui Hooniho
- Hui Huliau
- Hui Malama I Na Kūpuna O Hawaii Nei
- Kalihi-Palama Hawaiian Civic Club
- Koolau Foundation
- Maluohai Residents Association
- Native Hawaiian Church
- Oahu Island Burial Council
- Office of Hawaiian Affairs (OHA)
- Pacific Justice and Reconciliation Center
- Papakōlea Community Development Corporation
- The I Mua Group

Date: 10/31/2012 10:14 PM
Subject: Section 106 Consultation, Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue

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As Native Hawaiian Organizations (NHO) recognized by the NAGPRA process and native Hawaiian State recognized descendants with ancestral lineal and cultural ties with cultural knowledge and concerns for and cultural and religious attachment to the area(s) of the proposed subject, the NHO 'Ohana Keaweamahi, NHO 'Ohana Medeiros, NHO 'Ohana Kapu, Paulette Ka'anohiokalani Kaleikini request to be consulted and participate in discussions regarding the subject undertaking.

Mahalo,
Paulette K. Kaleikini

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ESTHER KIA'AINA
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

HISTORIC PRESERVATION DIVISION
DEPARTMENT OF LAND AND NATURAL RESOURCES

601 Kamokila Boulevard, Suite 555
Kapolei, HI 96806

December 3, 2012

Mr. Roy Siegel, FHWA Transportation Engineer
US Department of Transportation
Federal Highway Administration
Hawaii Federal-Aid Division
300 Ala Moana Blvd., Rm 3-306, Box 50206
Honolulu, Hawaii 96850
Roy.Siegel@dot.gov

LOG NO: 2012.2726
DOC. NO: 1212SL04
Archaeology
Architecture

Dear Mr. Siegel:

SUBJECT: Chapter 6E-8 and National Historic Preservation Act (NHPA) Section 106 Consultation– Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue Kalihi, Kapalama, and Honolulu Ahupua'a, Kona District, Island of O'ahu Federal Aid Project No. IM-HI-1(269) TMK: (1) 1 and TMK: (1) 2

Thank you for the opportunity to respond to your Section 106 Consultation submittal which our office received on September 18, 2012, with revisions received on October 31, 2012; we apologize for the delay and thank you for your patience. The submittal letter indicates that the proposed State of Hawaii Department of Transportation (HDOT) rehabilitation project is utilizing federal funding and therefore the project is considered a federal action and undertaking as defined by Section 106 of NHPA of 1966, as amended (2006). The FHWA has authorized the HDOT and its consultant, Parsons Brinckerhoff, to act on behalf of the FHWA regarding the NHPA Section 106 notification and consultation.

The project area of potential effect (APE) is a roughly 3.4-mile long section of the Interstate Route H-1 freeway, extending from Middle Street to the Vicinity of Ward Avenue. All work is within the existing highway right-of-way (ROW) which varies in width from 120 to 300 feet. The total APE is about 91 acres and the proposed work, which varies in location, includes pavement rehabilitation; replacement of highway lighting; restriping; minor modifications to storm drains, mainly inlets; and minor grading and structural improvements. In addition, the Nuuanu Stream Bridge will be widened about five feet on the *makai* (downstream) side in order to accommodate four through lanes and one exit lane in the Diamond Head (east) bound direction.

Archaeology

No historic properties have been identified within the APE, which occurs entirely within the limits of the highway right-of-way. SHPD concurs with FWHA's assessment of no archaeological resources within the APE based on (1) a review of historical records, archaeological monitoring conducted for nearby utility and roadway projects, and (2) subsurface disturbance related to the construction of the highway and associated infrastructure. Based on these findings, we believe **no historic properties will be affected** by the undertaking.

FWHA specifies the following mitigation measures will be implemented:

- If cultural materials (deposits and/or artifacts) are discovered during construction, all earth-moving activity within and around the immediate discovery area will be diverted until a qualified archaeologist can assess the nature and significance of the find; and

- If human remains are discovered, Hawaii Administrative Rules (HAR) §13-300 will be complied with. This includes the halting of all activities in the immediate area of the human skeletal remains, taking appropriate

action to protect the integrity and character of the find from damage, and contacting the Honolulu Police Department and the State Historic Preservation Division. Subsequent procedures will proceed in conformance with HAR §13-300-4 "Procedures for Proper Treatment of Burial Sites and Human Skeletal Remains."

Please contact Susan A. Lebo at (808) 692-8019 or Susan.A.Lebo@hawaii.gov if you have any questions or concerns regarding the archaeological resources.

Architecture

Surface architectural resources within the APE consist of the quarried basalt rock and mortared walls lining the channels of Nuuanu Stream, Kapalama Canal, and Kalihi Stream. The widening of the Nuuanu Stream Bridge will affect a 5-foot or greater *mauka* portion of the basalt mortared walls on either side of the channel on the downstream (*makai*) side of the bridge. These walls pre-date the Chinatown fire of 1900, making them more than 110 years old. The walls were constructed to channelize Nuuanu Stream in order to flush it of suspended waste materials during periodic heavy rains, to facilitate drainage of the lowlands behind town, and to create improved building sites. The walls are, however, exempt from consideration as historic properties based on the Advisory Council on Historic Preservation's adoption of the "Section 106 Exemption Regarding Effects to the Interstate Highway System" on March 10, 2005. Interstate Route H-1 is not on the Federal list of interstate highways that can be considered eligible for the National Register once they reach 50 years old.

SHPD requests a written and photographic history of this wall system be produced as part of the project and that any historic basalt rocks removed from the walls during the freeway widening be recycled for incorporation into other projects.

Please contact Ross W. Stephenson at (808) 692-8028 or at Ross.W.Stephenson@hawaii.gov if you have any questions or concerns regarding this letter.

Aloha,

Theresa K. Donham
Archaeology Branch Chief

cc: Ross Stephenson, Architecture Branch (Ross.W.Stephenson@hawaii.gov)

From: Hayes, James (Honolulu)
Sent: Friday, December 07, 2012 3:34 PM
To: 'pkaleikini@hawaii.rr.com'; 'kahunaiwi@yahoo.com'; 'JRKeoneakapu@gmail.com'
Cc: 'roy.siegel@dot.gov'; 'Ross Hironaka (ross.hironaka@hawaii.gov)'
Subject: Section 106 Consultation - Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue
Attachments: Fig1-UndertakingLocation-H1RehabMtoW.pdf

Dear NHO ʻOhana Keaweamahi, NHO ʻOhana Medeiros, and NHO ʻOhana Kapu:

Thank you for your request to be included in the Section 106 consultation process for the proposed State of Hawaiʻi Department of Transportation, Highways Division (HDOT) "Interstate Route H-1 Rehabilitation, Middle Street to the vicinity of Ward Avenue" undertaking. The Federal Highway Administration (FHWA) has authorized HDOT and its consultant, Parsons Brinckerhoff, to act on its behalf during Section 106 consultation regarding this undertaking. We would like to provide you with additional information for the proposed project, and request your assistance in expanding our understanding of the historical, cultural, and archaeological context of the area.

Overview of the Undertaking

The location of the proposed project (see attached Figure 1) is Interstate Route H-1 from Middle Street to the Vicinity of Ward Avenue. The planned undertaking includes the following general tasks:

- Pavement rehabilitation using one of two levels of treatment – rehabilitation or repaving – as necessary, from roughly Likelike Highway to Miller Street, including on and off ramps.
- Replacing the highway lighting system from roughly Middle Street to Vineyard Boulevard Diamond Head-bound (east-bound) on-ramp.
- Restriping the interstate to generate four through lanes in both directions to the extent possible throughout the project area.
- Installing a concrete glare screen on the median barrier from roughly Likelike Highway to Miller Street.
- Widening the Nuʻuanu Stream Bridge roughly 5 feet on the makai (downstream) side in order to accommodate four through lanes and one auxiliary (exit) lane in the Diamond Head-bound (east-bound) direction.
- Making minor modifications to support the fourth through lane, including storm drain, grade, and structural component modifications at select and discrete locations throughout the project area.

It has been our goal to complete all these activities within the existing Interstate Route H-1 right-of-way. However, as the design has progressed it has become apparent that very limited new right-of-way may be needed and/or construction easements obtained in order to replace some of the highway lighting.

Area of Potential Effect

The area of potential effect (APE) for the project is proposed to be the entire right-of-way of Interstate Route H-1 in the undertaking area plus any new right-of-way acquired and any construction easement areas. The width of the existing Interstate Route H-1 right-of-way varies from 120 to 300 feet wide in the undertaking area. The undertaking is roughly 3.5 miles long. The total APE is estimated to be 91 acres.

Identified Potential Historic Properties

The undertaking crosses through three Ahupuaʻa: Kalihi, Kapālama, and Honolulu.

Information from other projects in the vicinity of the APE indicate that the last roughly 150 years of intensive development in the project area has altered and/or destroyed evidence of the pre-contact Native Hawaiian developments, such as the loi and related habitations. Archaeological monitoring has been performed for utility and roadway projects nearby Interstate Route H-1 and has encountered modern and historic debris and artifacts such as glass bottles, ceramics, and metallic items. However, reports associated with those monitoring efforts indicate that no significant cultural resources have been encountered. Separate from those monitoring efforts, human remains have been discovered during development of parcels in the Kapālama, Downtown, and Nuʻuanu Valley areas; however, these discoveries were determined to be post-contact burials. Related to archaeological resources and the potential for subsurface finds, similar conditions to those encountered by recent nearby projects are predicted in the proposed project area.

Based on the review of photographs and viewing the APE from Interstate Route H-1 and parallel city streets, no surface archaeological resources are believed to be present within the APE.

The primary structure in the APE is Interstate Route H-1. In the proposed project area Interstate Route H-1 was built in the late 1950s to early 1960s; therefore, it is over 50 years old. The Advisory Council on Historic Preservation adopted the "Section 106 Exemption Regarding Effects to the Interstate Highway System" on March 10, 2005. The exemption states that all components of the interstate highway system, which includes Interstate Route H-1, are not to be considered eligible for the National Registry, except for a select list of interstate highway system facilities. Interstate Route H-1 is not on the "Final List of Nationally and Exceptionally Significant Features of the Federal Interstate Highway System," the select list of interstate highway system facilities that can be considered eligible for the National Registry once they are 50 years old. Therefore, features of Interstate Route H-1 are exempt from consideration for listing on the National Register.

Portions of the sidewalls of the three streams crossed by the undertaking are within the APE and potentially eligible for listing on the National Register. Nuʻuanu Stream, Kapālama Canal, and Kalihi Stream are channelized where Interstate Route H-1 crosses them and the channel sidewalls are composed of quarried lava rock and mortar. These stream sidewalls generally extend a relatively short distance upstream from Interstate Route H-1, but extend a significant distance downstream. Where Interstate Route H-1 crosses the streams, the lava rock and mortar stream sidewalls were replaced by concrete bridge abutments. The exact age of the lava rock and mortar sidewalls is unknown, but they do appear in photographs dating to the Chinatown fire in 1900, indicating that at least the Nuʻuanu Stream sidewalls are more than 110 years old.

Due to the potential need for construction easements and/or very small right-of-way acquisitions, very small portions of the following properties are currently within the APE:

- Bishop Museum Complex (TMK 1-6-024:001) is on both the Hawaiʻi Register and the National Register (SIHP site number 80-14-1353).
- Farrington High School (TMK 1-6-021:005) is on the Hawaiʻi Registry (SIHP site number 80-14-9768).

Only very small portions of these parcels nearest Interstate Route H-1 are within the APE. No known archaeological resources or historic structures on these two properties are within the APE.

Consultations

In addition to the newspaper notice/advertisement, Section 106 consultation letters were sent to organizations that might attach significance to this area and invite them to participate in the process.

Those receiving this email are the only groups that responded to the notice/advertisement or letters.

Mitigation Policies

Mitigation measures during the construction of the proposed undertaking would be implemented to minimize and avoid potential impacts to archaeological, cultural, and historic resources. Although the Section 106 process has not been completed and additional mitigation measures may be identified through the process, the following mitigation measures would be implemented at a minimum:

- Where possible, the lava rock and mortar for Nu‘uanu Stream’s sidewall would be rebuilt where removed during construction activities. Some portion of the wall would be removed to allow for bridge widening and storm drain relocation. The removed rocks would be set aside for wall restoration following construction.
- If cultural materials are discovered during construction, all earth-moving activity within and around the immediate discovery area will be diverted until a qualified archaeologist can assess the nature and significance of the find.
- If human remains are discovered, Hawaii Administrative Rules Title 13. Subtitle 13, Chapter 300 states that further disturbances and activities shall cease in any area or nearby area suspected to overlie remains, and SHPD and Police Department will be contacted. The appropriate process would then proceed in conformance with Hawaii Administrative Rules §13-300 Subchapter 4 “Procedures for Proper Treatment of Burial Sites and Human Skeletal Remains.”

HDOT and FHWA would prevent the disturbance or taking of any historic property or resource to the extent possible by instituting these mitigation measures and enforcing their implementation by contractors.

Request for Response

We welcome any comments you might have on the proposed undertaking. We are particularly interested in any information you may have on the historic and cultural sites in the area which you may have knowledge. In addition, if you are acquainted with any persons or organizations that are knowledgeable about the proposed project area, or any descendants with ancestral lineal or cultural ties to or cultural knowledge or concerns for, and cultural or religious attachment to the proposed project area, we would appreciate receiving their names and contact information.

We would appreciate a written response within 30 days from date of receipt, either in reply to this email or to Mr. Roy Siegel, FHWA Transportation Engineer, via email at roy.siegel@dot.gov, or by US Postal Service to Attn: Roy Siegel, FHWA, 300 Ala Moana Boulevard, Room 3-306, Box 50206, Honolulu, Hawaii 96850.

If you feel that a meeting would be beneficial, please contact me by replying to this email or calling 566-2239. We would happy to schedule a meeting with you and any other interested parties.

Have a good day,

Jim Hayes
Sr. Supervising Planner
Parsons Brinckerhoff
1001 Bishop Street, Suite 2400
Honolulu, Hawaii 96813
O: 808-566-2239; F: 808-528-2368; C: 808-354-4553
E: hayesja@pbworld.com

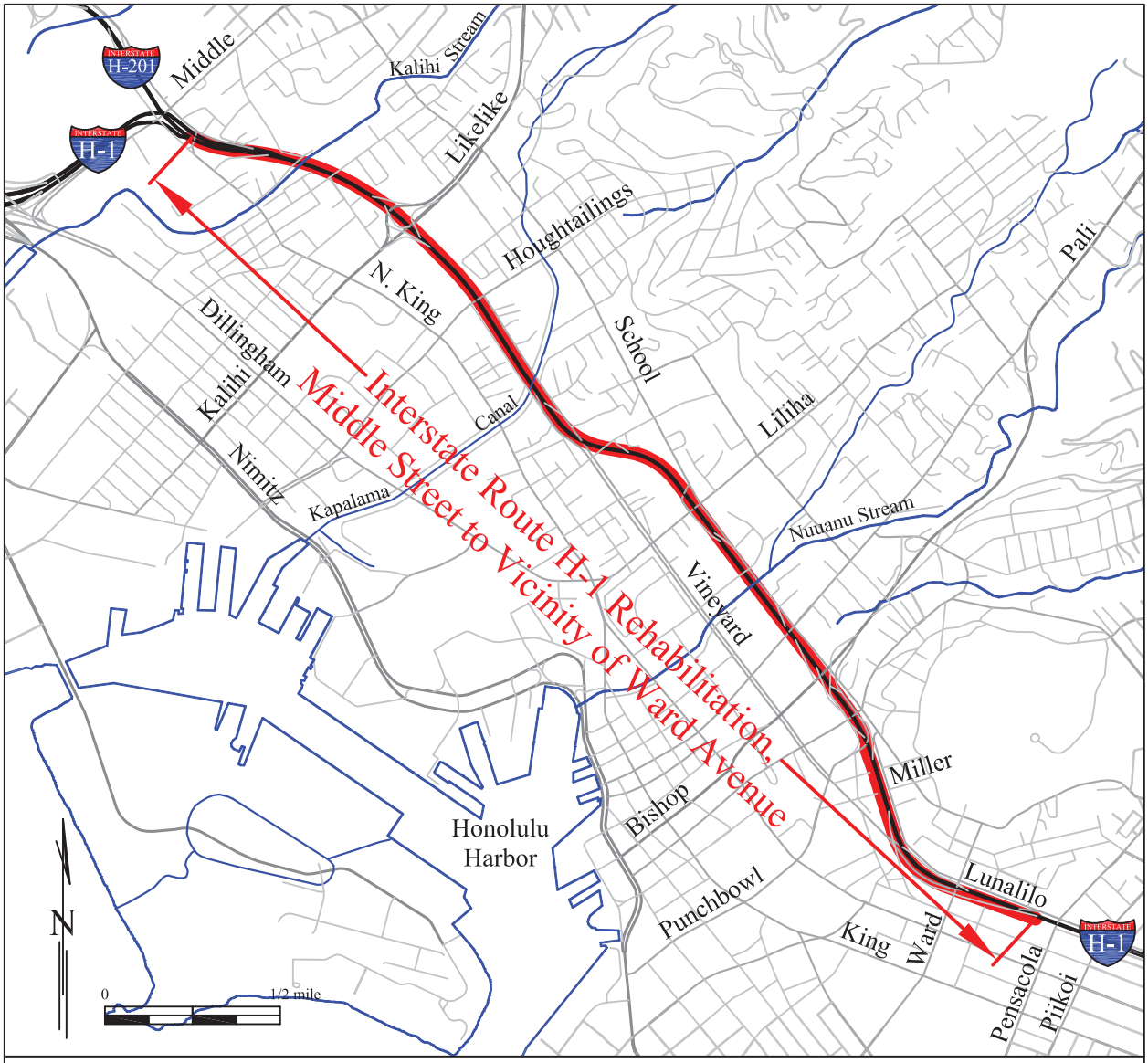


Figure 1: Project Location

Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue
State of Hawaii Department of Transportation, Highways Division

From: pkaleikini@hawaii.rr.com
Sent: Friday, December 07, 2012 7:29 PM
To: kahunaiwi@yahoo.com; JRKeoneakapu@gmail.com; Hayes, James (Honolulu)
Cc: Ross Hironaka (ross.hironaka@hawaii.gov); roy.siegel@dot.gov
Subject: Re: Section 106 Consultation - Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue

Aloha,

'Ohana Keaweamahi appreciates the opportunity to participate in the consultation being conducted pursuant to Section 106 of the National Historic Preservation Act.

In relation to the effect of this Undertaking on historic properties, we seek to be included in future consultations regarding this Undertaking and to be included as a Consulting Party especially as Claimants to human remains should there be any finds. We intend to participate with full dedication and commitment throughout the consultation process and expect our participation to be meaningful and productive.

We look forward to reviewing the overview of the Undertaking and will be responding as to how we would like to proceed with the consultation process.

Mahalo
Paulette Ka'anohi Kaleikini
'Ohana Keaweamahi

From: pkaleikini@hawaii.rr.com
Sent: Friday, December 07, 2012 7:36 PM
To: Hayes, James (Honolulu)
Cc: couldnttakethemana@gmail.com
Subject: Re: Section 106 Consultation - Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue

Mr. Hayes,

Please add to your list of NHOs the following 'ohana; 'Ohana Keliinoi, 'Ohana Kaleikini, 'Ohana Caceres. Mana Kaleilani Caceres is representative of 'Ohana Caceres and he is cc'd on this email. Contact emails for 'Ohanas Kaleikini and Keliinoi are forthcoming.

Mahalo for your assistance with this matter. Let me know if there are any questions.

P. Ka'anohi Kaleikini

From: pkaleikini@hawaii.rr.com
Sent: Sunday, December 09, 2012 7:49 PM
To: Hayes, James (Honolulu); roy.siegel@dot.gov; ross.hironaka@hawaii.gov
Cc: kahunaiwi@yahoo.com; JRKeoneakapu@gmail.com; couldnttakethemana@gmail.com
Subject: Section 106 Consultation - Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Ave-Comments
Attachments: Section 106 Consultation.docx

Aloha,

Mahalo for the opportunity to comment on this Undertaking. Our comment is attached for your review.

As a family recognized by the Native American Graves Protection and Repatriation Act (NAGPRA),the comments we provide reflect our belief that though there are no records indicating the presence of historic properties within the direct area of potential effect, there may remain pockets of areas of previously undisturbed soils. Our goal is to protect not only our ancestral remains but any/all items of cultural significance.

'Ohana Keaweamahi recommends a meeting to continue consultation. Any questions regarding our comments may be addressed at that time.

Mahalo,
Paulette Kaleikini
'Ohana Keaweamahi

Section 106 Consultation - Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Ave

Comments and questions regarding this proposed Undertaking – by ʻOhana Keaweamahi

Overview of the Undertaking:

*For pavement rehabilitation, how much ground disturbance will be caused by each of the two levels of treatment; rehabilitation and repaving; will there be digging/trenching to prepare the ground area for rehabilitation/repaving and at what depth

*Request information of the lighting system that will be used for replacement. How much ground disturbance will this system require

*Request information on the concrete glare screen

*Request more discussion of the Nuuanu Stream bridge widening task

*Request more discussion and description of any/all minor modifications to be used throughout the project area

Identified Potential Historic Properties:

*We disagree that based on the review of photographs and viewing the APE from Interstate Route H-1 and parcel city streets, that no surface archaeological resources are present within the APE; request further discussions

*Request more discussion of the effect of this Undertaking on the three streams which are potentially eligible for listing on the National Register as portions of the sidewalls of the three streams crossed by the Undertaking are within the APE; the Nuʻuanu Stream, Kapālama Canal, and Kalihi Stream.

*We disagree that on the very small portions of parcels nearest the route that there are no known archaeological resources or historic structures on the two historic properties within the APE; Bishop Museum Complex (TMK 1-6-024:001) and Farrington High School (TMK 1-6-021:005) which are both on the Hawaiʻi Registry (SIHP site number 80-14-9768) and request further discussions

Mitigation Policies:

*Ensure that SHPD concurs that this Undertaking does not require an Archaeological Inventory Survey

*If no AIS will be conducted, ʻOhana Keaweamahi recommends an archaeological monitoring plan (based on our cultural connections and knowledge indicating genealogical, religious and spiritual attachment to the APE) and that the AMP be submitted to the SHPD

*Removal of any/all lava rock and mortar from Nuuanu Stream sidewall must be monitored and the area to where it will be set aside for wall restoration at a later time must be adequately and securely protected and we recommend further discussion

*A qualified archaeologist must be onsite during any/all ground disturbing activities especially in the areas of the three streams that are eligible for the NR and the two properties that are currently on the Hawaii Register, Bishop Museum (also on the NR) and Farrington High School to assess the nature of any/all significant finds

*A qualified cultural monitor is recommended to be onsite during any/all ground disturbing activities to assess the nature of any/all cultural significant finds

From: Mana Kaleilani Caceres [couldnttakethemana@gmail.com]
Sent: Monday, December 10, 2012 5:27 PM
To: Hayes, James (Honolulu)
Cc: JR; Aunty Kaleo; pkaleikini@hawaii.rr.com
Subject: Section 106 Consultation - Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue

Aloha Jim,

My name is Mana (Norman) Kaleilani Caceres and I represent NHO 'ohana Huihui. Would you please add my name (as well as the NHO i represent) to those recognized as interested parties and consultants for SECTION 106-INTERSTATE ROUTE H-1 REHABILITATION. Thank you for your time and I look forward to being a part of this process.

Aloha,

Mana Kaleilani Cáceres

NHO 'OHANA HUIHUI

From: Hayes, James (Honolulu)
Sent: Tuesday, December 11, 2012 5:06 PM
To: 'Mana Kaleilani Caceres'; pkaleikini@hawaii.rr.com; JR; Aunty Kaleo; couldnttakethemana@gmail.com
Cc: roy.siegel@dot.gov; 'Ross.Hironaka@hawaii.gov'
Subject: Section 106 Consultation - Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue

Dear ‘Ohana Keaweamahi, ‘Ohana Medeiros, ‘Ohana Kapu, ‘Ohana Keliinoi, ‘Ohana Kaleikini, and ‘Ohana Huihui:

We have received your electronic mail messages: one from ‘Ohana Keaweamahi on Sunday the 9th with an attachment containing a number of questions and requests, and one from ‘Ohana Huihui requesting to be included in the consultation process (we assume ‘Ohana Huihui and ‘Ohana Caceres are one and the same NHO, please correct us if that is incorrect). We are also trying to identify the various people included in these electronic mail messages. Our current understanding is as follows:

‘Ohana Keaweamahi: Paulette Kaleikini (pkaleikini@hawaii.rr.com)
‘Ohana Medeiros: ?
‘Ohana Kapu: ? (JRKeoneakapu@gmail.com)
‘Ohana Keliinoi: ?
‘Ohana Huihui: Mana Kaleilani Caceres (couldnttakethemana@gmail.com)

If one of you could provide additional information that would be much appreciated. We want to be sure we have everyone included, know who we are coordinating with, and be able to keep our records clear and accurate. Mahalo.

We understand and respect your goal of protecting your ancestral remains and items of cultural significance. It is our goal to provide the appropriate level of protection for those resources throughout the proposed undertaking, should it proceed. We look forward to working with you to help establish measures that can provide the appropriate level of protection. Unfortunately, given the holiday season, it is not possible to arrange a meeting with all the necessary personnel at this time. We are reviewing the input received and collecting information to address the questions and requests from ‘Ohana Keaweamahi. We will provide additional information via electronic mail shortly; for now we just wanted to confirm that we have received your input and requests.

We look forward to consulting with you regarding the proposed undertaking. Have a good day,

Jim Hayes
Parsons Brinckerhoff
O: 808-566-2239; C: 808-354-4553

From: pkaleikini@hawaii.rr.com
Sent: Tuesday, December 11, 2012 5:23 PM
To: kahunaiwi@yahoo.com; Mana Kaleilani Caceres; JR; Hayes, James (Honolulu)
Cc: Ross.Hironaka@hawaii.gov; roy.siegel@dot.gov
Subject: Re: Section 106 Consultation - Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue

Aloha,

The representative for 'Ohana Medeiros is Jim Medeiros Sr and he can be reached at kahunaiwi@yahoo.com.

The representative for 'Ohana Keliinoi is Kalahikiola Keliinoi and he can be reached at kala.keliinoi@yahoo.com

Mahalo

Hayes, James (Honolulu)

From: Hayes, James (Honolulu)
Sent: Monday, January 07, 2013 5:41 PM
To: Paulette K. Kaleikini (pkaleikini@hawaii.rr.com); JR Keoneakapu Williams (JRKeoneakapu@gmail.com); Mana Kaleilani Cáceres (couldnttakethemana@gmail.com); Kalahikiola Keliinoi (kala.keliinoi@yahoo.com); Jim Medeiros Sr. (kahunaiwi@yahoo.com)
Cc: Ross.Hironaka@hawaii.gov; roy.siegel@dot.gov
Subject: RE: Section 106 Consultation - Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue
Attachments: 2013-01-07_Secton106AddInfo-H1RehabMtoW.pdf

Ms. Kaleikini,

Happy New Year. Mahalo for the clarification regarding who is who last month. I think my only outstanding question is about "JR" - just hoping you can provide a full name so we get it right.

The NHOs we have listed as consulting parties for this undertaking, and their designated contacts, is as follows:

‘Ohana Keaweamahi: Ms. Paulette Kaleikini (pkaleikini@hawaii.rr.com) ‘Ohana Kaleikini: Ms. Paulette Kaleikini (pkaleikini@hawaii.rr.com) ‘Ohana Medeiros: Mr. Jim Medeiros Sr. (kahunaiwi@yahoo.com) ‘Ohana Kapu: ? (JRKeoneakapu@gmail.com) ‘Ohana Keliinoi: Mr. Kalahikiola Keliinoi (kala.keliinoi@yahoo.com) ‘Ohana Huihui: Mr. Mana Kaleilani Caceres (couldnttakethemana@gmail.com)

If this list has any errors or omissions please let us know.

The attached provides some additional project and planning information in response to the questions and comments received from you on December 9, 2012.

We look forward to any additional information or questions you may have.

Have a good day,

Jim Hayes
Parsons Brinckerhoff
O: 808-566-2239; C: 808-354-4553

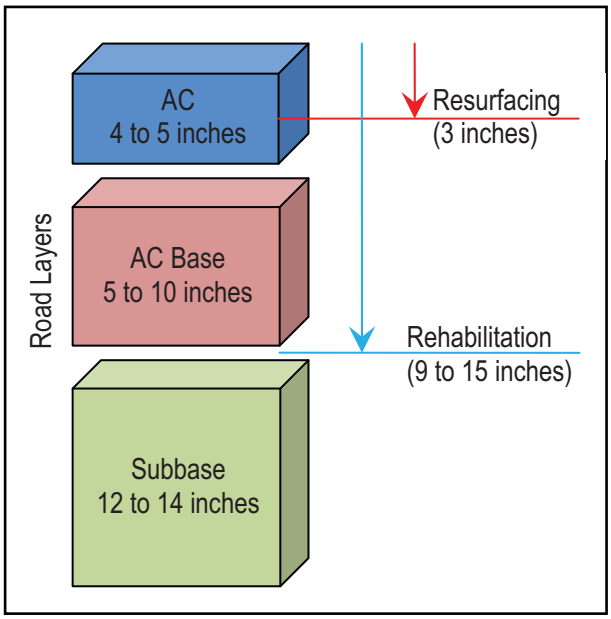
SECTION 106 CONSULTATION

INTERSTATE ROUTE H-1 REHABILITATION, MIDDLE STREET TO VICINITY OF WARD AVE

Comments and questions regarding the proposed undertaking, received from 'Ohana Keaweamahi on December 9, 2012, are underlined below. Additional information regarding the undertaking is provided below each underlined question or comment.

Overview of the Undertaking

<u>For pavement rehabilitation, how much ground disturbance will be caused by each of the two levels of treatment; rehabilitation and repaving; will there be digging/trenching to prepare the ground area for rehabilitation/repaving and at what depth.</u>



The rehabilitation and repaving would not require any digging or trenching. The only disturbance would be to asphaltic concrete (AC) and AC Base materials (note, AC Base is an engineered material). These materials are typically removed by a "cold planer" that grinds them up and places them directly into dump trucks for off-site management. No previously undisturbed materials would be disturbed by the rehabilitation or repaving. Please see graphic (note, the Subbase shown in the graphic is also an engineered material placed during original interstate construction).

<u>Request information of the lighting system that will be used for replacement. How much ground disturbance will this system require?</u>

The new lighting system would require some ground disturbance, as follows:

- Excavation for lighting foundations, roughly 8 feet in depth.
- Trenching for associated electrical conduit, roughly 3 feet in depth.

These activities would occur near the existing interstate roadway and associated current lighting system and retaining walls. Much of the new lights and conduit would be located (a) near the base of existing engineered slopes, or (b) immediately behind existing retaining walls. In these situations, and some others, we believe it is safe to assume the soil that would be excavated for the new lighting system would have been disturbed previously.

Request information on the concrete glare screen.

Glare screen

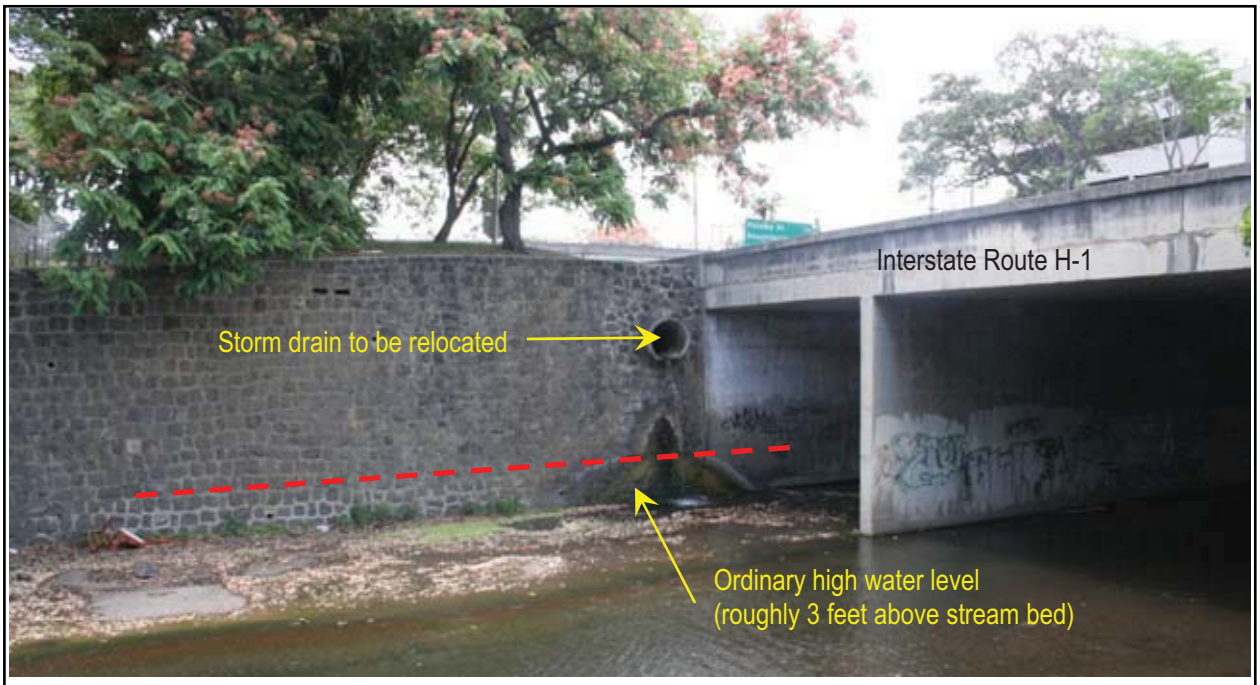
The glare screen does not require any excavation. The glare screen is a concrete addition to the existing concrete median barrier. Glare screens are installed to block the headlights of vehicles travelling the opposite direction and prevent those headlights from creating glare and distracting drivers. See photograph provided.

Request more discussion of the Nuuanu Stream bridge widening task.

Interstate Route H-1 crosses Nu‘uanu Stream between the A‘ala Street and Nu‘uanu Street overpasses. The existing bridge was built in 1964 and originally accommodated three 12-foot wide lanes in each direction but HDOT modified the Diamond Head-bound (east-bound) lanes in 2006 to accommodate four 11-foot wide lanes – three through lanes and one auxiliary lane.

As part of the proposed undertaking, the bridge would be widened roughly 5 feet on the makai side in order to provide sufficient room for five 10-foot wide lanes – four through lanes and one auxiliary lane.

The photograph of the Nu‘uanu Stream Bridge below illustrates current conditions in the area where the bridge would be widened. The photograph shows a storm drain pipe currently located in the area of the proposed bridge widening. The storm drain pipe would need to be moved further makai, roughly five feet, to make room for the widened bridge.



Nu'uanu Stream Bridge, makai-'Ewa side

HDOT is committed to avoiding dredging materials from the channel or placing fill within the stream channel during the widening of Nu'uanu Stream Bridge and relocation of the storm drain pipe. All excavation associated with the bridge widening would be behind the current stream sidewalls.

We believe excavations associated with the bridge widening would be unlikely to disturbed previously undisturbed soil and/or soil likely to contain cultural resources because:

- The interstate is in an excavated channel in this location – indicating significant excavation and grading has occurred in the area.
- The stream has been channelized – indicating significant grading in the area.
- There are a number of retaining walls in the immediate area – indicating significant grading in the area.
- What is inferred to be the natural ground level (i.e. the ground level at Foster Garden and Kauluwela Elementary School) is much higher than the existing grade at the bridge location.

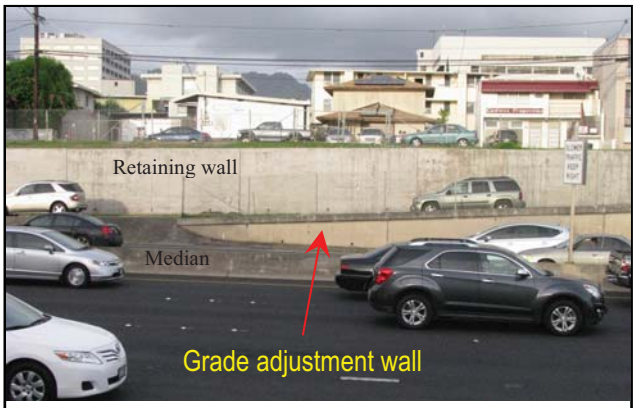
<u>Request more discussion and description of any/all minor modifications to be used throughout the project area.</u>

In order to accommodate and support the fourth through lane, minor modifications to existing ancillary facilities would be necessary. These include the following:

- Minor modifications to the storm drain system, primarily inlet modifications. Currently the storm drain inlets are at-grade grate inlets on both the median and

shoulder. The inlets are adjacent to or beyond the marked travel lanes. The restriping of the interstate to four through lanes would bring the marked travel lanes much closer to the existing grate inlets, or, in some cases, the new travel lane may be on a portion of the grate. Portions of the storm drain inlets that fall within the travel lane would be reconstructed to prevent them from becoming obstructions.

- Grade adjustment walls or curbing, similar to the one shown, would be constructed or existing walls extended at on- and off-ramp locations where the slopes would become less gradual due to minor pavement widening within the right-of-way. Generally, all these locations are sloping and covered with concrete; those sloping areas would be replaced by vertical walls that occupy less space. New walls or curbing would be necessary at the following locations:



Grade adjustment wall (between interstate through lanes and entrance ramp)

  - Likelike Highway on-ramp, Diamond Head-bound (east-bound);
  - Liliha Avenue on-ramp, Diamond Head-bound (east-bound);
  - Pali Highway on-ramp, Diamond Head-bound (east-bound);
  - Vineyard Boulevard on-ramp, Diamond Head-bound (east-bound);
  - Punchbowl Street on-ramp, ‘Ewa-bound (west-bound);
  - Hālona Street on-ramp, ‘Ewa-bound (west-bound); and
  - School Street on-ramp, ‘Ewa-bound (west-bound).

  For locations that require retaining walls, the walls would be relatively short compared to most existing retaining walls and overpass abutments in the project area.

- Some existing retaining walls would be shifted slightly. One example is that the existing retaining wall near the Pali Highway off-ramp, Diamond Head-bound (east-bound) would be reconstructed at the new roadway width associated with Nu‘uanu Stream Bridge widening.

- Overhead directional and destination signs would be modified and several new warning signs would be installed. New 45 mph speed limit signs would replace the existing 50 mph signs. Advisory signs of 35 mph and 40 mph would be placed in select locations, such as around the horizontal curves or in verticals sags, due to the limited sight distance at these locations. Signs advising motorists of the narrow lane conditions would also be posted.

- The curb and guardrail on the Pālama Separation Structure (between Vineyard Boulevard and School Street Diamond Head-bound (east-bound) overpass) would be removed and the bridge rail reconstructed.

- Some safety barriers (i.e. crash attenuators) and guardrails would also be relocated.

As this summary illustrates, these minor modifications are primarily modifications of existing engineered facilities associated with Interstate Route H-1. Construction activities to complete these modifications would be relatively minor and likely disturb soil that was previously disturbed during the installation of the existing structures being modified.

Identified Potential Historic Properties

<u>We disagree that based on the review of photographs and viewing the APE from Interstate Route H-1 and parcel city streets, that no surface archaeological resources are present within the APE; request further discussions.</u>

We have not been able to identify any evidence of surface archaeological resources within the APE. Please inform us of any specific locations where you believe surface (or subsurface) archaeological resources are present.

<u>Request more discussion of the effect of this Undertaking on the three streams which are potentially eligible for listing on the National Register as portions of the sidewalls of the three streams crossed by the Undertaking are within the APE; the Nu‘uanu Stream, Kapālama Canal, and Kalihi Stream.</u>

The undertaking would have no effect on stream channel sidewalls in Kapālama Canal and Kalihi Stream. The bridges over those water ways would not be modified by the proposed undertaking.

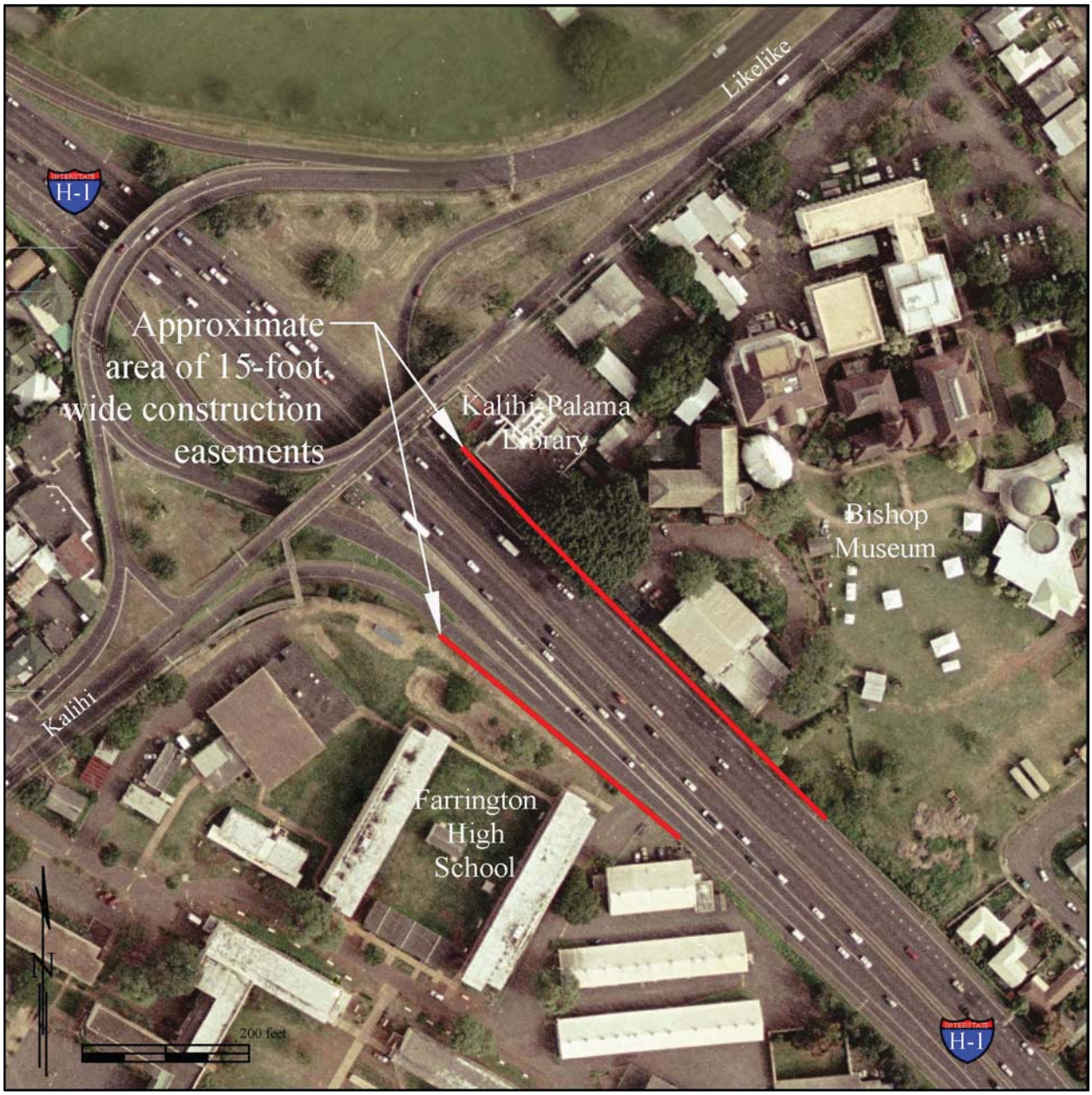
The lava rock and mortar Nu‘uanu Stream sidewalls extend a relatively short distance upstream from Interstate Route H-1, but extends more than 3,000 feet downstream, to Honolulu Harbor. The lava rock and mortar walls have been replaced by concrete bridge abutments at the various roadway crossings.

The undertakings affect on the lava rock wall would consist of (a) removal of a roughly 5-foot length of the lava rock wall on both sides of the stream (concrete bridge abutments would take the place of the lave rock wall), and (b) removal and then reconstruction, to the extent possible, of a roughly 8 foot long by 10 feet deep portion of the lava rock wall on the ‘Ewa (west) side for the relocation of the storm drain pipe.

We believe the affect would be minor because (a) the affected portion of the wall is a very short portion of the wall relative to its total length; and (b) the affected area is not readily visible from any publicly accessible area. Overall, the historic property would retain its integrity and continue to be eligible for listing on the National Register.

We disagree that on the very small portions of parcels nearest the route that there are no known archaeological resources or historic structures on the two historic properties within the APE; Bishop Museum Complex (TMK 1-6-024:001) and Farrington High School (TMK 1-6-021:005) which are both on the Hawai‘i Registry (SIHP site number 80-14-9768) and request further discussions.

No evidence of surface archaeological resources is present within the portion of these properties that is within the APE (only the 15 feet nearest the interstate is within the APE, see figure below). Please inform us of any specific locations where you believe archaeological resources are present.



Approximate location of construction easements and private property within the APE

Mitigation Policies

Ensure that SHPD concurs that this Undertaking does not require an Archaeological Inventory Survey.

We have requested SHPD consult with us and we will address this question, among others, with them.

If no AIS will be conducted, ‘Ohana Keaweamahi recommends an archaeological monitoring plan (based on our cultural connections and knowledge indicating genealogical, religious and spiritual attachment to the APE) and that the AMP be submitted to the SHPD.

If an AMP is deemed necessary, we would submit it to SHPD.

Removal of any/all lava rock and mortar from Nuuanu Stream sidewall must be monitored and the area to where it will be set aside for wall restoration at a later time must be adequately and securely protected and we recommend further discussion.

We agree with your recommendation that the resource be restored to the extent practicable and that the lava rock be adequately secured during the undertaking. The need for monitoring, beyond monitoring by HDOT and contractor personnel responsible for restoring the wall, is not immediately obvious. Is there some specific type of monitoring you feel is warranted?

A qualified archaeologist must be onsite during any/all ground disturbing activities especially in the areas of the three streams that are eligible for the NR and the two properties that are currently on the Hawaii Register, Bishop Museum (also on the NR) and Farrington High School to assess the nature of any/all significant finds.

The need for archaeological monitoring during any/all ground disturbing activities is not immediately obvious. As our earlier information stated, monitoring by other nearby projects has not encountered any significant cultural resources. Those monitoring activities took place in areas where the ground was in a less disturbed state than the APE for this undertaking.

Nevertheless, we would be willing to mandate archaeological monitoring during certain activities, including:

- Nu‘uanu Stream bridge widening and lighting replacement activities that disturb soil within 100 feet of Nu‘uanu Stream.
- Lighting replacement activities that disturb soil within 100 feet of Kapālama Canal.
- Lighting replacement activities that disturb soil within 100 feet of Kalihi Stream.

We do not feel monitoring at Bishop Museum or Farrington High School is warranted because all ground disturbance activities would be within a foot or two of the existing retaining walls. All materials within that distance of these retaining walls would have been disturbed during original retaining wall construction.

A qualified cultural monitor is recommended to be onsite during any/all ground disturbing activities to assess the nature of any/all cultural significant finds.

We believe having an archaeological monitor present at the activities described above would be sufficient to protect potential culturally significant finds in those areas. In the unlikely event that a potentially significant find is identified by the archaeological monitor or other personnel on site, we would inform SHPD the NHOs involved in this consultation process and seek input on the protection of the find, if warranted.

From: pkaleikini@hawaii.rr.com
Sent: Tuesday, February 19, 2013 8:38 AM
To: Jim Medeiros Sr. (kahunaiwi@yahoo.com); Mana Kaleilani Cáceres (couldnttakethemana@gmail.com); JR Keoneakapu Williams (JRKeoneakapu@gmail.com); Kalahikiola Keliinoi (kala.keliinoi@yahoo.com); Hayes, James (Honolulu)
Cc: Ross.Hironaka@hawaii.gov; roy.siegel@dot.gov
Subject: RE: Section 106 Consultation - Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue
Attachments: Section 106 Consultation - Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue.docx

Aloha Jim,

Attached are responses to the additional information and questions that were posed within the document.

Mahalo,
Paulette Ka'anohi Kaleikini

Identified Potential Historic Properties

We disagree that based on the review of photographs and viewing the APE from Interstate Route H-1 and parcel city streets, that no surface archaeological resources are present within the APE; request further discussions.

We have not been able to identify any evidence of surface archaeological resources within the APE. Please inform us of any specific locations where you believe surface (or subsurface) archaeological resources are present.

What method was used to help identify evidence of surface archaeological resources within the APE?

We disagree that on the very small portions of parcels nearest the route that there are no known archaeological resources or historic structures on the two historic properties within the APE; Bishop Museum Complex (TMK 1-6-024:001) and Farrington High School (TMK 1-6-021:005) which are both on the Hawai‘i Registry (SIHP site number 80-14-9768) and request further discussions.

No evidence of surface archaeological resources is present within the portion of these properties that is within the APE (only the 15 feet nearest the interstate is within the APE, see figure below). Please inform us of any specific locations where you believe archaeological resources are present.

What method was used to determine that no surface archaeological resources is present within the portion of these properties that is within the APE. What specific locations within the APE were tested? Is there a map to show these locations?

Removal of any/all lava rock and mortar from Nuuanu Stream sidewall must be monitored and the area to where it will be set aside for wall restoration at a later time must be adequately and securely protected and we recommend further discussion.

We agree with your recommendation that the resource be restored to the extent practicable and that the lava rock be adequately secured during the undertaking. The need for monitoring, beyond monitoring by HDOT and contractor personnel responsible for restoring the wall, is not immediately obvious. Is there some specific type of monitoring you feel is warranted?

If the wall restoration will not take place immediately and no monitoring (i.e., cultural or archaeological) for documentation then some security measures should be ensured. Explain security measures to be taken.

Hayes, James (Honolulu)

From: Hayes, James (Honolulu)
Sent: Tuesday, February 26, 2013 4:24 PM
To: 'pkaleikini@hawaii.rr.com'; Jim Medeiros Sr. (kahunaiwi@yahoo.com); Mana Kaleilani Cáceres (couldnttakethemana@gmail.com); JR Keoneakapu Williams (JRKeoneakapu@gmail.com); Kalahikiola Keliinoi (kala.keliinoi@yahoo.com)
Cc: Ross.Hironaka@hawaii.gov; 'Clifford.A.Corpuz@hawaii.gov'; 'Roy.Siegel@dot.gov'
Subject: Section 106 Consultation - Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue
Attachments: H1RehabMtoW_Section106-ResponsesTo2013-02-19Questions.pdf

Dear ‘Ohana Keaweamahi, ‘Ohana Kaleikini, ‘Ohana Medeiros, ‘Ohana Kapu, ‘Ohana Keliinoi, and ‘Ohana Huihui:

Please find attached additional information in response to Ms. Paulette Kaleikini’s questions and comments received on February 19, 2013, as part of the Section 106 consultation process for the above-referenced project. If you have any trouble accessing the PDF file attached let us know.

If you (a) have knowledge of historic resources within the undertaking’s APE, (b) have input on the measures outlined to avoid effects to historic resources, (c) disagree with our proposed Section 106 determination, or (d) have any other input, please provide a detailed response within 30 days (on or before March 28, 2013).

Have a good day,

Jim Hayes
Sr. Supervising Planner
Parsons Brinckerhoff
1001 Bishop Street, Suite 2400
Honolulu, Hawaii 96813
O: 808-566-2239; F: 808-528-2368; C: 808-354-4553
E: hayesja@pbworld.com

SECTION 106 CONSULTATION

INTERSTATE ROUTE H-1 REHABILITATION, MIDDLE STREET TO VICINITY OF WARD AVE

Date: February 26, 2013

Format: **Bold** = questions and comments from Paulette Ka'anohi Kaleikini; *italic* = previous information provided by PB/HDOT on January 9, 2013; regular type = new information and requests provided by PB/HDOT.

We disagree that based on the review of photographs and viewing the APE from Interstate Route H-1 and parcel city streets, that no surface archaeological resources are present within the APE; request further discussions.

We have not been able to identify any evidence of surface archaeological resources within the APE. Please inform us of any specific locations where you believe surface (or subsurface) archaeological resources are present.

What method was used to help identify evidence of surface archaeological resources within the APE?

Methods used:

- Reviewed HDOT as-built drawings and design drawings to assess if areas exist within the APE that were left undisturbed during Interstate H-1 construction and the development that pre-dated Interstate H-1 construction. Those drawings indicate:
    - The area where Interstate Route H-1 now exists was previously occupied by residential, commercial, and transportation land uses (some of the plans show building footprints and roadways that existed prior to Interstate Route H-1 construction). (Note, historic air photographs also show development of the area prior to Interstate Route H-1 construction.) Therefore, the current right-of-way was heavily modified prior to construction of Interstate Route H-1.
    - There are very few, if any, locations within the Interstate Route H-1 right-of-way where the present ground surface is at the same level as it was during pre-contact times. It is either in a "cut" or "fill" condition in the project area, as follows:
        - Middle Street (start of project) to Richard Lane: cut
        - Richard Lane to Pinkham Street: fill
        - Pinkham Street to middle of Bishop Museum: cut
        - Middle of Bishop Museum to Kama Lane: fill
        - Kama Lane to Kokea Street: fill (slight)
        - Kokea Street to Pālama Settlement back parking lot: fill
        - Pālama Settlement back parking lot to Punchbowl Street: cut

        - Punchbowl Street to Ward Avenue (end of project): cut on mauka side, fill on makai side
    - Retaining walls and slopes (embankments) were used for the cut and fill areas. The retaining walls used footings of various designs, but all footings included horizontal foundations that required significant excavations in the area prior to the walls being erected.
    - Irrigation systems and other utilities were installed in the unpaved areas.
    - There are no indications or notes related to the preservation of archaeological features; however, there are plans calling for work to be done to protect buildings near retaining walls during their construction.
- Knowledge of construction techniques employed during the 1950s and 1960s when Interstate Route H-1 was originally built. Since laws related to historic preservation and storm water runoff did not exist and were not concerns of that era, contractors generally disturbed the entire work area, particularly in restricted areas such as the project area.
- Visual observations from vehicles, bridges, and nearby streets.
- Walking the larger unpaved areas where:
    - There is a transition between "cut" and "fill" in Interstate Route H-1 design.
    - There is a top of slope in a "cut" area within the right-of-way that could be a pre-construction ground surface.
    - There is an area behind a retaining wall within the right-of-way that could be a pre-construction ground surface.

Together, these efforts have not revealed any evidence of archaeological features within the Interstate Route H-1 right-of-way in the project area. The vast majority of the unpaved area is covered with well maintained landscape consisting primarily of grass with some shrubs and trees. The ground surfaces are generally smooth with few stones or other objects protruding from the ground surface. The level areas on the top of cut slopes have evidence of being driven on recently or at some time in the past. In a few areas, rock rubble and concrete chunks are present at the ground surface. Those rubble areas appear to be made up of construction debris or bedrock that may have been covered with soil at one time but that soil has eroded away over the years. Some of the rubble areas are obscured by grass.

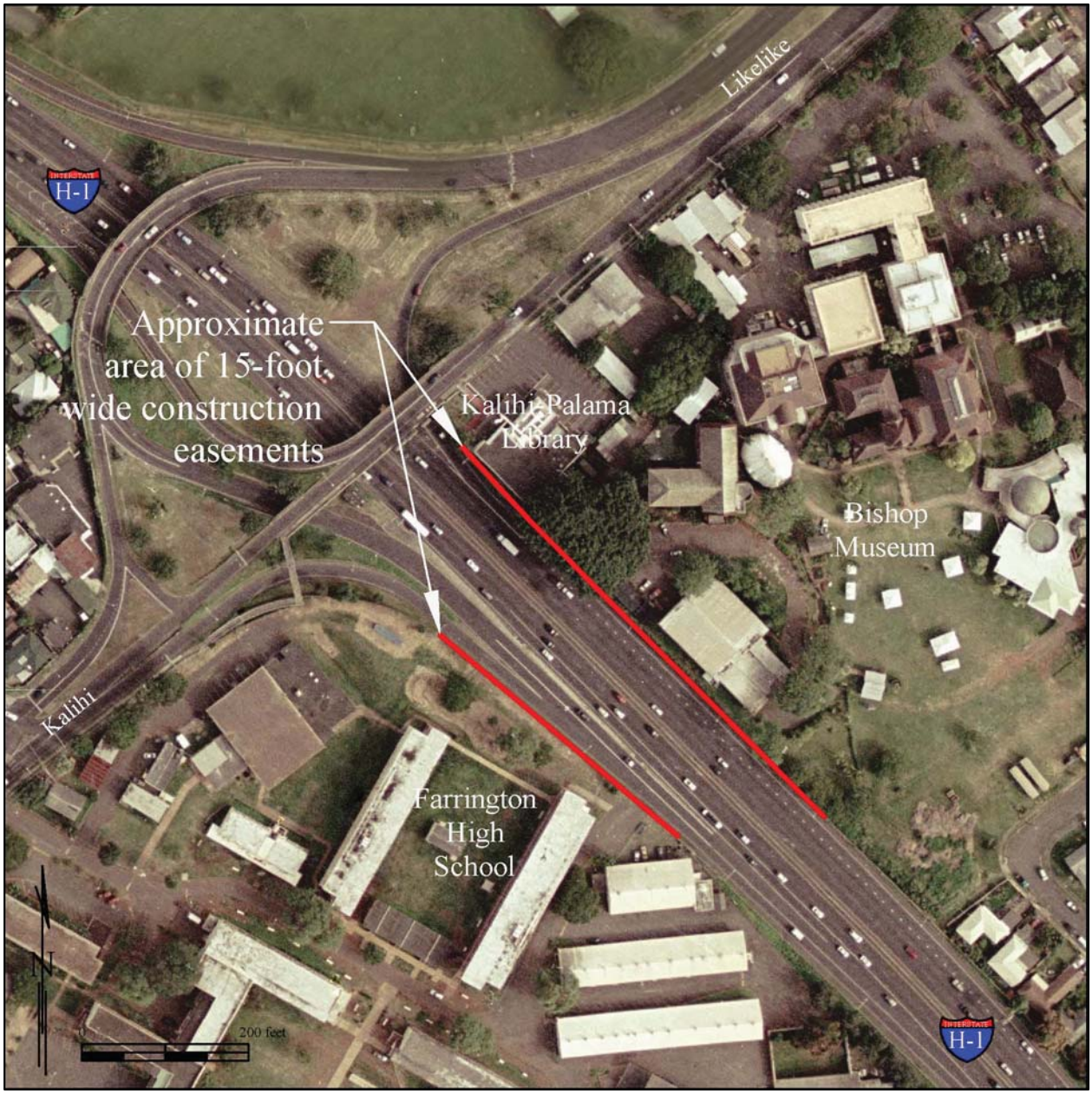
Overall, our research suggests that the likelihood of any pre-contact features being present at or near the ground surface within the right-of-way is remote and our observations indicate that no archaeological resources are present.

We disagree that on the very small portions of parcels nearest the route that there are no known archaeological resources or historic structures on the two historic properties within the APE; Bishop Museum Complex (TMK 1-6-024:001) and Farrington High School (TMK 1-6-021:005) which are both on the Hawai‘i Registry (SIHP site number 80-14-9768) and request further discussions.

No evidence of surface archaeological resources is present within the portion of these properties that is within the APE (only the 15 feet nearest the interstate is within the APE, see figure below). Please inform us of any specific locations where you believe archaeological resources are present.

What method was used to determine that no surface archaeological resources is present within the portion of these properties that is within the APE. What specific locations within the APE were tested? Is there a map to show these locations?

A map was provided in the previous set of information and quoted above. It is the 15 feet nearest the Interstate where the red lines are shown on the figure below. The red lines correspond with the limits of retaining walls along Interstate Route H-1. The air photograph used was taken prior to the construction of Bishop Museum’s Science Adventure Center; the red line ends behind where the Science Adventure Center now exists.



Approximate location of construction easements.

The areas within the APE but outside Interstate Route H-1 right-of-way are behind retaining walls installed during Interstate Route H-1 construction. The retaining walls indicate Interstate Route H-1 is in a "cut" in this area. The grade behind the retaining wall on Farrington High School and Bishop Museum property may be the original ground surface prior to Interstate Route H-1 construction and may be near the ground surface during pre-contact times. However, as discussed above, retaining wall construction requires an excavation for the foundation and the walls of that excavation would have been sloped to avoid collapse during construction. Therefore, at least a portion of the 15 foot wide strip behind the retaining wall was excavated during retaining wall construction (the higher the retaining wall the larger the excavation and the further the slope would have gone into the neighboring property). The two areas are discussed more below.

There were no reports available at the SHPD library related to Farrington High School. The portion of Farrington High School behind the retaining wall and within the APE is landscaped with well manicured grass and hibiscus bushes (see photos below). Within that landscaped area there (a) is an irrigation system with some sprinkler heads near the retaining wall; and (b) are a few locations where stone and concrete rubble are visible through the grass. The rubble that may be construction debris used to backfill the area behind the retaining wall during construction. At the Diamond Head end of the area there is a parking area and an area where mulch is sometimes stored (see photos below). The school staff drive golf carts through the area (both the parking area and the landscaped area) regularly.

Landscaped area and existing street light pole behind Farrington High School

Area behind Farrington High School, from parking area to mulch pile, golf cart path, and landscaped area

The parking area along the retaining wall behind Farrington High School

The portion of Farrington High School is relatively flat, appears to have been previously disturbed by highway or school development, and no archaeological features are present.

The portion of Bishop Museum within the APE is between the Interstate Route H-1 retaining wall and Bishop Museum's Science Adventure Center (built in the 2000's), a support building (built in the 1980s), a parking area, and a banyan tree. A subsurface sanitary sewer pipe runs parallel to the retaining wall throughout the area. Other utilities, including an irrigation system, some on-site drainage, and an electrical system for Bishop Museum's security lighting, are also present in the area. The area behind the two buildings is landscaped with well manicured grass and various trees and generally slopes down from the buildings and parking area to the top of the retaining wall (see photo below). The area near the banyan tree is relatively overgrown and the hanging roots of the banyan have taken root in some areas and have been cut in some areas. The area near the banyan is used as a storage/work area for Bishop Museum's maintenance crews.

Bishop Museum representatives reported that the support building used to have a loading dock, which is now gone. This indicates that area has been regarded a few times in the past. They also reported that the Science Adventure Center includes a lower/basement floor relative to the elevation in the planned work area. When the area was excavated for the basement they encountered bedrock. They also indicated that the Banyan tree is periodically trimmed.

Area behind Bishop Museum support building showing existing light pole, landscaping, slope of land, and sewer manhole.

Bishop Museum parking area and a portion of the area under the Banyan tree.

Research at the SHPD library found a report documenting archaeological monitoring during grading of the museum's central courtyard in 1993. The report states that there was no evidence of pre-contact deposits, but some historic artifacts were found (i.e. glass bottles). Those findings are consistent with other monitoring results in the overall area.

The slope of the land, presence of the sewer pipe, the proximity of the retaining wall and buildings, information from Bishop Museum representatives, and information from the archaeological monitoring report all indicate that the near surface soil has been disturbed previously and no archaeological resources are present in this portion of the APE.

No subsurface areas on either Farrington High School or Bishop Museum were tested.

Removal of any/all lava rock and mortar from Nuuanu Stream sidewall must be monitored and the area to where it will be set aside for wall restoration at a later time must be adequately and securely protected and we recommend further discussion.

We agree with your recommendation that the resource be restored to the extent practicable and that the lava rock be adequately secured during the undertaking. The need for monitoring, beyond monitoring by HDOT and contractor personnel responsible for restoring the wall, is not immediately obvious. Is there some specific type of monitoring you feel is warranted?

If the wall restoration will not take place immediately and no monitoring (i.e., cultural or archaeological) for documentation then some security measures should be ensured. Explain security measures to be taken.

The portion of the wall that requires removal will be removed, then the construction work done, and then the wall restored to the extent practicable. Archaeological monitors will be present when the wall is removed. The construction duration (the time between wall removal and restoration) is estimated to be roughly two months. During that time the rocks will be stored by the contractor at a secure location to be determined by the contractor. HDOT will require that the location be locked when not staffed by contractor personnel and inaccessible to the general public. HDOT will also require that the contractor flag the rock storage area so that the rocks are not used by contractor personnel for another purpose.

SUMMARY

We believe sufficient work has been performed to indicate that (a) there are no surface archaeological features present in the APE, and (b) the likelihood of encountering pre-contact subsurface archaeological or cultural deposits is remote.

HDOT will implement the following measures during construction to mitigate the potential for adverse effects to historic resources:

1. The portion of the Nu‘uanu Stream lava rock and mortar sidewall that needs to be removed will be restored to the extent practicable. During the construction period HDOT will require that the contractor store the lava rock in a locked location inaccessible to the general public. HDOT will also require that the contractor place a sign on the storage area so that the rocks are not used by contractor personnel for another purpose.
2. HDOT will mandate archaeological monitoring during the following construction activities:
    - Nu‘uanu Stream bridge widening and lighting replacement activities that disturb soil within 100 feet of Nu‘uanu Stream.
    - Lighting replacement activities that disturb soil within 100 feet of Kapālama Canal.
    - Lighting replacement activities that disturb soil within 100 feet of Kalihi Stream.

    The archaeological monitoring plan (AMP) will be submitted to SHPD for review prior to construction.
3. If cultural materials are discovered during construction, all earth-moving activity within and around the immediate discovery area would be diverted until a qualified archaeologist can assess the nature and significance of the find.
4. If human remains are discovered, Hawaii Administrative Rules Title 13, Subtitle 13, Chapter 300 states that all activities shall cease in the immediate area of the human skeletal remains, that appropriate action to protect the integrity and character of the

burial site from damage is undertaken, and SHPD and Police Department would be contacted. The appropriate process would then proceed in conformance with Hawaii Administrative Rules §13-300 Subchapter 4 "Procedures for Proper Treatment of Burial Sites and Human Skeletal Remains."

5. If the archaeological monitor believes a find may be significant, HDOT will inform SHPD and NHOs involved in this consultation process and seek input on the protection of the find, if warranted.

Based on our research and observations, plus the implementation of the measures outlined above, HDOT will recommend to FHWA that a "No Adverse Effect" determination is appropriate for the proposed undertaking.

If any of the NHOs involved as consulting parties (a) have knowledge of additional historic resources within the undertaking's APE, (b) have input on the measures outlined above to avoid impacts to historic resources, or (c) disagree with our proposed Section 106 determination, please provide a detailed response within 30 days of receiving this information (on or before March 28, 2013). As always, if a confidential consultation with FHWA is desired, please contact us and we will assist in setting that up.

We can be reached at:

Jim Hayes
Parsons Brinckerhoff (PB)
566-2239 / hayesja@pbworld.com

Ross Hironaka
Department of Transportation (HDOT)
692-7575 / ross.hironaka@hawaii.gov

From: pkaleikini@hawaii.rr.com
Sent: Sunday, March 03, 2013 11:56 AM
To: Jim Medeiros Sr. (kahunaiwi@yahoo.com); Mana Kaleilani Cáceres (couldnttakethemana@gmail.com); JR Keoneakapu Williams (JRKeoneakapu@gmail.com); Kalahikiola Keliinoi (kala.keliinoi@yahoo.com); Hayes, James (Honolulu)
Cc: Ross.Hironaka@hawaii.gov; roy.siegel@dot.gov
Subject: RE: Section 106 Consultation - Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue

Jim Hayes, aloha

Mahalo for the continued section 106 consultation, for providing additional information of the proposed undertaking and for the opportunity to provide comment.

The additional information provides that there will not be any potential impact of this undertaking on certain identified potential historic properties. Construction activities have the potential to result in damage to undocumented cultural resources as well.

We seek to continue the recommended mitigation measures that is intended to minimize or alleviate any adverse affects on historic properties and that these measures be developed in consultation with the State Historic Preservation Division (SHPD). Since the term historic property (and its types) only refer to those resources found eligible to the National Register, unidentified resource sites may also be affected by this undertaking and protective measures for those sites should also be included.

We would like to be kept informed of the mitigation measures (if any) that is recommended by the SHPD for this undertaking and to be notified either by you Jim (or the DOT) of any significant historic finds.

Paulette Kaleikini for 'Ohana Keaweamahi
Kalahikiola Keliinoi for 'Ohana Keliinoi

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APPENDIX A-7

SECTION 7 THREATENED AND ENDANGERED SPECIES COORDINATION

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U.S. Department of Transportation
Federal Highway Administration

Hawaii Federal-Aid Division

300 Ala Moana Blvd, Rm 3-306
Box 50206
Honolulu, Hawaii 96850
Phone: (808) 541-2700
Fax: (808) 541-2704

September 20, 2012

In Reply Refer To:
HDA-HI

Mr. Loyal Mehrhoff
U.S. Fish and Wildlife Office
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawai'i 96850

Subject: Section 7 Informal Consultation
Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue
Honolulu, Island of Oahu, Hawaii
Federal Aid Project No. IM-H1-1(269)

Dear Mr. Mehrhoff:

The State of Hawaii Department of Transportation, Highways Division (HDOT) is planning the Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue (Project) in Honolulu (Figure 1). Federal Highway Administration (FHWA) funds will partially fund the Project.

HDOT will be preparing a HRS Chapter 343 Environmental Assessment (EA) discussing the Project and disclosing potential impacts associated with it. At this time it is anticipated that FHWA will issue a Categorical Exclusion (CE) to comply with the National Environmental Policy Act (NEPA).

Project Overview

The planned Project includes the following general tasks:

- Pavement rehabilitation, including reconstruction and re-paving, as necessary, from Likelike Highway to Miller Street
- Replacement of the existing highway lighting system from Middle Street to Vineyard Boulevard Off-Ramp
- Re-striping the roadway to generate four through lanes in both directions to the extent possible throughout the Project area
- Widening the Nuuanu Stream Bridge approximately 5 feet on the makai (downstream) side in order to accommodate four through lanes and one exit lane in the Diamond Head-bound (east-bound) direction

- Minor modifications to the storm drain system, primarily inlet modifications
- Minor grading and structural improvements at select and discrete locations throughout the Project area

The Project does not involve any new areas being paved other than the widened portion of the Nuuanu Stream Bridge.

The Project area is urban in nature and the streams channelized. A photograph of the Nuuanu Stream Bridge, which will be widened a little as part of this Project, is attached as Figure 2.

Species and Habitat Information Request

Due to the bridge widening planned, this Project does not fall within the limits of the Programmatic Informal Consultation with the FHWA for Preventative Maintenance and Shoulder and Guardrail Improvement Projects in the State of Hawaii dated December 20, 2011.

We request that your office provide any pertinent information concerning threatened and endangered species and/or designated critical habitat in the Project area. We also request that your office share with us any specific or general concerns you may have regarding the Project.

Please feel free to contact me by telephone at (808) 541-2314 or by e-mail at Roy.Siegel@dot.gov, if you have any questions. We look forward to working with you on these needed improvements.

Sincerely yours,

Roy S. Siegel, P.E.
Transportation Engineer

Attachments:
Figure 1 – Project Location
Figure 2 – Photograph, Nuuanu Stream Bridge

cc: Jim Hayes (Parsons Brinckerhoff)
Ross Hironaka and Todd Nishioka (HDOT)

RECEIVED
OCT 15 2012
HAWAII DIVISION

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

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OCT 12 2012

In Reply Refer To:
2013-SL-0009

Mr. Roy S. Siegel
U.S. Department of Transportation
Federal Highway Administration
300 Ala Moana Boulvard
Room 3-306, Box 50206
Honolulu, Hawaii 96850

Subject: Species List for the Proposed Route H-1 Rehabilitation Project, Oahu

Dear Mr. Siegel:

The U.S. Fish and Wildlife Service (Service) received your letter on September 20, 2012, requesting a list of federally listed species or designated critical habitat that may occur within the vicinity of the proposed Route H-1 Rehabilitation Project on the island of Oahu [Federal-Aid Project Number IM-H1-1 (269)]. The project consists of pavement reconstruction and re-paving between Likelike Highway and Miller Street, replacement of the highway lighting system, re-striping, minor grading and structural improvements throughout the project area, and minor modifications to the existing storm drain system. Additionally, the proposed project will widen the existing Nuuanu Stream Bridge by approximately five feet. We understand that Federal Highway Administration plans to partially fund the proposed project.

We have reviewed the information you provided and pertinent information in our files, including data compiled by the Hawaii Biodiversity and Mapping Program and the Hawaii GAP Program. Our data indicate there are no federally listed species or designated critical habitat within the immediate vicinity of the proposed project.

We appreciate your efforts to conserve listed species. If you have questions regarding this letter, please contact Michelle Bogardus, Fish and Wildlife Biologist, Consultation and Habitat Conservation Planning Program (phone: 808-792-9473, fax: 808-792-9581).

Sincerely,

for Loyal Mehrhoff
Field Supervisor

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122, Box 50088
Honolulu, Hawaii 96850

In Reply Refer To:
2013-TA-0103

FEB 20 2013

Mr. James Hayes
Parsons Brinckerhoff
1001 Bishop Street,
American Savings Bank Tower, Suite 2400
Honolulu, Hawaii 96813

Subject: Technical Assistance for the Proposed Route H-1 Rehabilitation Project, Oahu

Dear Mr. Hayes:

The U.S. Fish and Wildlife Service (Service) received your letter on January 23, 2013, requesting review and comments on the Draft Environmental Assessment (EA) for the proposed Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue project on the island of Oahu [Federal-Aid Project Number IM-H1-1 (269)]. The project consists of pavement rehabilitation and resurfacing between Likelike Highway and Miller Street, replacement of the highway lighting system, installation of glare screens, widening of Nuuanu Stream Bridge by approximately five feet, and minor structural and grading modifications. We understand that the Federal Highway Administration plans to partially fund the proposed project.

We have previously provided a species list under the authorities of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) for the proposed project in a letter dated October 12, 2012 (Service File 2013-SL-0009). In that letter we informed you that no federally listed species or designated critical habitat occur within the immediate vicinity of the proposed project. To our knowledge, conditions at the site have not changed.

We have reviewed the Draft EA that you provided with your January 23, 2013, letter and pertinent information in our files. In response to this review, we are providing additional comments under the authority of and in accordance with the provisions of the Fish and Wildlife Coordination Act of 1934 (16 U.S.C. 1531 *et. seq.*; 48 Stat. 401), as amended (FWCA); the National Environmental Policy Act of 1969 [42 U.S.C. 4321 et seq.; 83 Stat. 852], as amended, and other authorities mandating the Service's review of projects and provision of technical assistance to conserve trust resources.

We appreciate your effort to incorporate extensive measures into the project design that avoid and minimize impacts to the aquatic environment. We recommend the following best management practices to further avoid impacts to aquatic resources.

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- We recommend that the Nuuanu Stream bridge widening activities not be performed during periods of high flood risk.

- Turbidity and siltation from project-related work shall be minimized and contained within the vicinity of the site through the appropriate use of effective silt containment devices and the curtailment of work during adverse tidal and weather conditions.

- No project-related materials (fill, revetment rock, pipe, etc.) should be stockpiled in the water (intertidal zones, reef flats, stream channels, wetlands, etc.) or on beach habitats.

- No contamination (trash or debris disposal, non-native species introductions, attraction of non-native pests, etc.) of adjacent habitats (reef flats, channels, open ocean, stream channels, wetlands, beaches, forests, etc.) shall result from project-related activities. This shall be accomplished by implementing a litter-control plan and developing a Hazard Analysis and Critical Control Point Plan (HACCP – see http://www.haccp-nrm.org/Wizard/default.asp) to prevent attraction and introduction of non-native species or comparable plans.

- Fueling of project-related vehicles and equipment should take place away from the water and a contingency plan to control petroleum products accidentally spilled during the project shall be developed. Absorbent pads and containment booms shall be stored on-site, if appropriate, to facilitate the clean-up of accidental petroleum releases.

- Any soil exposed near water as part of the project shall be protected from erosion (with plastic sheeting, filter fabric etc.) after exposure and stabilized as soon as practicable (with native or non-invasive vegetation matting, hydro-seeding, etc.).

Should project plans change or new information regarding the presence of listed species become available, we recommend you coordinate with our office.

We appreciate your efforts to conserve listed species and to avoid and minimize impacts to aquatic habitat. If you have questions, please contact Diane Sether, Wildlife Biologist, at 808-792-9458.

Sincerely,

for Loyal Mehrhoff
Field Supervisor

cc: Mr. Ross Hironaka, Hawaii Department of Transportation

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APPENDIX A-8

SECTION 404 OF THE CLEAN WATER ACT COORDINATION

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U.S. Department of Transportation
Federal Highway Administration

Hawaii Federal-Aid Division

300 Ala Moana Blvd, Rm 3-306
Box 50206
Honolulu, Hawaii 96850
Phone: (808) 541-2700
Fax: (808) 541-2704

October 22, 2012

In Reply Refer To:
HDA-HI

U.S. Army Corps of Engineers, Honolulu District
ATTN: CEPOH-EC-R, George Young
Building 230
Fort Shafter, HI 96858-5440

Subject: Section 404 Coordination
Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue
Honolulu, Island of Oahu, Hawaii
Federal Aid Project No. IM-H1-1(269)

Dear Mr. Young:

The State of Hawaii Department of Transportation, Highways Division (HDOT) is planning the Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue project in Honolulu (Figure 1). Federal Highway Administration (FHWA) funds will partially fund the project. Parsons Brinckerhoff (PB) has been contracted by HDOT to design the project and manage necessary permit and approval activities prior to seeking contractor bids.

HDOT will be preparing a HRS Chapter 343 Environmental Assessment discussing the project and disclosing potential impacts associated with it. It is anticipated that FHWA will issue a Categorical Exclusion to comply with the National Environmental Policy Act (NEPA).

Project Overview

The planned project includes the following general tasks:

- Pavement rehabilitation, including reconstruction and repaving, as necessary, from roughly Likelike Highway to Miller Street, including on and off ramps
- Replacement of highway lighting system from roughly Middle Street to Vineyard Boulevard Off-Ramp
- Restriping the roadway to generate four through lanes in both directions to the extent possible throughout the Project area
- Widening the Nu‘uanu Stream Bridge roughly 5 feet on the makai (downstream) side in order to accommodate four through lanes and one exit lane in the Diamond Head-bound (east-bound) direction
- Minor modifications to the storm drain system, primarily inlet modifications

- Minor grading and structural improvements at select and discrete locations throughout the Project area

The project does not involve any new areas being paved other than the widened portion of the Nuʻuanu Stream bridge.

Waters of the United States

In the project area, H-1 crosses three streams: Nuʻuanu Stream, Kapālama Canal Stream, and Kalihi Stream (Figure 1). The three streams are channelized; a photograph of the Nuʻuanu Stream Bridge is attached as Figure 2 and illustrates a level of channelization that is indicative of all three of the streams.

The only project work that has the potential to directly impact Waters of the U.S. is the widening of Nuʻuanu Stream Bridge and necessary related relocation of the storm drain pipe currently located in the area (Figure 2). Attached for reference are the available plans for the existing Nuʻuanu Stream Bridge.

Water flows downgradient in a laminar flow at the existing Nuʻuanu Stream Bridge; it is above the influence of the ocean tides. The bottom of the channel is roughly 4 feet above mean sea level (aMSL) on the downstream side of Nuʻuanu Stream Bridge; the mean higher-high water (MHHW) tide at nearby Honolulu Harbor is 1.08 feet aMSL based on Honolulu Harbor tide gage station (Station #1612340).

Figure 2 illustrates the location of a proposed Ordinary High Water Mark (OHWM) for the purposes of delineating the extent of Waters of the U.S. at the Nuʻuanu Stream Bridge. Due to the highly channelized nature of the stream at this location there are limited indicators available to establish the OHWM. The OHWM illustrated on Figure 2 is based on discoloration along the lava rock and mortar channel walls and is roughly 3 feet above the channel floor (elevation of roughly 7 feet aMSL). The concrete walls of the bridge are covered with graffiti and cover paint which obscures any evidence of an OHWM.

Need for a Section 404 Department of the Army Permit

HDOT is committed to avoiding dredging materials from the channel or placing fill within the Waters of the U.S. during the widening of Nuʻuanu Stream Bridge and relocation of the storm drain line. To achieve this goal, HDOT will require, in the bid documents, that the contractor perform all work above the OHWM. The selected contractor will be required to clearly illustrate how this will be achieved in their proposal. One possible method includes the following:

- Dredging is not considered to be needed due to the channelized nature of the stream
- Lowering materials into the channel from the deck of the freeway without the need for heavy equipment below the OHWM
- Mounting temporary horizontal beams on the sidewalls and vertical walls of the existing bridge above the OHWM

- Building a temporary solid scaffold on those horizontal beams from which work can be performed to complete the widening and capture any materials so that there are no discharges to the stream
- All permanent structural components of the bridge widening and relocated storm drain line will be kept above the OHWM.
- Removing the temporary scaffold materials using equipment on the deck of the freeway without the need for heavy equipment below the OHWM.

HDOT believes that requiring the contractor to keep all of their equipment and materials above the OHWM will eliminate the need for a Section 404 Department of the Army (DA) permit. We request your input on the need for a Section 404 DA permit for this project and other general concerns you may have regarding the project.

We would be happy to meet with you to discuss the project in greater detail if that would be helpful. Please feel free to contact me by telephone at (808) 541-2314, or by e-mail at Roy.Siegel@dot.gov if you have any questions. We look forward to working with you on these needed improvements.

Sincerely yours,

Roy Siegel, P. E.
Transportation Engineer

Attachment:
Figure 1 – Site Location
Figure 2 – Photograph, Nuuanu Stream Bridge, with estimated OHWM
Nuuanu Stream Bridge Plans

cc: Jim Hayes (PB)
Ross Hironaka and Todd Nishioka (HDOT)

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, HONOLULU DISTRICT
FORT SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF:

January 31, 2013

Regulatory Branch

POH-2012-00244

RECEIVED
FEB - 5 2013
PARSONS BRINCKERHOFF
HONOLULU, HAWAII

Mr. Roy Siegel, P.E.
U.S. Department of Transportation
Federal Highway Administration
300 Ala Moana Blvd. Rm 3-306
Box 50206
Honolulu, HI 96850

NO PERMIT REQUIRED

Dear Mr. Siegel:

We have received your letter requesting a determination as to whether or not a Department of the Army (DA) permit is required for the Interstate H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue (HDA-HI) in Honolulu, on the Island of Oahu, Hawaii. We have reviewed your proposal pursuant to Section 10 of the Rivers and Harbors Act of 1899 (Section 10) and Section 404 of the Clean Water Act (Section 404). We have determined that a DA permit is not required for the activities described in your letter, dated October 22, 2012.

Section 10 requires that a DA permit be obtained for certain structures or work in or affecting navigable waters of the United States (U.S.), prior to conducting the work (33 U.S.C. 403). Your letter states that all work will be conducted above the ordinary high water mark of any waters within or adjacent to the project site; therefore, we have determined that a Section 10 permit is not required for work at the site. Section 404 requires that a DA permit be obtained for the discharge of dredged and/or fill material into waters of the U.S., including wetlands and tributaries of navigable waters of the U.S, prior to conducting the work (33 U.S.C. 1344). A Section 404 permit is not required for your proposed work because, based on your description of the work to be conducted for the project, no discharge of dredged and/or fill material will be allowed into waters of the U.S. Although a permit is not required, we highly recommend the use of Best Management Practices to ensure discharges do not inadvertently occur or to prevent construction debris from entering the waterway.

Thank you for giving us the opportunity to review this proposal and for your cooperation with our regulatory program. Please be advised you can provide comments on your experience with the Honolulu District Regulatory Branch by accessing our web-based customer survey form at http://per2.nwp.usace.army.mil/survey.html.

Should you have any questions, please contact Ms. Emilee Stevens at (808) 835-4310, by facsimile at (808) 835-4126, or by Email at emilee.r.stevens2@usace.army.mil. Please refer to File No. POH-2012-00244 in all future communications with this office regarding this or other projects at this location.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

Copy Furnished:

Mr. Jim Hayes
Parsons Brinckerhoff
1001 Bishop Street, Suite 2400
Honolulu, HI 96813

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APPENDIX B NOISE TECHNICAL REPORT

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Noise Technical Report
Interstate Route H-1 Rehabilitation,
Middle Street to Vicinity of Ward Avenue
Honolulu, Island of O‘ahu, Hawai‘i

Prepared for:

State of Hawai‘i Department of Transportation

Prepared by:

Parsons Brinckerhoff

March 2013

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EXECUTIVE SUMMARY

The purpose of this report is to analyze the traffic noise impacts of the proposed rehabilitation and re-striping of Interstate Route H-1 (H-1 Freeway) between Middle Street to the vicinity of Ward Avenue in Honolulu, on the island of O‘ahu.

The State of Hawai‘i Department of Transportation (HDOT) and the Federal Highway Administration (FHWA) are proposing to rehabilitate (including pavement reconstruction and repaving) a roughly 2.2 mile section of H-1 Freeway from Likelike Highway to Miller Street and re-stripe an approximately 3.2 mile section of H-1 Freeway between Middle Street to the vicinity of Ward Avenue in Honolulu, on the island of O‘ahu (Figure 2-1). The proposed re-striping would reconfigure the existing H-1 lanes to add an additional lane of traffic in each direction, increasing the vehicle capacity of H-1 Freeway within the project limits. Project actions also include highway lighting replacement, the addition of a glare screen on the median barrier, and other minor modifications throughout the project area.

A noise study is required for this project because the re-striping component of the proposed project meets the definition of a Type I Project because it increases roadway capacity by restriping existing pavement for the purpose of adding a new through lane to an existing highway (HDOT, 2011). Type I projects require mitigation of noise levels that approach or exceed the FHWA noise abatemanet criteria if the mitigation is found to be both feasible and reasonable to provide. In the absence of the re-striping, this study would not be necessary.

The HDOT has recently completed the re-striping of an adjacent stretch of H-1, from the Punahou Street to the Pali Highway off-ramp. That project, “Interstate Route H-1, Lane Reconfiguration Demonstration Project, Pali Highway to Punahou Street”, is separate from the action currently under consideration. The current action is designated “Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue” (the Project) and is Federal Aid Interstate Project No. IM-H1-1(269).

In addition to the project (Build Alternative), a No-Build Alternative was also studied in this report. The following is a description of the two alternatives considered in this report:

> No-Build Alternative – The No-Build Alternative assumes that the re-striping of H-1 would not be accomplished by future year 2035. The existing primarily three general-purpose-lane configuration in each direction would remain.
>
> Build Alternative – The Build Alternative involves, among other things, re-striping the H-1 Freeway to a four-lane configuration in each direction from Middle Street to the vicinity of Ward Avenue. The additional lane in each direction would be achieved by reducing the width of each lane as new pavement is not planned in any areas not currently paved for highway use. The speed limit on H-1 Freeway in this area would be lowered from 50 mph to 45 mph with advisory 35 mph signs posted along curves. Additional actions would include pavement reconstruction and repaving and highway lighting replacement throughout the project area (Figure 2-2).

Existing land uses located along this portion of H-1 include roadways, commercial businesses, office buildings, residential buildings, mixed-use buildings, schools, parks, museums, libraries,

and other uses. No vacant land was identified that would be likely for future development along the Interstate Route H-1 project area.

Twenty-one short-term (15-minute) measurements were taken at noise sensitive locations along the proposed alignment. Forty-three additional residential sites were modeled to supplement the measured sites.

The FHWA Traffic Noise Model (TNM) was used to model the noise levels at 64 sites for existing conditions, Future No-Build Alternative, and Future Build Alternatives along the H-1 Freeway Project area. Traffic data used for Existing and Future Year 2035 noise predictions were representative of the maximum hourly traffic volumes that would occur at Level of Service C, which would be the loudest operating condition for H-1 Freeway (i.e. the most vehicles operating at the posted speed limit).

Existing modeled worst-hour traffic noise levels for residential areas range from 58 dBA to 79 dBA (Table 3-4). The existing worst-hour traffic noise levels approach or exceed the Noise Abatement Criteria (NAC) of 67 dBA constant energy level equivalent (Leq) at 53 of the 64 modeled sites representing 594 residences, five parks, five schools, and two places of worship.

The No-Build Alternative includes the same predicted noise levels at the same sites as under existing conditions as the same maximum vehicle per lane hour traffic volumes and lane configuration were used for both scenarios (Table 4-3) because H-1 Freeway currently operates at capacity during some hours of the day (at peak hours capacity is exceeded). The No-Build Alternative is used as the baseline of future traffic noise levels. Noise abatement was not modeled for this alternative because it does not include the implementation of a Type I Project.

The Build Alternative includes 49 sites that approach or exceed the NAC (Table 4-3). An increase of 1 to 2 dBA in Build Alternative noise levels is predicted over the existing condition at two of the 64 total sites. No change to a decrease of 1 to 3 dBA is predicted at the majority of the 64 total sites representing 590 residences, five parks, two schools, and two places of worship. A decrease in Build Alternative noise levels would result from lowering the H-1 Freeway speed limit in the project area from 50 mph currently to 45 mph with the proposed project. Should the project be implemented, despite the predicted small decrease in traffic noise levels, the NAC would still be exceeded, therefore noise barrier evaluation was necessary.

Twenty-four noise barriers were evaluated to reduce traffic noise levels at sites were noise impacts were predicted under the Build Alternative. Nineteen of the 24 evaluated noise barriers were able to achieve the necessary noise reduction to satisfy HDOT Feasibility Criteria; however, the maximum allowance for reasonable cost for each of the 19 evaluated noise barriers was below the engineer's cost estimate for each barrier. Therefore, each evaluated barrier is not reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the proposed project. Details of each barrier evaluation is provided in Chapter 5 of this report.

Minority and low-income communities are represented all along the H-1 Freeway Project area. Existing and future traffic noise levels are generally consistent along the H-1 Freeway Project area and were not identified to disproportionately impact minority or low-income communities located along the project area.

CHAPTER 1 INTRODUCTION

The purpose of this report is to analyze the traffic noise impacts of the proposed rehabilitation of Interstate Route H-1 between Middle Street and the vicinity of Ward Avenue in Honolulu, on the island of O‘ahu (Figure 2-1). The proposed re-striping would reconfigure the existing H-1 lanes to add an additional lane of traffic in each direction, increasing the vehicle capacity of H-1 Freeway within the project limits. This project is not included in the current Statewide Transportation Improvement Program (STIP) or the Hawai‘i Long Range Land Transportation Plan; however this project replaces projects that appear on both plans.

This study was prepared in accordance with Federal Highway Administration (FHWA) rules and procedures (FHWA 1995) and the State of Hawai‘i Department of Transportation (HDOT) Highway Noise Policy and Abatement Guidelines (HDOT 2011). Report elements include:

1. Measurements of existing noise levels at representative noise sensitive receivers;
2. Prediction of future traffic noise levels;
3. Comparison of existing and predicted future traffic noise levels with the FHWA/HDOT Noise Abatement Criteria (NAC);
4. Recommendations to reduce noise impacts;
5. Evaluation of possible noise barriers; and
6. The effects of construction noise and proposed mitigation measures.

CHAPTER 2 PROJECT DESCRIPTION

The State of Hawai‘i Department of Transportation (HDOT) and the Federal Highway Administration (FHWA) are proposing to rehabilitate (including pavement reconstruction and repaving) a roughly 2.2 mile section of H-1 Freeway from Likelike Highway to Miller Street and re-stripe an approximately 3.2 mile section of H-1 Freeway between Middle Street to the vicinity of Ward Avenue in Honolulu, on the island of O‘ahu (Figure 2-1). The proposed action would include re-striping the existing Interstate Route H-1 lane configuration to add an additional lane of traffic in each direction, increasing the vehicle capacity of H-1 Freeway within the project limits. Project actions also include highway lighting replacement, the addition of a glare screen on the median barrier, and other minor modifications throughout the project area.

The HDOT has recently completed the re-striping of an adjacent stretch of H-1, from Punahou Street to the Pali Highway off-ramp. That project, called “Interstate Route H-1, Lane Reconfiguration Demonstration Project, Pali Highway to Punahou Street” (Figure 2-1), is separate from the action currently under consideration. The current action, is designated “Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue” (the Project; Figure 2-1) and is Federal Aid Interstate Project No. IM-H1-1(269).

In addition to the proposed action (Build Alternative), a No-Build Alternative was also studied in this report. The following is a description of the two alternatives considered in this report:

> No-Build Alternative – The No-Build Alternative assumes that the re-striping of H-1 Freeway would not be accomplished by future year 2035. The existing primarily three general-purpose-lane configuration in each direction would remain.
>
> Build Alternative – The Build Alternative involves, among other things, re-striping H-1 Freeway to a four-lane configuration in each direction from Middle Street to the vicinity of Ward Avenue. The additional lane in each direction would be achieved by reducing the width of each lane (Figure 2-2) as new pavement is not planned in any areas not currently paved for highway use. The speed limit on H-1 Freeway in this area would be lowered from 50 mph to 45 mph with advisory 35 mph signs posted along curves. Additional actions would include pavement reconstruction and repaving and highway lighting replacement throughout the project area.

Figure 2-1. Project Location

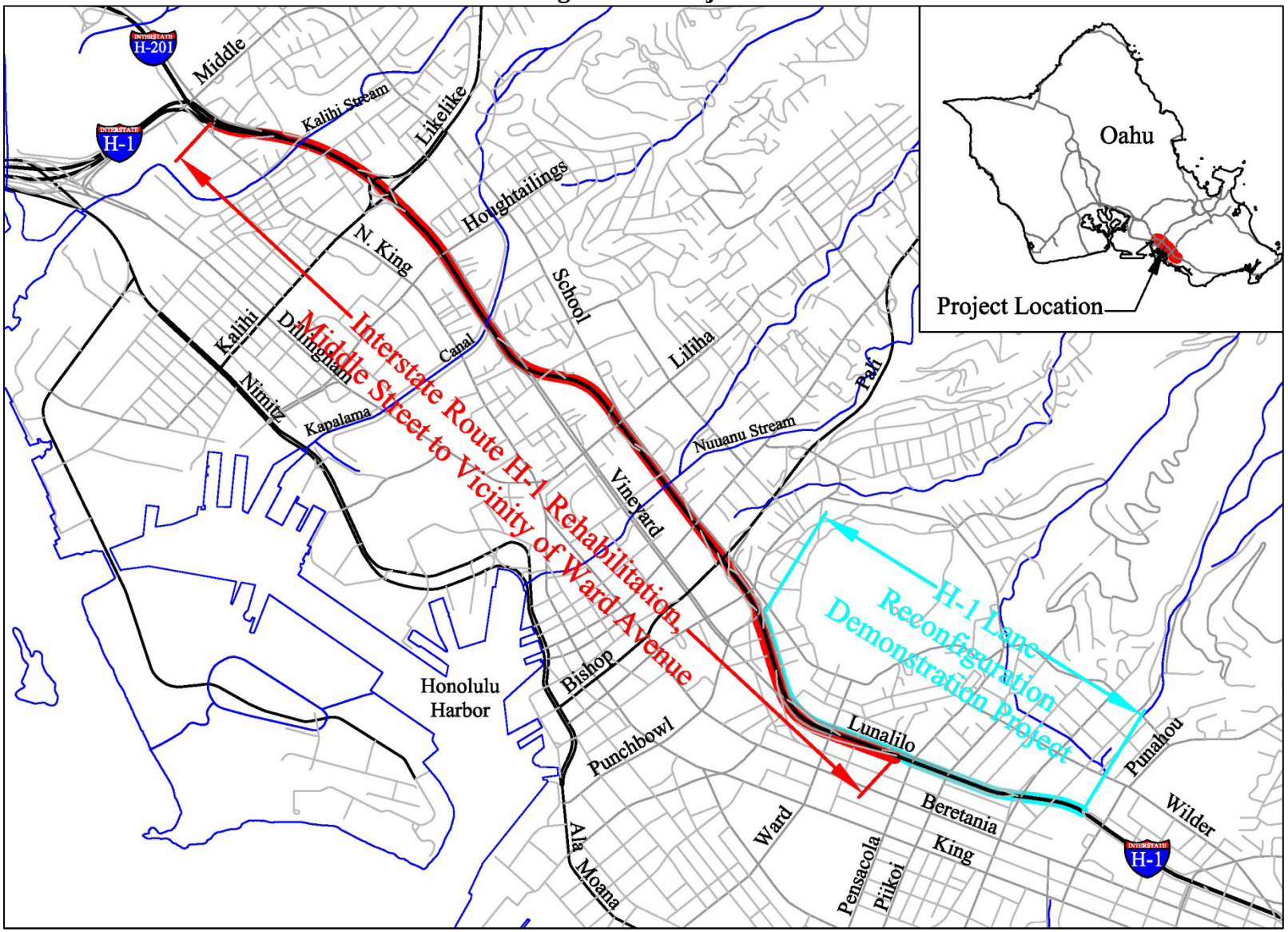
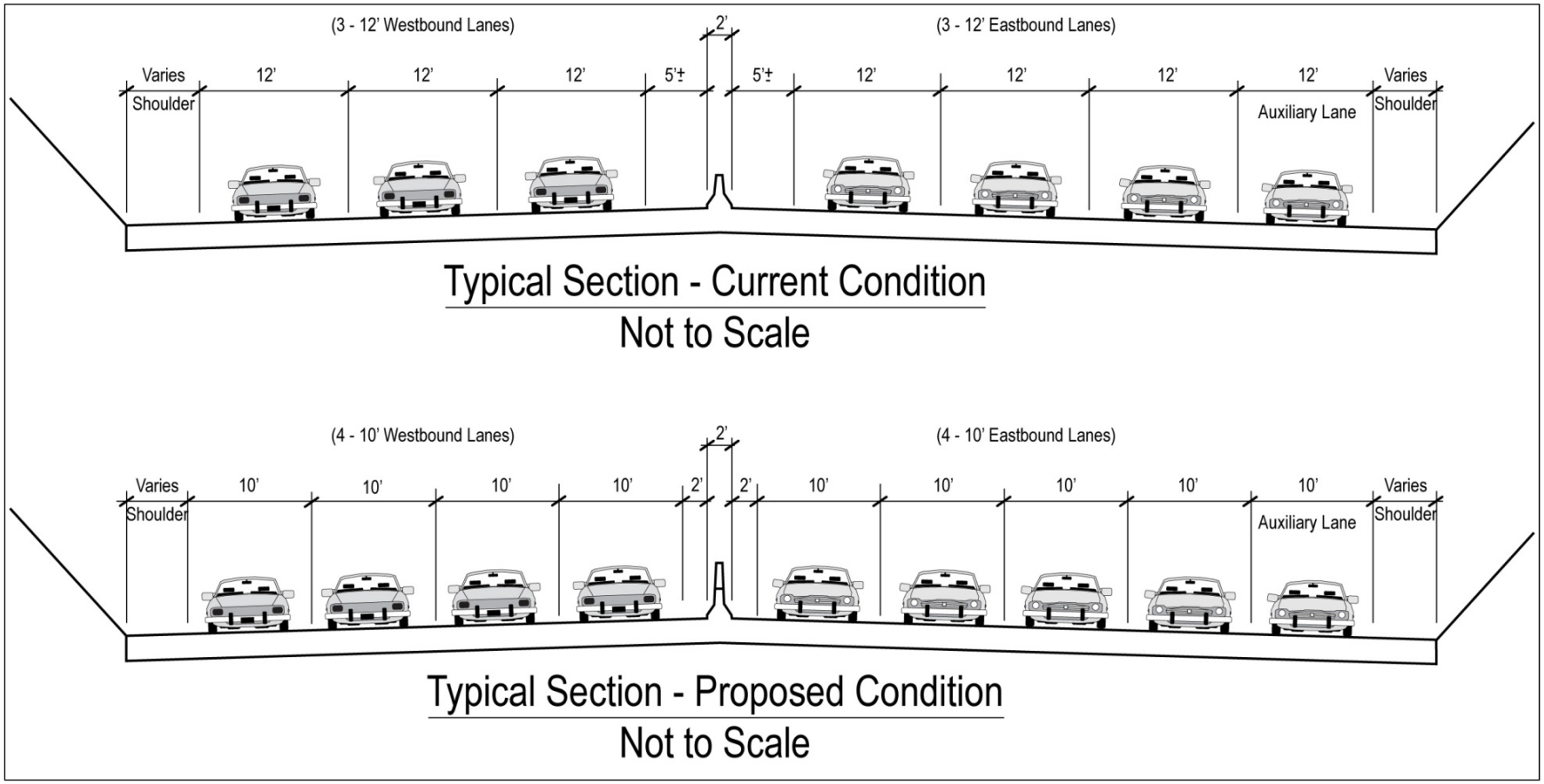


Figure 2-2. Build Alternative Cross Section of Interstate Route H-1



CHAPTER 3 EXISTING NOISE ENVIRONMENT

3.1 BACKGROUND

Noise is defined as any sound that is undesirable or interferes with normal human activities. The decibel (dB) scale is used to quantify sound intensity and represents the ratio between a given sound and the faintest sound detectable by human hearing. Because sound pressure levels vary widely within the range of human hearing, the dB scale is logarithmic. The human ear is not equally sensitive to all frequencies within the entire sound spectrum. Accordingly, noise measurements are made using an A-weighting (dBA) scale to correspond to human perceptions of noise. A-scale sound levels are currently in use in many community and city noise ordinances and in state and city highway traffic noise codes.

Time variation in noise exposure is typically accounted for as a constant energy level equivalent (Leq) for a given time period. The Leq is the constant noise level over some specified period of time that is equivalent in energy to a fluctuating (or brief) noise "averaged" over that period of time. Leq is also a function of time and is expressed as Leq (time period). For example, Leq(h), expressed in A-weighted decibels (dBA), is the calculated constant noise over one hour which is equivalent in total energy to the varying noise levels actually measured during that one hour.

3.2 NOISE CRITERIA

The HDOT Noise Policy and Abatement Guidelines implements FHWA regulations on noise abatement (23 CFR 772) for the State of Hawai‘i. The regulations and policy require that a noise analysis be performed whenever potentially affected receivers exist, either as developed or undeveloped lands for future use. The FHWA has established Noise Abatement Criteria (NAC), shown on Table 3-1, for different exterior and interior land use activities. The NAC do not constitute legally enforceable noise standards, but represent a yardstick for evaluating the effect of project noise on the surrounding community. The NAC have been adopted by the State of Hawai‘i as its standard.

Under HDOT policy, a noise impact occurs when the predicted traffic noise levels approach or exceed the NAC, or when the predicted traffic noise levels substantially exceed the existing noise levels. "Approach" means within 1 dBA less than the NAC, and "substantially exceed the existing noise levels" means an increase of at least 15 dBA. If the NAC are approached or exceeded, or if there is a substantial increase above the existing noise level, noise abatement measures must be considered.

Changes in traffic noise are assessed using human perceptions of sound level changes. Generally, changes in noise levels of less than 3 dBA are barely perceptible to most listeners, but an increase of 10 dBA is perceived as a doubling (or halving for a decrease) of noise levels. These guidelines permit estimation of an individual's probable perception of changes in noise levels.

Table 3-1. Noise Abatement Criteria (NAC)

Activity Category	Activity Leq(h) dBA[1]	Criteria [2] L10(h)	Evaluation Location	Description of Activity
A	57	60	Exterior	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B[3]	67	70	Exterior	Residential.
C[3]	67	70	Exterior	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas Section 4(f) sites, schools, televisions studios, trails, and trail crossings.
D	52	55	Interior	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios.
E[3]	72	75	Exterior	Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A-D or F.
F	----	----	----	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities, (water resources, water treatment, electrical), and warehousing.
G	----	----	----	Undeveloped lands that are not permitted.

Notes: [1] Either Leq(h) or L10(h) (but not both) may be used on a project.
[2] The Leq(h) and the L10(h) Activity Criteria values are for impact determination only, and are not design standards for noise abatement measures.
[3] Includes undeveloped lands permitted for this activity category.
L10(h) is the noise level exceeded for 10% of the time of the measurement duration (one hour).
Source: Federal Highway Administration

3.3 EXISTING AND FUTURE NOISE-SENSITIVE LAND USES

Existing and future noise sensitive land uses and activities adjacent to the H-1 Freeway Project and nearby major roadways were identified from site inspections and existing mapping. Existing land uses located along this portion of H-1 Freeway include roadways, commercial businesses, office buildings, residential buildings, mixed use buildings, schools, parks, museums, libraries, and other uses. All residences along the H-1 Freeway project area are Category B and all recreation areas, parks, schools, and similar uses are Category C. Category B and Category C activities have an exterior NAC of Leq(h) 67 dBA.

No undeveloped land that would likely be part of a future development was identified along the H-1 Freeway project area during site observations. The City and County of Honolulu Department of Planning and Permitting was contacted on November 30, 2012 regarding any permitted development located within 500 feet of the centerline of the H-1 Freeway Project area. At the time of this report no permits are on file at the City and County of Honolulu Department of Planning and Permitting for planned developments along the H-1 Freeway Project area.

Additional land use and local zoning information is provided in the Environmental Assessment (EA) for the proposed project.

3.4 NOISE MEASUREMENT SITES

Twenty-one short-term (15-minute) measurements were taken at noise sensitive sites located along the project area. The approximate locations of all 21 measurements taken at outdoor use locations from Middle Street to Ward Avenue are illustrated in Figure 3-1 and 3-2. When present, measurement locations were discussed with residents to determine the outdoor areas most frequently used. The noise measurements were performed during satisfactory weather conditions and during times when traffic on H-1 Freeway was free-flowing. The temperatures on these days ranged from 82 to 94 degrees Fahrenheit with mostly sunny skies, no precipitation, and low wind speeds during measurement periods.

HDOT was contacted to identify the need for longer-term supplemental measurements along the project corridor. At the time of this report HDOT has no complaints on file relating to traffic noise along this area of H-1 Freeway and no complaints from the community about experiencing louder nighttime traffic noise levels than during daytime hours (HDOT 2012). Site observations indicated that short-term measurement periods provided sufficient traffic noise levels with free-flow traffic conditions for noise model validation and prediction of worst-hour or loudest hour traffic noise levels.

3.4.1 Noise Measurements

Noise level measurements were conducted for 15-minute periods at 21 sites on September 18, 19, 20 and 21, 2012. These sites extend from outdoor use areas near the Ward Avenue overpass at H-1 Freeway to the east to outdoor use areas near the Kaua Street overpass at H-1 Freeway near Middle Street to the west (see Figure 3-1 and 3-2). Traffic volumes were simultaneously counted for all of the measurement sites. The traffic counts used three vehicle classifications: automobiles, medium trucks, heavy trucks, motorcycles, and buses. Vehicle speeds were observed during all measurements and the corridor was driven daily to estimate vehicle speeds during measurement periods. Noise measurements were not taken unless traffic conditions were free-flowing. Because traffic conditions are typically congested along this section of Interstate Route H-1, with weaving, geometry, and other non-volume factors affecting flow and speed, the free-flow traffic conditions are at times below the posted speed limit. All measurements were started after the morning peak hour which often results in congestion that slows traffic below the H-1 Freeway speed limit. Afternoon traffic congestion in the area is less defined resulting in less frequent periods where traffic operates below the posted speed limit. The following is a description of the noise sensitive activities at the measurement sites:

3.4.1.1 Site 1

Site 1 was measured at a single-family residence located along Magellan Avenue at the corner of Alapai Street. A 15-minute measurement was taken in the front yard approximately 10 feet from Magellan Avenue and approximately 80 feet from H-1 Freeway. H-1 Freeay is depressed in relation to Site 1; however, traffic from the freeway is the dominant noise source. The surrounding area consists of single-family and multi-family residential buildings and Dole Park. An Leq of 68.4 dBA was recorded at 10:42 a.m.

3.4.1.2 Site 2

A 15-minute measurement was taken approximately 10 feet from Kinalau Place which runs adjacent to H-1 Freeway eastbound traffic in this area. The sound level meter was located adjacent to the front yard at a single-family residence where traffic noise from the freeway is the dominant noise source. H-1 Freeway is at approximately the same elevation as Site 2. The surrounding area primarily consists of high-rise residential towers and commercial office space. An Leq of 70.3 dBA was recorded at 11:17 a.m.

3.4.1.3 Site 3

Site 3 was measured at Matsuyama Play Field which is adjacent to Kamalu Playground located between Pali Highway and Queen Emma Street. A 15-minute measurement was taken in the center of the playfield approximately 115 feet from eastbound H-1 Freeway traffic. A berm separates the playfield from H-1 Freeway in this area and prevents line-of-sight between the highway and the park; however, traffic from the freeway is the dominant noise source at Site 3. The surrounding area includes Royal School and the local YMCA. An Leq of 62.2 dBA was recorded at 12:05 p.m.

3.4.1.4 Site 4

Site 4 was measured at a multi-family residential building located on North School Street, north of Nuuanu Avenue. The measurement location was approximately 10 feet from North School Street and approximately 100 feet from H-1 mainline traffic. H-1 Freeway is depressed in relation to Site 4; however, traffic from the freeway is the dominant noise source in the area. The surrounding area consists of single-family and multi-family residential buildings and commercial businesses. An Leq of 69.8 dBA was recorded at 1:47 p.m.

3.4.1.5 Site 5

A 15-minute measurement was taken approximately 20 feet from North School Street and approximately 100 feet from mainline traffic on H-1 Freeway. The sound level meter was located adjacent to residential front yards along North School Street. Traffic noise from te freweay is the dominant noise source in this area. H-1 Freeway is depressed in relation to Site 5 and much of the surrounding area. Land use in the surrounding area consists of residential and commercial businesses. An Leq of 66.4 dBA was recorded at 2:31 p.m.

3.4.1.6 Site 6

Site 6 was measured at play fields outside Likelike Elementary School located along Palama Street. A 15-minute measurement was taken at play areas located near H-1 Freeway. H-1 Freeway is located approximately 130 feet from Site 6 and is at a higher elevation than Site 6 as it passes over Palama Street. Traffic from the freeway is the dominant noise source at Site 6. The surrounding area primarily includes residential development and limited commercial businesses located along Palama Street. An Leq of 65.4 dBA was recorded at 3:02 p.m.

3.4.1.7 Site 7

A 15-minute measurement was taken in the front yard of a residence located along Kiapu Place, approximately 55 feet from H-1 Freewaymainline traffic. H-1 Freeway is depressed in relation

to the surrounding area; however it is the dominant noise source. The surrounding area primarily consists of residences with commercial businesses located on Liliha Street. An Leq of 66.4 dBA was recorded at 3:44 p.m.

3.4.1.8 Site 8

Site 8 was measured adjacent to residential back yards located along North School Street. H-1 Freeway is located approximately 45 feet from Site 8 and is at a lower elevation than Site 8 as the freeway is depressed in this area. Traffic from H-1 Freeway is the dominant noise source at Site 8. The surrounding area primarily includes residential development and limited commercial businesses located along North School Street. An Leq of 70.8 dBA was recorded at 4:05 p.m.

3.4.1.9 Site 9

A 15-minute measurement was taken in the front yard of a residence located along Kamehameha IV Road, approximately 60 feet from H-1 Freeway. H-1 Freeway is depressed in relation to the surrounding area; however, the freeway is the dominant noise source. The surrounding area consists of residential development. An Leq of 65.6 dBA was recorded at 5:18 p.m.

3.4.1.10 Site 10

Site 10 was measured at an outdoor use area at Kalihi Union School. The sound level meter for this measurement was located approximately 80 feet from H-1 Freeway traffic. H-1 Freeway is depressed in relation to Site 10; however, traffic from the freeway is the dominant noise source in the area. The surrounding area primarily consists of single-family and multi-family residences. An Leq of 67.4 dBA was recorded at 9:44 a.m.

3.4.1.11 Site 11

A 15-minute measurement was taken in the front yard of a residence located along Richard Lane, approximately 50 feet from vehicles traveling on H-1 Freeway. H-1 Freeway is located at approximately the same elevation in the area of Site 11 which provides a direct line-of-sight to the freeway traffic at first row residences in this area. H-1 Freeway is the dominant noise source in this area. The surrounding area consists of single and multi-family residences. An Leq of 70.7 dBA was recorded at 10:15 a.m.

3.4.1.12 Site 12

Site 12 was measured adjacent to an outdoor use area at a residence located along Nakuina Street. The measurement location was approximately 35 feet from the Kalihi Street freeway on-ramp. H-1 Freeway is depressed in relation to Site 12; however traffic from the freeway is the dominant noise source in the area. The surrounding area consists of single and multi-family development. An Leq of 74.2 dBA was recorded at 10:46 a.m.

3.4.1.13 Site 13

Site 13 was measured at an unnamed play ground located at Nakuina Street and Beckley Street. The sound level meter for this measurement was located approximately 85 feet from H-1 Freeway traffic. H-1 Freeway is depressed in relation to Site 13; however, traffic from the freeway is the dominant noise source in the area. The surrounding area consists of residential

development and commercial businesses located on Gulick Avenue. An Leq of 67.4 dBA was recorded at 11:15 a.m.

3.4.1.14 Site 14

A 15-minute measurement was taken in the front yard of a second row residence located along Kapalama Avenue, approximately 155 feet from vehicles traveling on H-1 Freeway. H-1 Freeway is located at similar elevation in relation to Site 14. This second row residence has a direct line-of-sight to the freeway traffic whereas many first row residences in this area do not as local terrain shields H-1 Freeway. H-1 Freeway is the dominant noise source in this area. The surrounding area consists of single-family residences and the Jabulka Pavilion and Planetarium. An Leq of 59.5 dBA was recorded at 11:50 a.m.

3.4.1.15 Site 15

Site 15 was measured at athletic fields located at Farrington High School. The sound level meter for this measurement was located approximately 150 feet from H-1 Freeway traffic. H-1 Freeway is located slightly higher than Site 15; however traffic from the freeway is the dominant noise source in the area. The surrounding area consists of play fields, sports courts, and the high school campus. An Leq of 64.6 dBA was recorded at 2:01 p.m.

3.4.1.16 Site 16

Site 16 was measured at an outdoor use space facing H-1 Freeway at a residence located along Olomea Street. The sound level meter for this measurement was located approximately 10 feet from Olomea Street and approximately 50 feet from eastbound H-1 Freeway mainline traffic. H-1 Freeway is at approximately the same elevation as Site 16 and the surrounding area. Traffic on the freeway is the dominant noise source in the area. The surrounding area consists of residential development. An Leq of 71.7 dBA was recorded at 2:38 p.m.

3.4.1.17 Site 17

A 15-minute measurement was taken in the front yard of a residence located along Olomea Street, approximately 15 feet from Olomea Street and 150 feet from vehicles traveling on H-1 Freeway. H-1 Freeway is located at similar elevation in relation to Site 17. The freeway is the dominant noise source in this area. The surrounding area consists of residential development. An Leq of 70.8 dBA was recorded at 3:03 p.m.

3.4.1.18 Site 18

Site 18 was measured at an outdoor use space facing H-1 Freeway at a residence located along Halona Street. The sound level meter for this measurement was located approximately 10 feet from Holona Street and approximately 50 feet from westbound H-1 Freeway. H-1 Freeay is at approximately the same elevation as Site 18 and the surrounding area. Traffic on the freeway is the dominant noise source in the area. The surrounding area consists of residential development and Damien Memorial High School. An Leq of 71.4 dBA was recorded at 3:44 p.m.

3.4.1.19 Site 19

A 15-minute measurement was taken in the front yard of a residence located along Magellan Avenue, approximately 15 feet from Magellan Avenue and 75 feet from vehicles traveling on H-1 Freeway. H-1 Freeway is depressed in this area and is lower in elevation compared with Site 19. The freeway is the dominant noise source in this area. The surrounding area consists of residential and commercial development. An Leq of 71.0 dBA was recorded at 9:10 a.m.

3.4.1.20 Site 20

Site 20 was measured at an outdoor use area at a multi-family residential building located at South School Street at the Pali Highway. The measurement location was approximately 20 feet from South School Street and approximately 150 feet from H-1 Freeway mainline traffic. H-1 Freeway is depressed in relation to Site 20; however, traffic from the freeway is the dominant noise source in the area. The surrounding area consists of single-family and multi-family residential buildings and commercial businesses. A Leq of 69.3 dBA was recorded at 9:45 a.m.

3.4.1.21 Site 21

Site 21 was measured at a park benches overlooking H-1 Freeway at Foster Botanical Garden that are located approximately 40 feet from H-1 Freeway. H-1 Freeway is depressed in this area; however traffic from the freeway is the dominant noise source in the area. The surrounding area consists of garden and park space. An Leq of 70.7 dBA was recorded at 10:30 a.m.

3.5 MODEL CALIBRATION

FHWA Traffic Noise Model (TNM) version 2.5 was used to model existing traffic noise levels at the measurement sites along the existing lane configuration of H-1 Freeway and the sites along the proposed H-1 Freeway lane configuration (the Build Alternative) (see Figure 3-1 and 3-2). The model estimates the traffic noise level at a receptor location resulting from a series of straight-line roadway segments. Noise emissions from free-flowing traffic depend on the number of automobiles, medium trucks, and heavy trucks per hour; vehicular speed; and reference noise emission levels of specified vehicles. TNM also considers effects of intervening barriers, topography, trees, and atmospheric absorption. By intent and design, noise from sources other than traffic is not included. Therefore, when non-traffic noise, such as aircraft, is considerable in an area, the TNM results can be less than the measured noise levels.

Base maps were exported as DXF files and imported into the TNM package. In addition, ArcGIS was used to develop the TNM model. Major roadways, retaining walls, topographical features, building rows, and sensitive receptors were digitized into the model. The United States Geological Survey (USGS) 7.5-minute Digital Elevation Model was also used (USGS 2004).

Traffic volumes counted during the short-term measurement periods were scaled up to one-hour volumes and entered into the model along with the measured vehicle speeds to calibrate the model. There is reasonable agreement between measured and modeled noise levels (within 3.0 dBA) for all the measured sites near H-1 Freeway. Table 3-2 compares measured noise levels and levels modeled in the TNM for all measured sites.

Table 3-2. Noise Measurement Data and TNM Model Validation

Site ID	Site Location	Land Use	Date of Measurement and Start Time	Measured Leq(h), dBA	Modeled Noise Level for Calibration Leq(h), dBA	Difference between Modeled and Measured Noise Level Leq(h), dBA
1	1401 Alapai St	Residential	9/18/12 10:42 a.m.	68	68	0
2	745 Kinalau Pl	Residential	9/18/12 11:17 a.m.	70	71	1
3	Matsuyama Field	Park	9/18/12 12:05 p.m.	62	64	2
4	50 N School St	Residential	9/18/12 1:47 p.m.	70	71	1
5	Puuhue Pl / N School St	Residential	9/18/12 2:31 p.m.	66	67	1
6	Likelike Elementary School	School	9/18/12 3:02 p.m.	65	67	2
7	521 Kiapu Pl	Residential	9/18/12 3:44 p.m.	66	66	0
8	N School St / Kiapu Pl	Residential	9/18/12 4:05 p.m.	71	72	1
9	Kamehameha IV Rd, #8	Residential	9/18/12 5:18 p.m.	66	66	0
10	Kalihi Union School	School	9/19/12 9:44 a.m.	67	69	2
11	1212 Richard Lane	Residential	9/19/12 10:15 a.m.	71	74	3
12	1242 Nakuina St	Residential	9/19/12 10:46 a.m.	74	74	0
13	Park at Nakuina St / Beckley St	Park	9/19/12 11:15 a.m.	67	67	0
14	1269 Kapalama	Residential	9/19/12 11:50 a.m.	60	62	2
15	Farrington High School	School	9/19/12 2:01 p.m.	65	64	-1
16	1179 Olomea St	Residential	9/19/12 2:38 p.m.	72	72	0
17	1081 Olomea St	Residential	9/19/12 3:03 p.m.	71	69	2
18	1116 Halona St	Residential	9/19/12 3:44 p.m.	71	72	1
19	326 Magellan Ave	Residential	9/20/12 9:10 a.m.	71	70	-1
20	112 S School St	Residential	9/21/12 9:45 a.m.	69	70	1
21	Foster Botanical Garden	Park	9/21/12 10:30 a.m.	71	71	0

Note : All measurements were taken at outdoor use areas for 15 minutes
Modeled Noise Levels Leq(h) are within 3 dBA of measured values indicating the model is correctly calibrated.

HDOT suggests traffic data used for existing and design year noise predictions should represent the Design Hour Volume or the peak truck traffic hour or the maximum hourly volume under Level of Service C, depending on which would result in the loudest condition (HDOT 2011).

Traffic data used for Existing and Future Year 2035 noise predictions were representative of the maximum hourly traffic volumes under Level of Service C (Table 3-3). Modeled H-1 Freeway vehicle classifications were generally consistent with traffic counted during measurements with 92% automobiles, 4% medium trucks, 2% heavy trucks, 1% motorcycles, and 1% buses.

Forty-three additional sites were added to the model to supplement the measured sites and describe noise levels at additional areas along the H-1 Freeway Project area. The approximate locations of the modeled sites are illustrated in Figure 3-1 and Figure 3-2.

3.6 MODELED TRAFFIC EXISTING NOISIEST TRAFFIC HOUR

Table 3-3. Existing Conditions Modeled Traffic

Roadway	Between Cross Street	Between Cross Street	WB Vehicles per Hour	EB Vehicles per Hour	Posted Speed Limit (MPH)
H-1 Freeway	Ward Avenue	Middle Street	5,250	5,250	50
H-1 Freeway Off- and On-Ramps	Ward Avenue	Middle Street	1,000	1,000	35

Note: Three H-1 Freeway lanes in each direction
WB = Westbound
EB = Eastbound

3.7 RESULTS OF EXISTING NOISE MEASUREMENTS

Table 3-4 presents the modeled existing worst-hour traffic noise levels, the number of receptors represented by each measurement site, and the NAC for each of the short-term and modeled measurement locations. Worst-hour traffic noise levels for residential areas range from 58 dBA to 79 dBA depending on the proximity of the receiver to the roadway traffic and the presence of buildings and topography providing noise attenuation between the receiver and the roadway. The worst-hour traffic noise levels approach or exceed the NAC at 53 of the 64 measurement sites representing 594 residences, five parks, five schools, and two places of worship.

Figure 3-1. Noise Measurement and Modeling Locations and Modeled Existing Noise Levels (H-1 Freeway, Ward Avenue to Liliha Street)

Figure 3-2. Noise Measurement and Modeling Locations and Modeled Existing Noise Levels (H-1 Freeway, Liliha Street to Middle Street)

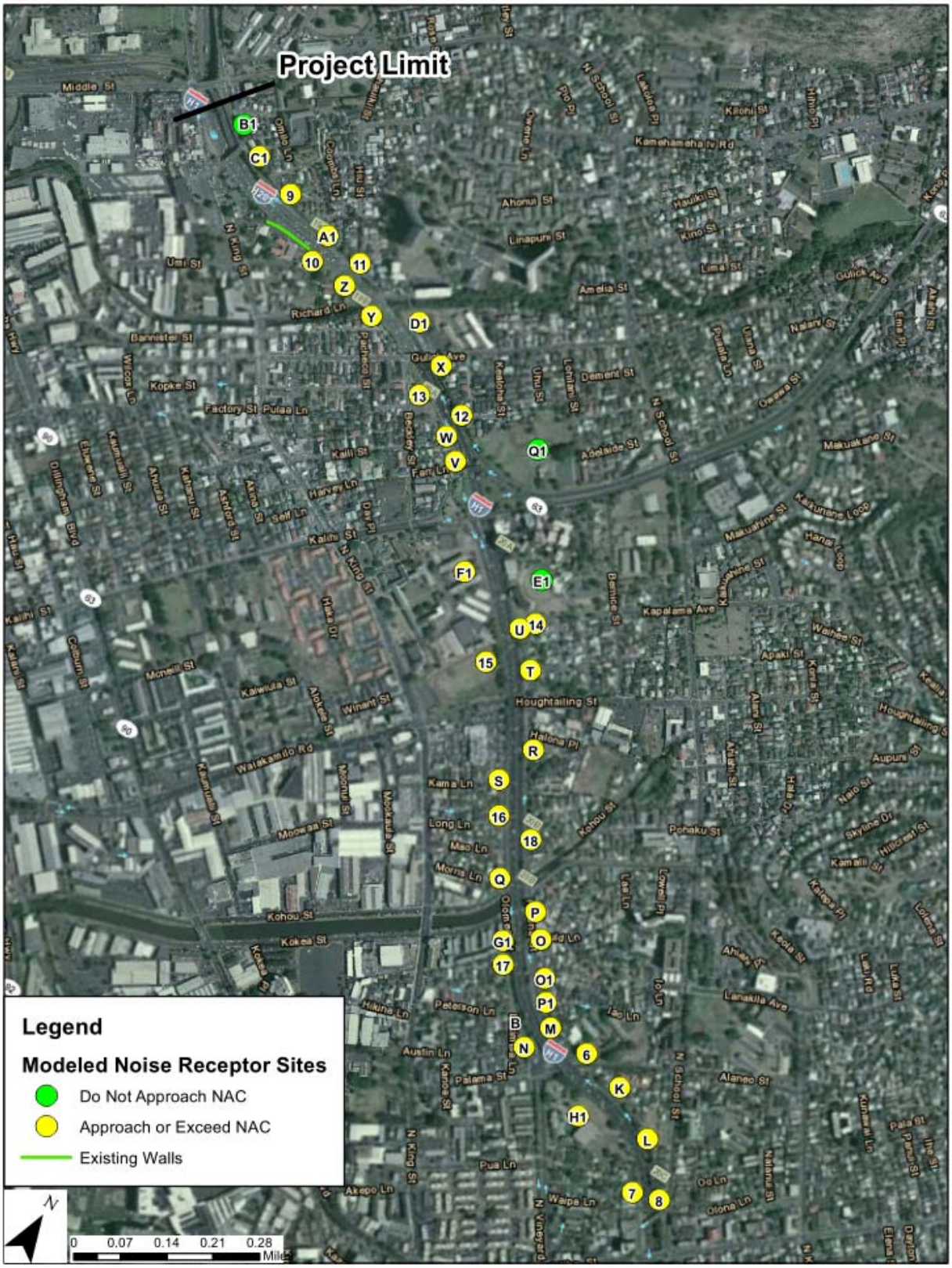


Table 3-4. Predicted Existing Worst-Hour Traffic Noise Levels

Site ID	Description of Receivers Represented	Number of Receivers Represented	HDOT Noise Abatement Category (Criterion)*	Modeled Existing Worst-Hour Leq(h), dBA	Impact Type* (S, A/E, or None)
1	Residences on Captain Cook Ave and Magellan Ave between Emerson St and Malele St	120	B	**69**	A/E
2	Residences on Kinalau Pl west of Freeland Pl	2	B	**71**	A/E
3	Matsuyama Field and Royal School	Park/School	C	65	None
4	Residences and Commercial on N School St between Nuuanu and Lili'uokalani Botanical Garden	11	B/E	**71**	A/E
5	Residences and Commercial on N School St between Frog Ln and Puuhue Pl	5	B/E	**67**	A/E
6	Likelike Elementary School	School	C	**70**	A/E
7	Residences on Kiapu Pl north of Liliha St	17	B	**70**	A/E
8	Residences on N School St between Kiapu Pl and Panalaau St	6	B	**75**	A/E
9	Residences on Kamehameha IV Rd north of H-1	8	B	**72**	A/E
10	Kalihi Union School	School	C	**70**	A/E
11	Residences west of Richard Lane and north of H-1	14	B	**76**	A/E
12	Residences Nakuina St north of Kamehameha Park	6	B	**76**	A/E
13	Park at Nakuina St / Beckley St	Park	C	**69**	A/E
14	2nd Row Residences on Kapalama Ave	5	B	**66**	A/E
15	Athletic Fields at Farrington High School	School	C	**67**	A/E
16	Residences on Olomea St between Mao Ln and Kama Ln	10	B	**75**	A/E
17	Residences on Olomea St north of Palama St	23	B	**71**	A/E
18	Residences on Halona St between Kohou St and Kaauwai Pl and Damien Memorial High School	6	B/C	**76**	A/E
19	Residences on Magellan Ave between Miller St and Pele St	58	B	**69**	A/E
20	Residences and Commercial on S School St between Lusitana St and Pali Highway	16	B/E	**69**	A/E
21	Foster Botanical Garden	Park	C	**71**	A/E
A	Residences on Kinau St between Ward Ave and Freeland Pl	98	B	**67**	A/E
B	Residences on Lunalilo St between Ward Ave and Emerson St	8	B	**72**	A/E
C	Residences on Magellan Ave between Frear St and Miller St and Dole Park	6 + Park	B/C	**68**	A/E
D	Residences on Magellan Ave between Pele St and Lolani Ave	22	B	**69**	A/E
E	Residences on Captain Cook Ave and Miller St	8	B	**76**	A/E

Site ID	Description of Receivers Represented	Number of Receivers Represented	HDOT Noise Abatement Category (Criterion)*	Modeled Existing Worst-Hour Leq(h), dBA	Impact Type* (S, A/E, or None)
F	Residences on Lusitana St between Miller St and Pele St	6	B	**77**	A/E
G	Residences on Lusitana St between Pele St and Punchbowl St	19	B	**68**	A/E
H	Residences on Iolani Ave between Kamamalu Ave and Lusitana St	14	B	**71**	A/E
I	Residences on H-1 between Pali Hwy and Nuuanu Ave and Queen Emma Gardens	44 + Park	B/C	62	None
J	Residences on N School St between Stillman Ln and Frog Ln	5	B	**71**	A/E
K	Residences on Panalaau St and Sing Loy Ln	4	B	**66**	A/E
L	Residences on N School St between Kiapu Pl and Panalaau St	4	B	**75**	A/E
M	Residences on Halona St north of Palama St	5	B	**72**	A/E
N	Residences and Hawai‘i First Samoan Assembly Church on Olomea St and Palama St	5 + Church	B/C	**68**	A/E
O	Residences on Halona St at Auld Ln	4	B	**71**	A/E
P	Residences on Halona St between Auld Ln and Kokea St	6	B	**74**	A/E
Q	Residences on Olomea St between Kohou St and Mao Ln	8	B	**74**	A/E
R	Residences on Halona St between Kaauwai Pl and Houghtailing St	12	B	**74**	A/E
S	Hawai‘i Kotohira Jinsha – Hawai‘i Dazaifu Tenmangu on Kama Ln	Temple	C	**74**	A/E
T	Residences on Kapalama Ave and Peter Buck Mini Park	3 + Park	B	**76**	A/E
U	Residences on Kapalama Ave south of Planetarium	7	B	**78**	A/E
V	Residences on Kaili St west of H-1	6	B	**77**	A/E
W	Residences on Nakuina St west of H-1	4	B	**77**	A/E
X	Residences on Pahukui St south of Gulick Ave	8	B	**71**	A/E
Y	Residences on Gulick Ave and Pinkham St west of H-1	4	B	**77**	A/E
Z	Residences on Richard Ln and Puanani Ln	8	B	**68**	A/E
A1	Residences on Kamehameha IV Rd north of H-1	4	B	**79**	A/E
B1	Residences on Middle St north of Ola Ln	6	B	65	None
C1	Residences on Ola Ln north of Kamehameha IV Rd	3	B	**69**	A/E
D1	Kalihi Waena Elementary School	School	C	**67**	A/E
E1	Jabulka Pavillion & Planetarium	Park	C	64	None
F1	Outdoor area at Farrington High School	School	C	**67**	A/E
G1	Residences on Olomea St and Kokea St	12	B	**71**	A/E
H1	Palama Settlement	Other	E	68	None

Site ID	Description of Receivers Represented	Number of Receivers Represented	HDOT Noise Abatement Category (Criterion)*	Modeled Existing Worst-Hour Leq(h), dBA	Impact Type* (S, A/E, or None)
I1	Kauluwela Elementary School / Liliha Public Library	School and Library	C	62	None
J1	Kauluwela Elementary School	School	C	58	None
K1	Foster Botanical Garden	Park	C	59	None
L1	Foster Botanical Garden	Park	C	60	None
M1	Residences and Commercial on S School St between Pali Hwy and Nuuanu Ave	8	B/E	62	None
N1	Lili'uokalani Botanical Garden	Park	C	**69**	A/E
O1	Residences on Halona St between Holona and Iao St	2	B	**71**	A/E
P1	Residences on Halona St north of Iao St	2	B	**71**	A/E
Q1	Kamehameha Park	Park	C	58	None

Note : See Table 3-1 for descriptions of Noise Abatement Categories.
Bold = level approaches or exceeds the NAC.
A "Receiver" is an area of frequent human outdoor activity, homes, apartments, motel, hotels, etc.
*Impact Type: S = Substantial Increase (15 dBA or more), A/E = Approach or Exceed NAC, Sites that begin with letters are modeled only sites.

CHAPTER 4 FUTURE TRAFFIC NOISE LEVELS

The noise impact analysis considers traffic noise levels at receivers for the two alternatives.

4.1 PREDICTION METHODOLOGY

FHWA Traffic Noise Model (TNM) was used to model the noise levels in 2035 at 64 sites for the No-Build Alternative along Route H-1. The No-Build Alternative is used as the baseline of future traffic noise levels. Noise levels for the No-Build Alternative are identical to existing conditions noise levels. This is because (a) the lane configuration would remain unchanged from the existing condition in the No-Build Alternative; (b) vehicle noise is greatest when the facility operates at LOS C; and (c) the H-1 Freeway currently operates at Level of Service C much of the time, including when noise measurements were conducted for this study.

Input variables to noise modeling and analysis include traffic volumes, speeds and vehicle fleet mix (auto, medium truck, heavy truck, motorcycle, and bus percentages). The noise analysis considers the peak traffic hour as the noisiest hour of the day. The number of vehicles expected to travel on H-1 Freeway in 2035 may be greater than existing conditions, but the greatest level of traffic noise would remain the same as existing conditions. Table 4-1 summarizes maximum hourly traffic volumes under Level of Service C currently and in 2035 under the No-Build Alternative.

Table 4-1. No-Build Alternative 2035 Traffic Volumes

Roadway	Between Cross Street	Between Cross Street	WB Vehicles per Hour	EB Vehicles per Hour	Posted Speed Limit (MPH)
H-1 Freeway	Ward Avenue	Middle Street	5,250	5,250	50
H-1 Freeway Off- and On-Ramps	Ward Avenue	Middle Street	1,000	1,000	35

Note: Three H-1 Freeway lanes in each direction
WB = Westbound
EB = Eastbound

Table 4-2 summarizes maximum hourly traffic volumes under Level of Serivce C should the proposed restriping and speed limit change be implemented.

Table 4-2. Build Alternative 2035 Traffic Volumes

Roadway	Between		WB Vehicles per Hour	EB Vehicles per Hour	Posted Speed Limit (MPH)
	Cross Street	Cross Street			
H-1 Freeway	Ward Avenue	Middle Street	6,000	6,000	45
H-1 Freeway Off and On-Ramps	Ward Avenue	Middle Street	1,000	1,000	35

Note: Four H-1Freeway lanes in each direction
WB = Westbound
EB = Eastbound

Future vehicle mix is predicted to be 92 percent automobiles, four percent medium trucks, two percent heavy trucks, one percent motorcycles, and one percent buses for all roadways. Vehicle mix is based on traffic counts taken during the noise measurements (Table 3-3).

4.2 NOISE IMPACT ANALYSIS

In terms of the one-hour Leq(h) noise descriptor, a noise impact could potentially require mitigation if either of the following conditions is predicted to occur:

- Future year traffic noise approaches or exceeds the FHWA NAC; or
- Future year traffic noise substantially exceeds (15 dBA or more) the existing ambient noise level.

4.2.1 No-Build Alternative

Under the No-Build Alternative, predicted 2035 traffic noise levels at the receiver sites are predicted to be the same as existing conditions as the same maximum vehicle per lane hour traffic volumes and lane configuration were used for both scenarios. The NAC of Leq(h) 67 dBA is predicted to be approached or exceeded at the same 53 modeled sites as the existing condition representing 594 residences, five parks, five schools, and two places of worship (Table 4-3).

4.2.2 Build Alternative

Predicted 2035 traffic noise levels for the Build Alternative are expected to be within 2 to 3 dBA of existing and No-Build noise levels. The NAC of 67 dBA Leq(h) is predicted to be approached or exceeded at 49 modeled sites representing 590 residences, five parks, two schools, and two places of worship (Table 4-3). An increase of 1 to 2 dBA in Build Alternative noise levels is predicted over the existing condition at two of the 64 total sites. A decrease of 1 to 3 dBA or no change is predicted at the majority of the 64 total sites. A decrease in Build Alternative noise levels at several sites would result from lowering the H-1 Freeway speed limit in the project area from 50 mph currently to 45 mph with the proposed project. There would be no substantial noise increase impacts as a result of the project.

Minority and low-income communities are represented all along the H-1 Project area. Existing and future traffic noise levels are generally consistent along the H-1 Project area and were not identified to disproportionately impact minority or low-income communities.

Figure 4-1. Modeled Future Build Noise Levels (H-1 Freeway, Ward Avenue to Liliha Street)

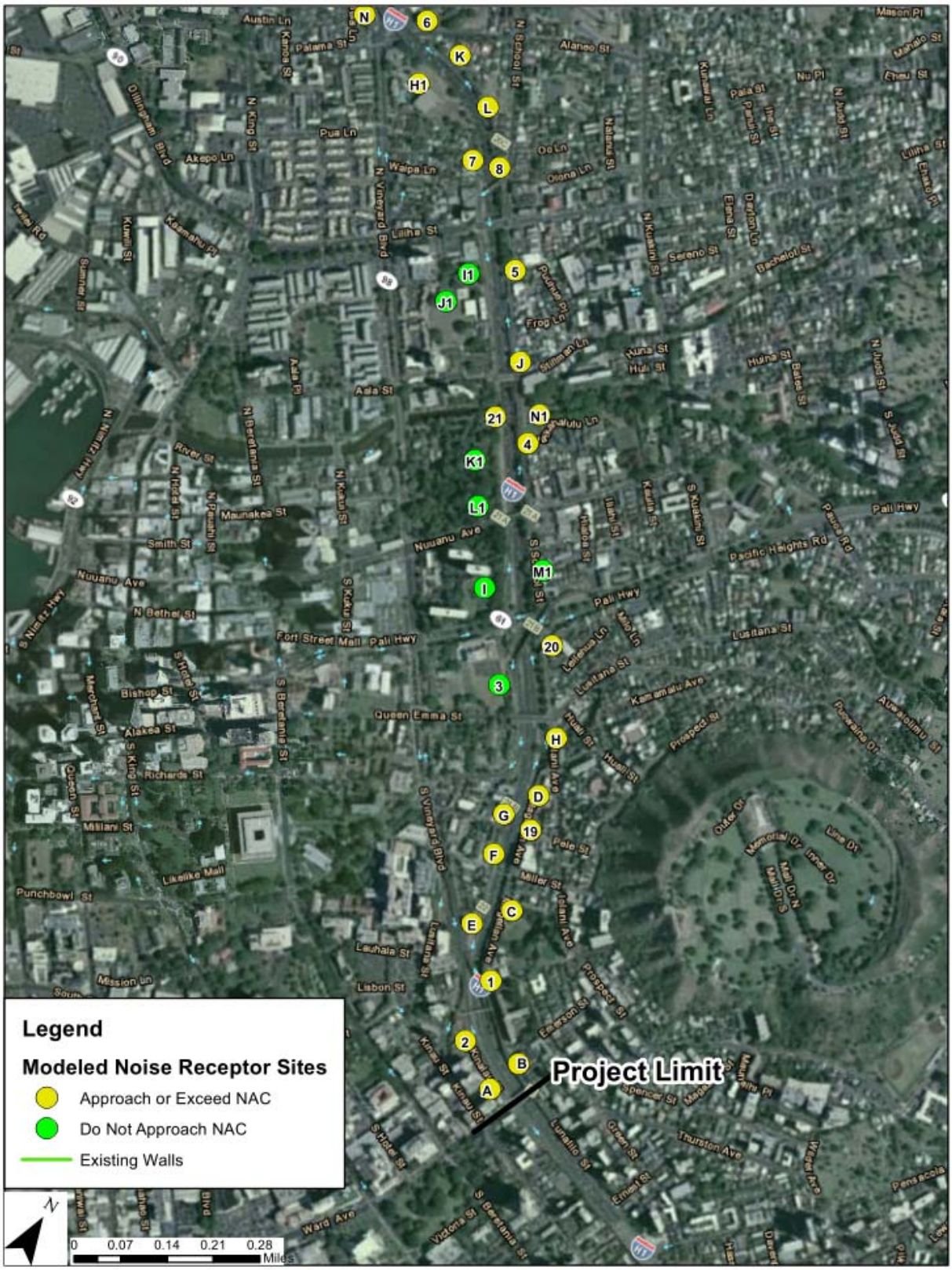


Figure 4-2. Modeled Future Build Noise Levels (H-1 Freeway, Liliha Street to Middle Street)

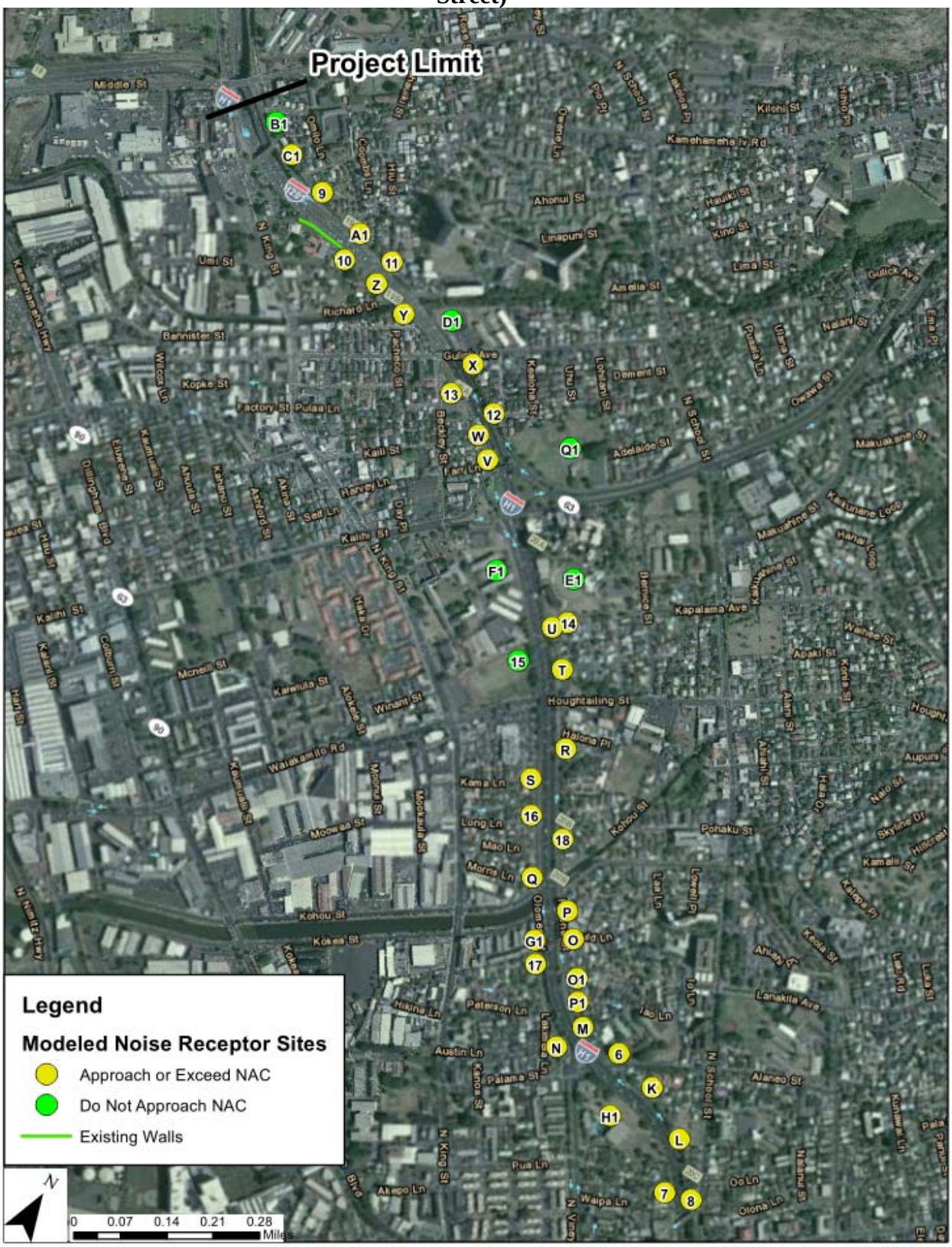


Table 4-3. Existing, No-Build, and Build Worst-Hour Traffic Noise Levels

Site ID	Location	Modeled Existing and No-Build Alternative Worst-Hour Leq(h), dBA	Modeled 2035 Build Alternative Worst-Hour Leq(h), dBA	Leq(h), dBA Increase (+) or Decrease (-)	Noise Abatement Category (Criterion)	2035 Build Impact Type* (S, A/E, or None)
1	Residences on Captain Cook Ave and Magellan Ave between Emerson St and Malele St	**69**	**69**	0	B	A/E
2	Residences on Kinalau Pl west of Freeland Pl	**71**	**71**	0	B	A/E
3	Matsuyama Field and Royal School	65	65	0	C	None
4	Residences and Commercial on N School St between Nuuanu and Lili'uokalani Botanical Garden	**71**	**70**	-1	B/E	A/E
5	Residences and Commercial on N School St between Frog Ln and Puuhue Pl	**67**	**66**	-1	B/E	A/E
6	Likelike Elementary School	**70**	**69**	-1	C	A/E
7	Residences on Kiapu Pl north of Liliha St	**70**	**71**	+1	B	A/E
8	Residences on N School St between Kiapu Pl and Panalaau St	**75**	**75**	0	B	A/E
9	Residences on Kamehameha IV Rd north of H-1	**72**	**69**	-3	B	A/E
10	Kalihi Union School	**70**	**70**	0	C	A/E
11	Residences west of Richard Lane and north of H-1	**76**	**75**	-1	B	A/E
12	Residences Nakuina St north of Kamehameha Park	**76**	**75**	-1	B	A/E
13	Park at Nakuina St / Beckley St	**69**	**68**	-1	C	A/E
14	2nd Row Residences on Kapalama Ave	**66**	**68**	+2	B	A/E
15	Athletic Fields at Farrington High School	**67**	64	-3	C	None
16	Residences on Olomea St between Mao Ln and Kama Ln	**75**	**73**	-2	B	A/E
17	Residences on Olomea St north of Palama St	**71**	**70**	-1	B	A/E
18	Residences on Halona St between Kohou St and Kaauwai Pl and Damien Memorial High School	**76**	**75**	-1	B/C	A/E
19	Residences on Magellan Ave between Miller St and Pele St	**69**	**68**	-1	B	A/E
20	Residences and Commercial on S School St between Lusitana St and Pali Highway	**69**	**68**	-1	B/E	A/E
21	Foster Botanical Garden	**71**	**70**	-1	C	A/E
A	Residences on Kinau St between Ward Ave and Freeland Pl	**67**	**66**	-1	B	A/E

Site ID	Location	Modeled Existing and No-Build Alternative Worst-Hour Leq(h), dBA	Modeled 2035 Build Alternative Worst-Hour Leq(h), dBA	Leq(h), dBA Increase (+) or Decrease (-)	Noise Abatement Category (Criterion)	2035 Build Impact Type* (S, A/E, or None)
B	Residences on Lunalilo St between Ward Ave and Emerson St	**72**	**71**	-1	B	A/E
C	Residences on Magellan Ave between Frear St and Miller St and Dole Park	**68**	**68**	0	B/C	A/E
D	Residences on Magellan Ave between Pele St and Iolani Ave	**69**	**68**	-1	B	A/E
E	Residences on Captain Cook Ave and Miller St	**76**	**76**	0	B	A/E
F	Residences on Lusitana St between Miller St and Pele St	**77**	**76**	-1	B	A/E
G	Residences on Lusitana St between Pele St and Punchbowl St	**68**	**67**	-1	B	A/E
H	Residences on Lolani Ave between Kamamalu Ave and Lusitana St	**71**	**70**	-1	B	A/E
I	Residences on H-1 between Pali Hwy and Nuuanu Ave and Queen Emma Gardens	62	62	0	B/C	None
J	Residences on N School St between Stillman Ln and Frog Ln	**71**	**69**	-2	B	A/E
K	Residences on Panalaau St and Sing Loy Ln	**66**	65	-1	B	None
L	Residences on N School St between Kiapu Pl and Panalaau St	**75**	**75**	0	B	A/E
M	Residences on Halona St north of Palama St	**72**	**70**	-2	B	A/E
N	Residences and Hawai‘i First Samoan Assembly Church on Olomea St and Palama St	**68**	**68**	0	B/C	A/E
O	Residences on Halona St at Auld Ln	**71**	**71**	0	B	A/E
P	Residences on Halona St between Auld Ln and Kokea St	**74**	**74**	0	B	A/E
Q	Residences on Olomea St between Kohou St and Mao Ln	**74**	**73**	-1	B	A/E
R	Residences on Halona St between Kaauwai Pl and Houghtailing St	**74**	**71**	-3	B	A/E
S	Hawai‘i Kotohira Jinsha – Hawai‘i Dazaifu Tenmangu on Kama Ln	**74**	**72**	-2	C	A/E
T	Residences on Kapalama Ave and Peter Buck Mini Park	**76**	**74**	-2	B	A/E
U	Residences on Kapalama Ave south of Planetarium	**78**	**77**	-1	B	A/E

Site ID	Location	Modeled Existing and No-Build Alternative Worst-Hour Leq(h), dBA	Modeled 2035 Build Alternative Worst-Hour Leq(h), dBA	Leq(h), dBA Increase (+) or Decrease (-)	Noise Abatement Category (Criterion)	2035 Build Impact Type* (S, A/E, or None)
V	Residences on Kaili St west of H-1	**77**	**76**	-1	B	A/E
W	Residences on Nakuina St west of H-1	**77**	**75**	-2	B	A/E
X	Residences on Pahukui St south of Gulick Ave	**71**	**69**	-2	B	A/E
Y	Residences on Gulick Ave and Pinkham St west of H-1	**77**	**75**	-2	B	A/E
Z	Residences on Richard Ln and Puanani Ln	**68**	**68**	0	B	A/E
A1	Residences on Kamehameha IV Rd north of H-1	**79**	**78**	-1	B	A/E
B1	Residences on Middle St north of Ola Ln	65	64	-1	B	None
C1	Residences on Ola Ln north of Kamehameha IV Rd	**69**	**67**	-2	B	A/E
D1	Kalihi Waena Elementary School	**67**	65	-2	C	None
E1	Jabulka Pavillion & Planetarium	64	64	0	C	None
F1	Outdoor area at Farrington High School	**67**	65	-2	C	None
G1	Residences on Olomea St and Kokea St	**71**	**71**	0	B	A/E
H1	Palama Settlement	68	66	-2	E	None
I1	Kauluwela Elementary School / Liliha Public Library	62	62	0	C	None
J1	Kauluwela Elementary School	58	57	-1	C	None
K1	Foster Botanical Garden	59	59	0	C	None
L1	Foster Botanical Garden	60	60	0	C	None
M1	Residences and Commercial on S School St between Pali Hwy and Nuuanu Ave	62	62	0	B/E	None
N1	Lili'uokalani Botanical Garden	**69**	**68**	-1	C	A/E
O1	Residences on Halona St between Holona and Iao St	**71**	**70**	-1	B	A/E
P1	Residences on Halona St north of Iao St	**71**	**70**	-1	B	A/E
Q1	Kamehameha Park	58	57	-1	C	None

Note: See Table 3-1 for descriptions of Noise Abatement Categories.
Bold = level approaches or exceeds the NAC.
A "Receiver" is an area of frequent human outdoor activity, homes, apartments, motel, hotels, etc.
*Impact Type: S = Substantial Increase (15 dBA or more), A/E = Approach or Exceed NAC

CHAPTER 5 NOISE ABATEMENT MEASURES

Noise abatement measures must be considered as part of the project if traffic noise impacts are identified and must be provided where it is feasible and reasonable to do so. Impacts occur at sites where traffic noise levels approach or exceed the NAC of Leq(h) 67 dBA, or substantially exceed (by 15 dBA or more) the ambient noise levels. HDOT's Highway Noise Policy and Abatement Guidelines (HDOT, 2011) are used to determine whether noise abatement measures can be implemented, depending on whether these measures are reasonable and feasible based on the following criteria:

- Provide at least 5 dBA highway traffic noise reduction for two thirds of front row receptors located along the subject Type I project
- Determination that it is possible to design and construct the barrier after considering issues related to safety, barrier height, topography, drainage, utilities, maintenance, maintenance access to adjacent properties, and access to adjacent properties
- Consideration of viewpoints of the property owners and residents benefited by the barrier
- Cost of noise abatement does not exceed $60,000 per benefited receptor
- Achieve noise reduction design goal of 7 dBA for 75% of the benefited front-row receptors located along the subject project

The noise abatement evaluated for the project is based on an engineer's cost estimate of the feasible abatement measures identified in this report.

5.1 NOISE ABATEMENT EVALUATION: NO-BUILD ALTERNATIVE

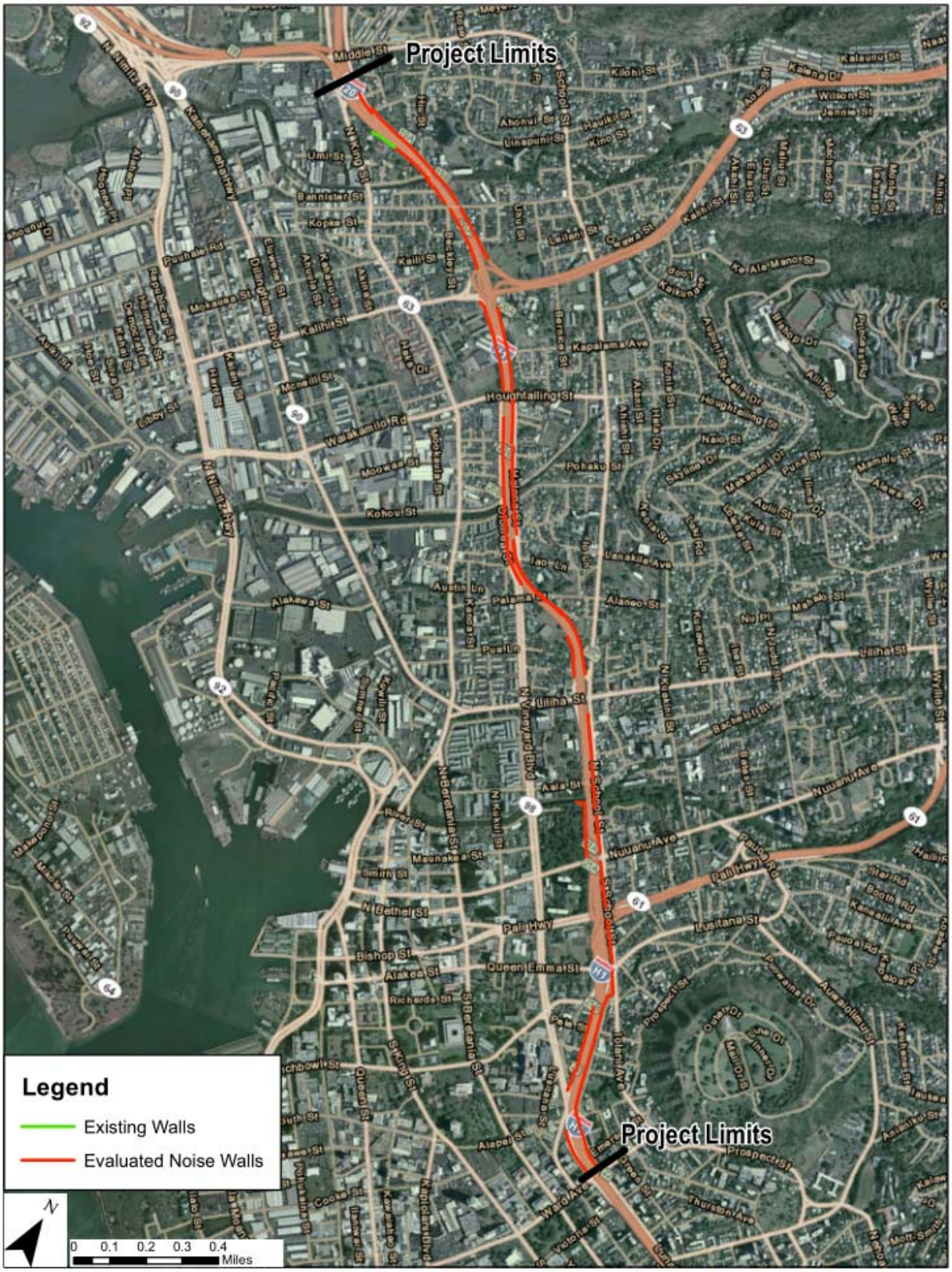
The No-Build Alternative has 53 sites that would approach or exceed the NAC (Table 4-3). The No-Build Alternative is used as the baseline of future traffic noise levels. Noise abatement was not modeled for the No-Build alternative.

5.2 NOISE ABATEMENT EVALUATION: BUILD ALTERNATIVE

The Build Alternative has 49 sites representing 590 residences, five parks, two schools, and two places of worship that are predicted to approach or exceed the NAC of Leq(h) 67 dBA in 2035 (Table 4-3). The future 2035 noise levels at all 49 sites are predicted to be within 3 dBA of existing and No-Build Alternative noise levels. Under the Build Alternative, all 49 sites are considered to have a noise impact requiring the evaluation of noise abatement.

Twenty-four noise barriers were evaluated to reduce traffic noise levels at sites were noise impacts are predicted under the Build Alternative. The locations of all 24 evaluated noise barriers and one existing noise barrier are presented in Figure 5-1. A summary of each noise barrier evaluation is provided in the following section along with figures showing the location of each evaluated noise barrier (Figures 5-2 through 5-8).

Figure 5-1. Noise Barrier Locations Evaluated



After determining if each evaluated noise barrier can satisfy HDOT's Feasibility Criteria, each feasible noise barrier was then evaluated by comparing the maximum allowable cost to the engineer's cost estimate (summarized in Table 5-1). Had any barrier met cost-reasonableness criteria, adjoining property owners would have been consulted to determine if a barrier is desired by the residents. A noise barrier is deemed reasonable only if the estimated cost is less than the maximum allowable cost and a majority of the residents want a barrier.

5.2.1 Noise Barrier 1

Noise Barrier 1 (NB-1) was evaluated along the eastbound H-1 Freeway ROW from the Ward Avenue overcrossing to a nearby pedestrian overcrossing to the west (Figure 5-2) to mitigate for noise impacts at Sites 2 and A. The analysis looked at a length of approximately 800 linear feet at heights from 8 feet to 20 feet. At 18 feet high, Noise Barrier 1 would meet the 7 dBA noise reduction design goal and provide at least 5 dBA reduction to at least two thirds of the front row receptors and is therefore feasible. At an allowance of $60,000 per benefited residence, the maximum allowance for Noise Barrier 1 is $1,200,000. The engineer's cost estimate for Noise Barrier 1 is $1,297,800; therefore the barrier is not reasonable relative to HDOT's cost per benefitted residence allowance. Higher noise barrier heights up to 20 feet would be more costly per benefitted residence and shorter noise barrier heights would not provide the required noise reduction. Therefore, Noise Barrier 1 is deemed not reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

5.2.2 Noise Barrier 2

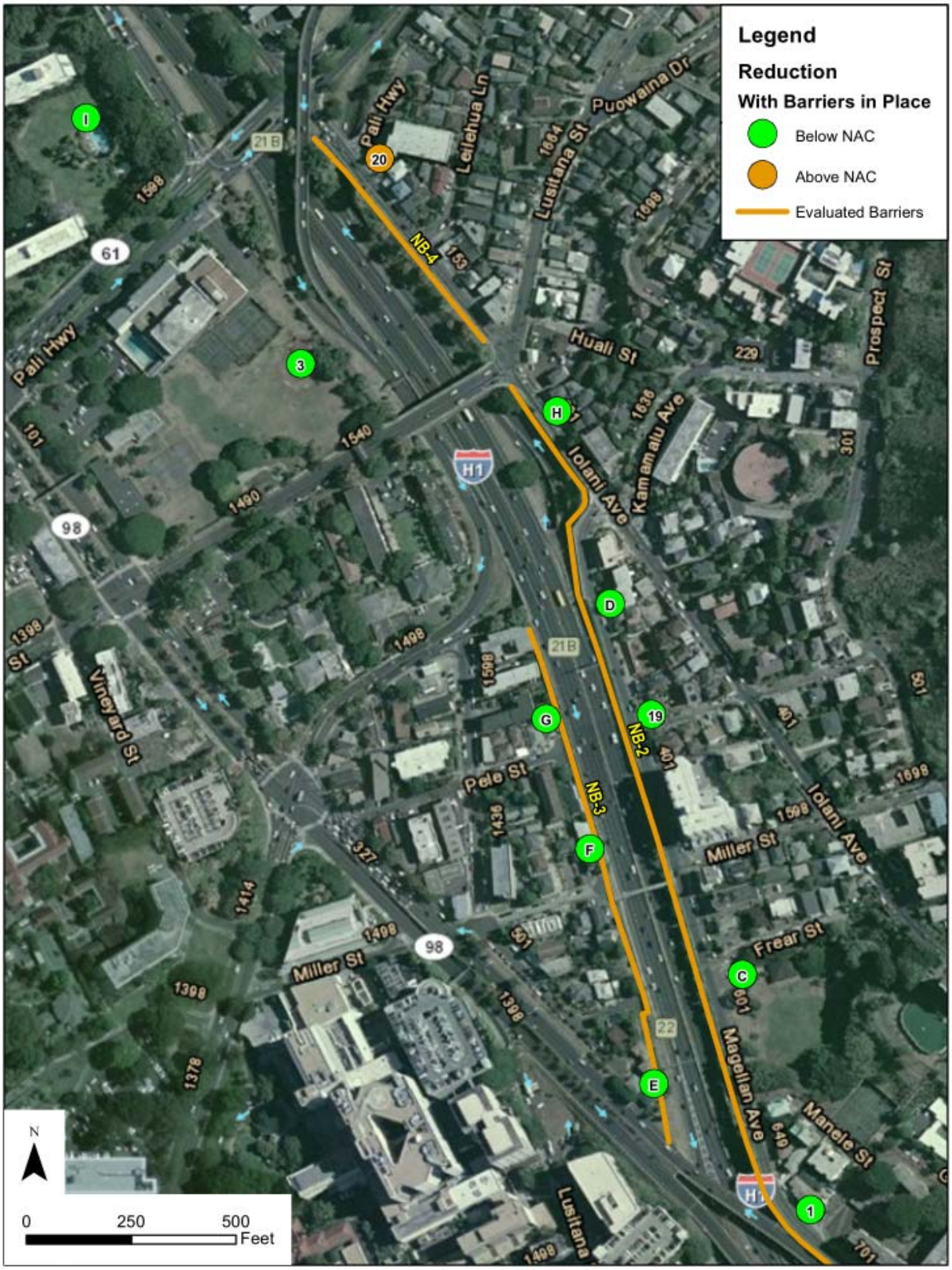
Noise Barrier 2 (NB-2) was evaluated along the westbound H-1 Freeway ROW from the Ward Avenue overcrossing (Figures 5-2 and 5-3) to Queen Emma Street to mitigate for noise impacts at Sites 1, 19, B, C, D, and H. The analysis looked at a length of approximately 3,000 linear feet at heights from 8 feet to 20 feet. At 10 feet high, Noise Barrier 2 would meet the 7 dBA noise reduction design goal and provide at least 5 dBA reduction to at least two thirds of the front row receptors and is therefore feasible. At an allowance of $60,000 per benefited residence, the maximum allowance for Noise Barrier 2 is $3,000,000. The engineer's cost estimate for Noise Barrier 2 is $3,500,580; therefore the barrier is not reasonable relative to HDOT's cost per benefitted residence allowance. Higher noise barrier heights up to 20 feet would be more costly per benefitted residence. Therefore, Noise Barrier 2 is deemed not reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

5.2.3 Noise Barrier 3

Noise Barrier 3 (NB-3) was evaluated along the eastbound H-1 Freeway ROW from South Vineyard Boulevard to the Punchbowl Street undercrossing (Figures 5-2 and 5-3) to mitigate for noise impacts at Sites E, F, and G. The analysis looked at a length of approximately 1,300 linear feet at heights from 8 feet to 20 feet. At 16 feet high, Noise Barrier 3 would meet the 7 dBA noise reduction design goal and provide at least 5 dBA reduction to at least two thirds of the front row receptors and is therefore feasible. At an allowance of $60,000 per benefited residence, the maximum allowance for Noise Barrier 3 is $1,980,000. The engineer's cost estimate for Noise Barrier 3 is $3,298,860; therefore the barrier is not reasonable relative to HDOT's cost per benefitted residence allowance.

Figure 5-2. Evaluated Noise Barrier Locations 1, 2, and 3

Figure 5-3. Evaluated Noise Barrier Location 2, 3, and 4



Higher noise barrier heights up to 20 feet would be more costly per benefitted residence. Therefore, Noise Barrier 3 is deemed not reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

5.2.4 Noise Barrier 4

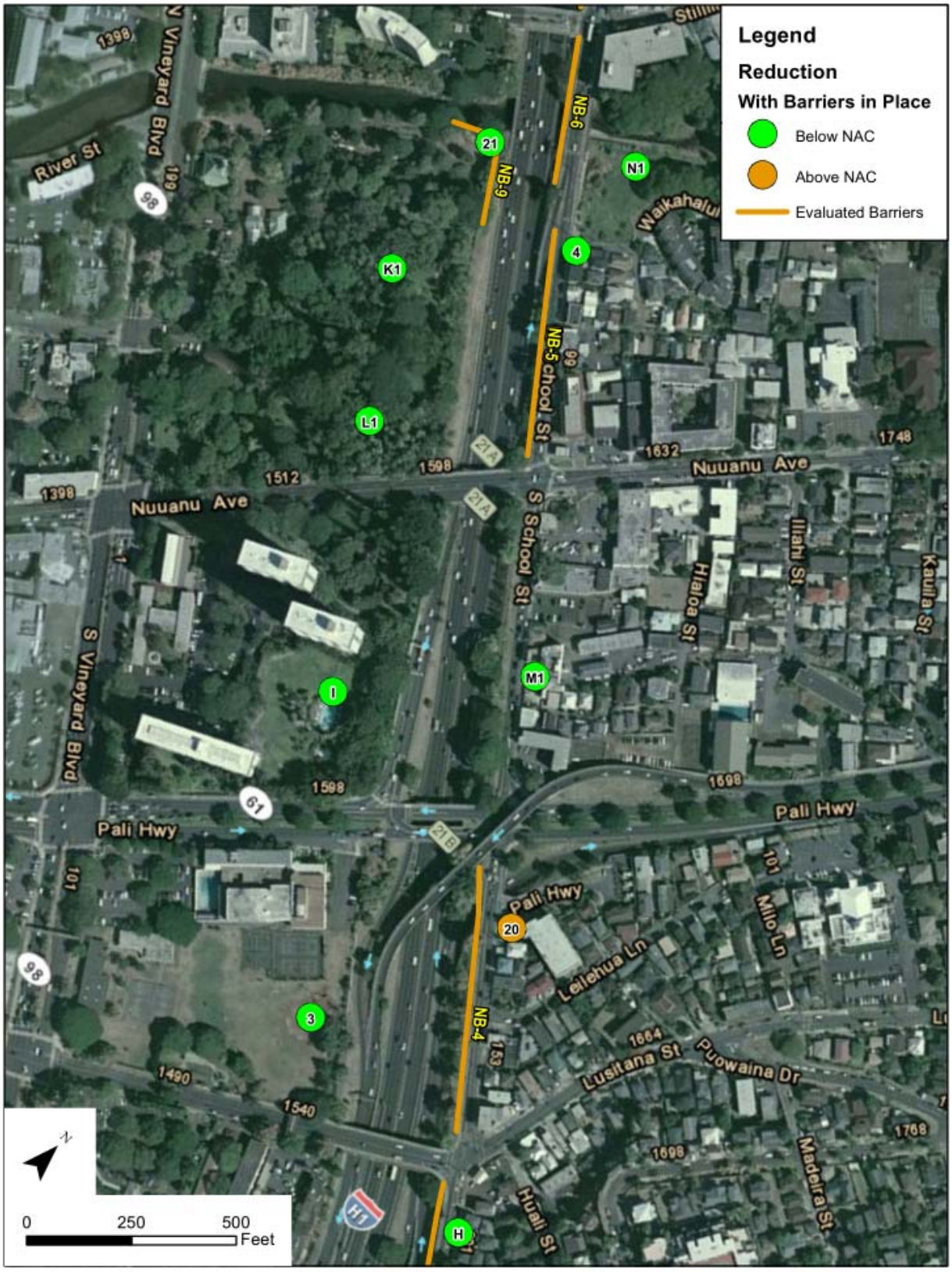
Noise Barrier 4 (NB-4) was evaluated along the westbound H-1 Freeway ROW adjacent to Iolani Avenue from Lusitana Street to the eastbound H-1 Freeway on-ramp from the Pali Highway (Figure 5-3) to mitigate for noise impacts at Site 20. The analysis looked at a length of approximately 700 linear feet at heights from 8 feet to 20 feet. Noise Barrier 4 was only able to provide 2 dBA noise reduction at 20 feet high, therefore Noise Barrier 4 does not meet HDOT's Feasibility Criteria of providing a minimum 5 dBA reduction to at least two thirds of the front row receptors. Alternate locations for placing Noise Barrier 4 were considered; however, no other locations would provide an improved opportunity to reduce noise at the receptors located behind Noise Barrier 4. Therefore, Noise Barrier 4 is deemed not feasible under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

5.2.5 Noise Barriers 5 to 8

Noise Barriers 5, 6, 7, and 8 were evaluated together as they were only able to achieve the required noise reduction as a system of noise barriers because of the multiple westbound off- and on-ramps located in the area. Noise Barrier 5 (NB-5) was evaluated at the top of retaining wall along South School Street (Figure 5-4). Noise Barrier 6 (NB-6) was evaluated along the top of slope between the H-1 Freeway off-ramp to South School Street and the Stillman Lane overcrossing (Figure 5-4). Noise Barrier 7 (NB-7) was evaluated along the top of slope between Stillman Lane and the H-1 Freeway westbound School Stret on-ramp (Figure 5-5). Noise Barrier 8 (NB-8) was evaluated from the H-1 Freeway westbound School Street on-ramp to approximately 100 feet east of Liliha Street (Figure 5-5). The four barriers were evaluated to mitigate for noise impacts at Sites 4, 5, J, and N1.

The analysis looked at a length of approximately 1,900 linear feet at heights from 8 feet to 20 feet. At 14 feet high for each barrier, the four barriers would meet the 7 dBA noise reduction design goal and provide at least 5 dBA reduction to at least two thirds of the front row receptors and therefore would be feasible. At an allowance of $60,000 per benefited residence, the maximum allowance for the combined Noise Barriers is $1,080,000. The engineer's cost estimate for the combined Noise Barriers is $7,244,800; therefore the barrier system is not reasonable relative to HDOT's cost per benefitted residence allowance. Higher noise barrier heights up to 20 feet would be more costly per benefitted residence, and each barrier was not able to provide the necessary noise reduction individually. Therefore, Noise Barriers 5, 6, 7, and 8 are deemed not reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

Figure 5-4. Evaluated Noise Barrier Locations 4, 5, 6, and 9



5.2.6 Noise Barrier 9

Noise Barrier 9 (NB-9) was evaluated along the eastbound H-1 Freeway ROW near the western boundary of Foster Botanical Garden (Figure 5-4) to mitigate for noise impacts at Site 21 which represents park benches nearest to H-1 Freeway. The analysis looked at a length of approximately 300 linear feet at heights from 8 feet to 20 feet. At 8 feet high, Noise Barrier 9 would meet the 7 dBA noise reduction design goal and provide at least 5 dBA reduction to at least two thirds of the front row receptors and is therefore feasible. To calculate the number of impacted receptors at this non-residential site, the total impacted area of 3,750 square feet was divided by 4,200 square feet (the typical urban lot size provided by HDOT). The number of impacted receptors was approximately 1 as the impacted area at Foster Botanical Garden is the area closest to H-1 Freeway. At an allowance of $60,000 per benefited residence, the maximum allowance for Noise Barrier 9 is $60,000. The engineer's cost estimate for Noise Barrier 9 is $239,600; therefore the barrier is not reasonable relative to HDOT's cost per benefitted residence allowance. Higher noise barrier heights up to 20 feet would be more costly per benefitted residence. Therefore, Noise Barrier 9 is deemed not reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

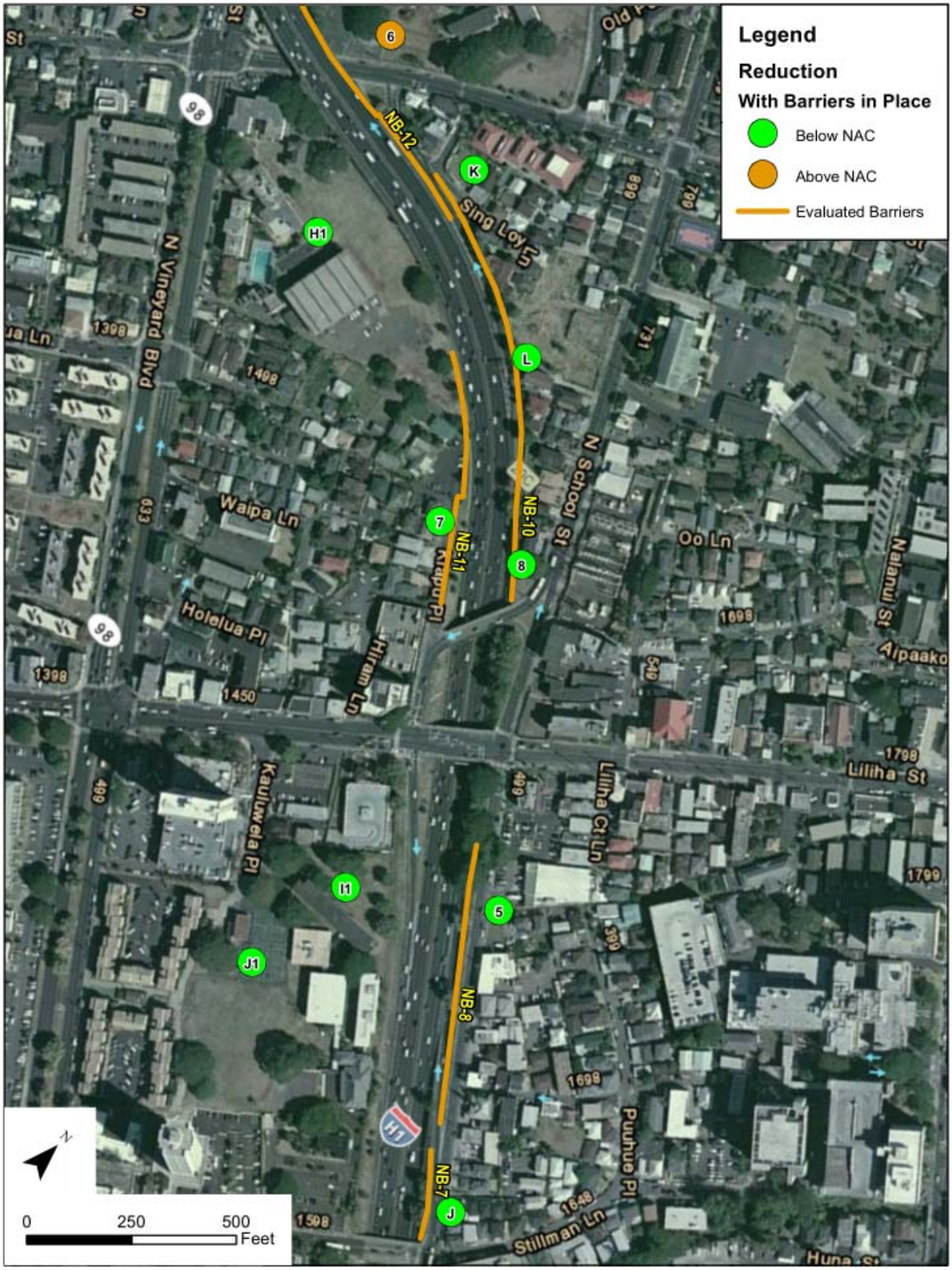
5.2.7 Noise Barriers 10 and 12

Noise Barriers 10 and 12 (NB-10 and NB-12) were evaluated together along the westbound H-1 Freeway ROW adjacent to residences located along North School Street, Sing Loy Lane, and Halona Street near the Palama Street undercrossing (Figures 5-5 and 5-6) to mitigate for noise impacts at Sites 6, 8, K, L, M, P1, and O1. The analysis looked at a length of approximately 1,300 linear feet at heights from 8 feet to 20 feet. At an average of 8 feet tall, this system of noise barriers would meet the 7 dBA noise reduction design goal and provide at least 5 dBA reduction to at least two thirds of the front row receptors and is therefore feasible. At an allowance of $60,000 per benefited residence, the maximum allowance for the combined noise barriers is $840,000. The engineer's cost estimate for the combined noise barriers is $3,576,960; therefore the barrier system is not reasonable relative to HDOT's cost per benefitted residence allowance. Higher noise barrier heights up to 20 feet would be more costly per benefitted residence, and each barrier was not able to provide the necessary noise reduction individually. Therefore, Noise Barriers 10 and 12 are deemed not reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

5.2.8 Noise Barrier 11

Noise Barrier 11 (NB-11) was evaluated along the eastbound H-1 Freeway ROW from Kiapu Street overcrossing to the approximately 100 feet west of the western terminus of Kiapu Place (Figure 5-5) to mitigate for noise impacts at Site 7. The analysis looked at a length of approximately600 linear feet at heights from 8 feet to 20 feet. At 14 feet high, Noise Barrier 11 would meet the 7 dBA noise reduction design goal and provide at least 5 dBA reduction to at least two thirds of the front row receptors and is therefore feasible. At an allowance of $60,000 per benefited residence, the maximum allowance for Noise Barrier 11 is $1,020,000. The engineer's cost estimate for Noise Barrier 11 is $1,513,760; therefore the barrier is not reasonable relative to HDOT's cost per benefitted residence allowance.

Figure 5-5. Evaluated Noise Barrier Locations 7, 8, 10, 11, and 12



Higher noise barrier heights up to 20 feet would be more costly per benefitted residence. Therefore, Noise Barrier 11 is deemed not reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

5.2.9 Noise Barrier 13

Noise Barrier 13 (NB-13) was evaluated along the eastbound H-1 Freeway edge of shoulder from Kokea Street to the Palama Street undercrossing (Figure 5-6) to mitigate for noise impacts at Sites 17, N, and G1 which represents residences located along Olomea Street. The analysis looked at a length of approximately 1,000 linear feet at heights from 8 feet to 20 feet. Noise Barrier 13 was only able to provide 4 dBA noise reduction at 20 feet high, therefore Noise Barrier 13 does not meet HDOT's Feasibility Criteria by providing a minimum 5 dBA reduction to at least two thirds of the front row receptors. Alternate locations for placing Noise Barrier 13 were considered; however, Olomea Street, which has local-access driveways, is located directly to the west (makai) of H-1 Freeway in this area which adds to the traffic noise at these sites and prohibits additional locations to evaluate noise barriers. Therefore, Noise Barrier 13 is deemed not feasible under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

5.2.10 Noise Barrier 14

Noise Barrier 14 (NB-14) was evaluated along the westbound H-1 Freeway ROW from approximately Iao Lane to the H-1 Freeway off-ramp to Houghtailing Street (Figure 5-6) to mitigate for noise impacts at Sites 18, O, and P. The analysis looked at a length of approximately 1,400 linear feet at heights from 8 feet to 20 feet. At 10 feet high, Noise Barrier 14 would meet the 7 dBA noise reduction design goal and provide at least 5 dBA reduction to at least two thirds of the front row receptors and is therefore feasible. At an allowance of $60,000 per benefited residence, the maximum allowance for Noise Barrier 14 is $960,000. The engineer's cost estimate for Noise Barrier 14 is $1,701,560; therefore the barrier is not reasonable relative to HDOT's cost per benefitted residence allowance. Higher noise barrier heights up to 20 feet would be more costly per benefitted residence. Therefore, Noise Barrier 14 is deemed not reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

5.2.11 Noise Barrier 15

Noise Barrier 15 (NB-15) was evaluated along the westbound H-1 Freeway off-ramp at Houghtailing Street (Figure 5-6) to mitigate for noise impacts at Site R. The analysis looked at a length of approximately 600 linear feet at heights from 8 feet to 20 feet. Noise Barrier 15 was only able to provide 4 dBA noise reduction at 20 feet high, therefore Noise Barrier 15 does not meet HDOT's Feasibility Criteria by providing a minimum 5 dBA reduction to at least two thirds of the front row receptors. Alternate locations for placing Noise Barrier 15 were considered; however, no additional locations were identified between H-1 Freeway and Halona Street. Therefore, Noise Barrier 15 is deemed not feasible under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

Figure 5-6. Evaluated Noise Barrier Locations 12 through 16

5.2.12 Noise Barrier 16

Noise Barrier 16 (NB-16) was evaluated along the eastbound H-1 Freeway edge of shoulder from approximately 100 feet east of Houghtailing Street to the eastbound H-1 Freeway off-ramp to Olomea Street (Figure 5-6) to mitigate for noise impacts at Sites 16, Q, and S. The analysis looked at a length of 1,500 linear feet at heights from 8 feet to 20 feet. At 8 feet high, Noise Barrier 16 would meet the 7 dBA noise reduction design goal and provide at least 5 dBA reduction to at least two thirds of the front row receptors and is therefore feasible. At an allowance of $60,000 per benefited residence, the maximum allowance for Noise Barrier 16 is $1,080,000. The engineer's cost estimate for Noise Barrier 16 is $1,558,880; therefore the barrier is not reasonable relative to HDOT's cost per benefitted residence allowance. Higher noise barrier heights up to 20 feet would be more costly per benefitted residence. Therefore, Noise Barrier 16 is deemed not reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

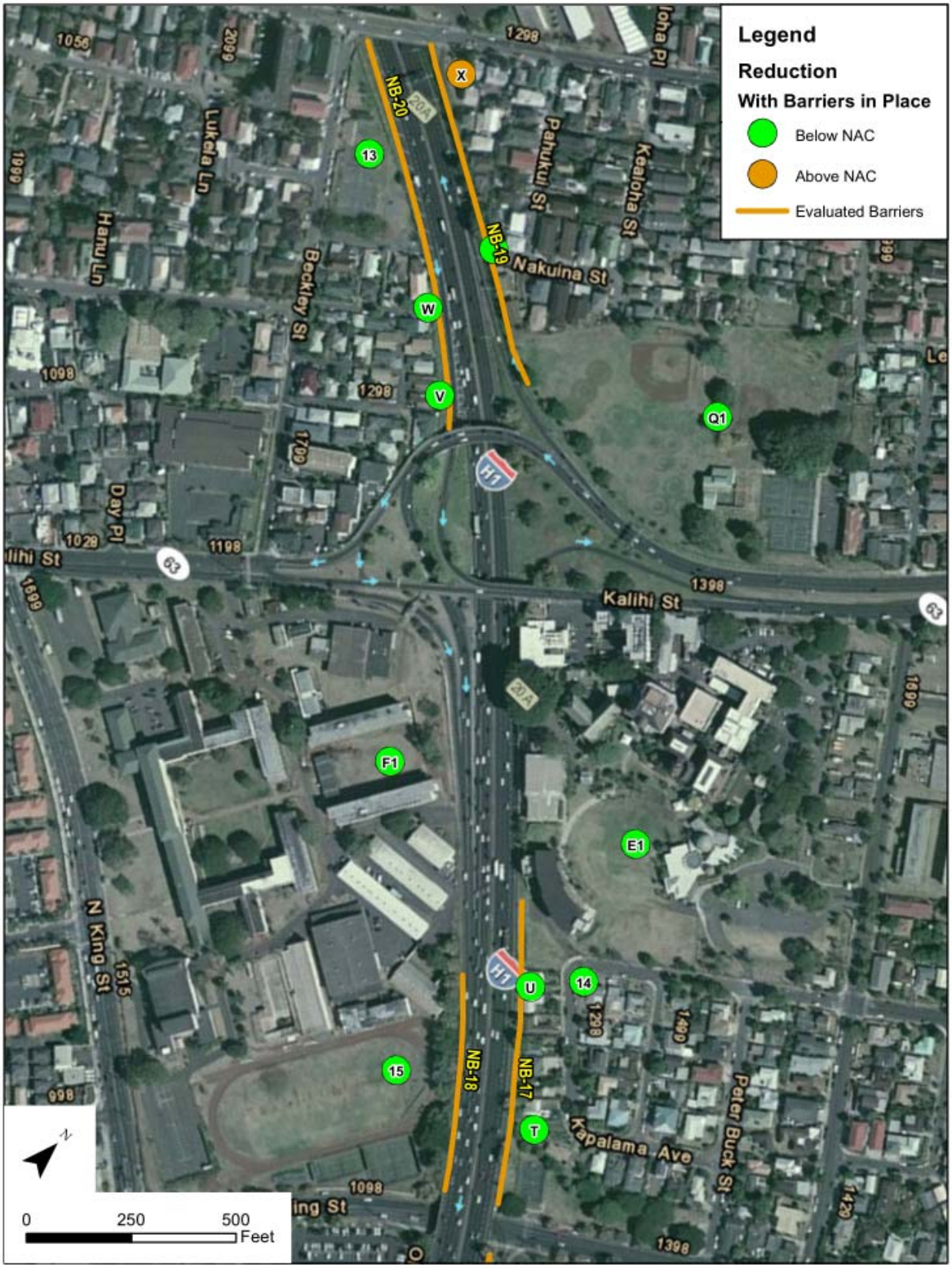
5.2.13 Noise Barrier 17

Noise Barrier 17 (NB-17) was evaluated along the westbound H-1 Freeway edge of shoulder from Houghtailing Street to approximately 100 feet west of Kapalama Avenue (Figure 5-7) to mitigate for noise impacts at Sites 14, T, and U. The analysis looked at a length of 775 linear feet at heights from 8 feet to 20 feet. At 18 feet high, Noise Barrier 17 would meet the 7 dBA noise reduction design goal and provide at least 5 dBA reduction to at least two thirds of the front row receptors and is therefore feasible. At an allowance of $60,000 per benefited residence, the maximum allowance for Noise Barrier 17 is $900,000. The engineer's cost estimate for Noise Barrier 17 is $3,680,700; therefore the barrier is not reasonable relative to HDOT's cost per benefitted residence allowance. Higher noise barrier heights up to 20 feet would be more costly per benefitted residence. Therefore, Noise Barrier 17 deemed is not reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

5.2.14 Noise Barrier 18

Noise Barrier 18 (NB-18) was evaluated at a length of approximately 1,300 linear feet along the eastbound H-1 Freeway edge of shoulder west of Houghtailing Street (Figure 5-7) to mitigate for noise impacts at Site 15 which represents the Farrington High School athletic fields. The analysis looked at heights from 8 feet to 20 feet. Noise Barrier 18 was only able to provide 6 dBA noise reduction at 20 feet high to satisfy HDOT Feasibility Criteria, but not the 7 dBA reduction design goal. Therefore, Noise Barrier 18 is deemed not feasible under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

Figure 5-7. Evaluated Noise Barrier Locations 17 through 20



5.2.15 Noise Barrier 19

Noise Barrier 19 (NB-19) was evaluated along the westbound H-1 Freeway ROW at the top of slope from the H-1 Freeway on-ramp at Kalihi Street to the Gulick Avenue overcrossing (Figure 5-7) to mitigate for noise impacts at Sites 12 and X. The analysis looked at a length of approximately 600 linear feet at heights from 8 feet to 20 feet. At 8 feet high, Noise Barrier 19 would meet the 7 dBA noise reduction design goal and provide at least 5 dBA reduction to at least two thirds of the front row receptors and is therefore feasible. At an allowance of $60,000 per benefited residence, the maximum allowance for the Noise Barrier 19 is $840,000. The engineer's cost estimate for Noise Barrier 19 is $1,324,820; therefore the barrier is not reasonable relative to HDOT's cost per benefitted residence allowance. Higher noise barrier heights up to 20 feet would be more costly per benefitted residence. Therefore, Noise Barrier 19 is deemed not reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

5.2.16 Noise Barrier 20

Noise Barrier 20 (NB-20) was evaluated along the eastbound H-1 Freeway ROW at the top of slope from the Gulick Avenue overcrossing to the H-1 Freeway off-ramp at Kalihi Street (Figure 5-7) to mitigate for noise impacts at Sites 13, V, and W. The analysis looked at a length of approximately 1,000 linear feet at heights from 8 feet to 20 feet. At 8 feet high, Noise Barrier 20 would meet the 7 dBA noise reduction design goal and provide at least 5 dBA reduction to at least two thirds of the front row receptors and is therefore feasible. At an allowance of $60,000 per benefited residence, the maximum allowance for Noise Barrier 20 is $600,000. The engineer's cost estimate for Noise Barrier 20 is $3,564,620; therefore the barrier is not reasonable relative to HDOT's cost per benefitted residence allowance. Higher noise barrier heights up to 20 feet would be more costly per benefitted residence. Therefore, Noise Barrier 20 is deemed not reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

5.2.17 Noise Barrier 21

Noise Barrier 21 (NB-21) was evaluated along the eastbound H-1 Freeway ROW at the top of slope from an existing concrete block wall located at Kalihi Union School to the H-1 Freeway overcrossing at Richard Lane (Figure 5-8) to mitigate for noise impacts at Sites 10 and Z. The analysis looked at a length of approximately 1,200 linear feet at heights from 8 feet to 20 feet. At 12 feet high, Noise Barrier 21 would meet the 7 dBA noise reduction design goal and provide at least 5 dBA reduction to at least two thirds of the front row receptors and is therefore feasible. At an allowance of $60,000 per benefited residence, the maximum allowance for Noise Barrier 21 is $480,000. The engineer's cost estimate for Noise Barrier 21 is $3,847,520; therefore the barrier is not reasonable relative to HDOT's cost per benefitted residence allowance. Higher noise barrier heights up to 20 feet would be more costly per benefitted residence. Therefore, Noise Barrier 21 is deemed not reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

5.2.18 Noise Barrier 22

Noise Barrier 22 (NB-22) was evaluated along the eastbound H-1 Freeway ROW at the top of slope at the H-1 Freeway overcrossing at Richard Lane to the Gulick Avenue overcrossing (Figure 5-8) to mitigate for noise impacts at Site Y. The analysis looked at a length of approximately 300 linear feet at heights from 8 feet to 20 feet. At 8 feet high, Noise Barrier 22 would meet the 7 dBA noise reduction design goal and provide at least 5 dBA reduction to at least two thirds of the front row receptors and is therefore feasible. At an allowance of $60,000 per benefited residence, the maximum allowance for Noise Barrier 22 is $240,000. The engineer's cost estimate for Noise Barrier 22 is $1,923,760; therefore the barrier is not reasonable relative to HDOT's cost per benefitted residence allowance. Higher noise barrier heights up to 20 feet would be more costly per benefitted residence. Therefore, Noise Barrier 22 is deemed not reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

5.2.19 Noise Barrier 23

Noise Barrier 23 (NB-23) was evaluated along the westbound H-1 Freeway ROW at the top of slope at the H-1 overcrossing at Richard Lane to Kamehameha IV Road (Figure 5-8) to mitigate for noise impacts at Sites 9, 11, and A1. The analysis looked at a length of approximately 1,300 linear feet at heights from 8 feet to 20 feet. At 10 feet high, Noise Barrier 23 would meet the 7 dBA noise reduction design goal and provide at least 5 dBA reduction to at least two thirds of the front row receptors and is therefore feasible. At an allowance of $60,000 per benefited residence, the maximum allowance for Noise Barrier 23 is $1,560,000. The engineer's cost estimate for Noise Barrier 23 is $2,912,420; therefore the barrier is not reasonable relative to HDOT's cost per benefitted residence allowance. Higher noise barrier heights up to 20 feet would be more costly per benefitted residence. Therefore, Noise Barrier 23 is deemed not reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

Figure 5-8. Evaluated Noise Barrier Locations 21 through 24

5.2.20 Noise Barrier 24

Noise Barrier 24 (NB-24) was evaluated at a length of approximately 400 linear feet along the edge of shoulder of the westbound H-1 Freeway off-ramp to Middle Street (Figure 5-8) to mitigate for noise impacts at Site C1. The analysis looked at heights from 8 feet to 20 feet. Noise Barrier 24 was only able to provide 2 dBA noise reduction at 20 feet high, therefore Noise Barrier 24 does not meet HDOT's Feasibility Criteria by providing a minimum 5 dBA reduction to at least two thirds of the front row receptors. Alternate locations for placing Noise Barrier 24 were considered; however, no additional locations were identified between the H-1 Freeway mainline and H-1 Freeway westbound off-ramp. Therefore, Noise Barrier 24 is deemed not feasible under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

Table 5-1. Summary of Noise Barrier Feasibility and Reasonableness Analysis for the Build Alternative

Noise Barrier I.D.	Height	Number of Benefited Residences	Maximum Cost Allowance Per Noise Barrier	Noise Barrier Engineer's Cost Estimate	Is Barrier Feasible and Reasonable?
NB-1	18 feet	20	$1,200,000	$1,297,800	Not Reasonable
NB-2	10 feet	50	$3,000,000	$3,500,580	Not Reasonable
NB-3	16 feet	33	$1,980,000	$3,298,860	Not Reasonable
NB-4	up to 20 feet	0	$0	N/A	Not Feasible
NB-5	14 feet	18	$1,080,000	$7,244,800	Not Reasonable
NB-6					
NB-7					
NB-8					
NB-9	8 feet	1	$60,000	$239,600	Not Reasonable
NB-10	8 feet	14	$840,000	$3,576,960	Not Reasonable
NB-12					
NB-11	14 feet	17	$1,020,000	$1,513,760	Not Reasonable
NB-13	up to 20 feet	0	$0	N/A	Not Feasible
NB-14	10 feet	16	$960,000	$1,701,560	Not Reasonable
NB-15	up to 20 feet	0	$0	N/A	Not Feasible
NB-16	8 feet	18	$1,080,000	$1,558,880	Not Reasonable
NB-17	18 feet	15	$900,000	$3,680,700	Not Reasonable
NB-18	up to 20 feet	0	$0	N/A	Not Feasible
NB-19	8 feet	14	$840,000	$1,324,820	Not Reasonable
NB-20	8 feet	10	$600,000	$3,564,620	Not Reasonable
NB-21	12 feet	8	$480,000	$3,847,520	Not Reasonable
NB-22	8 feet	4	$240,000	$1,923,760	Not Reasonable
NB-23	10 feet	26	$1,560,000	$2,912,420	Not Reasonable
NB-24	up to 20 feet	0	$0	N/A	Not Feasible

Note: NA = Not Applicable; cost not calculated because the evaluated noise barrier did not meet HDOT Feasibility Criteria.

5.3 PRELIMINARY NOISE MITIGATION FINDINGS

Five-hundred and ninty residential units, 5 parks, 2 schools, and 1 place of worship represented by Sites 1, 2, 4-14, 16-21, A-H, J, L-Z, A1, C1, G1, and N1-P1 are predicted to approach or exceed the FHWA noise abatement criteria with the Project Build Alternative (Table 4-3). No

substantial increase impacts of 15 dBA or more above existing conditions were predicted with the Project.

Twenty-four noise barriers were evaluated to reduce traffic noise levels at sites were noise impacts were predicted under the Build Alternative. Nineteen of the 24 evaluated noise barriers were able to achieve the necessary noise reduction to satisfy HDOT Feasibility Criteria; however, the maximum allowance for each of the 19 evaluated noise barriers was below the engineer's cost estimate for each barrier. Therefore each of the 19 evaluated barrier is not reasonable under HDOT's *Highway Noise Policy and Abatement Guidelines* and will not be included in the Project.

CHAPTER 6 CONSTRUCTION NOISE IMPACTS

The duration and level of construction noise depends on the phase and type of activity, including: asphalt removal, grading, paving, and restriping.

Areas where concrete and asphalt is planned for removal will typically generate the highest noise levels during construction of the project. Noise generated by construction equipment, including trucks, graders, excavators, demolition equipment, cold planers, concrete mixers, and generators can reach levels from 77 dBA to 85 dBA at 50 feet. Construction equipment noise emissions are regulated by the Environmental Protection Agency's Noise Control Program (Part 204 of Title 40, Code of Federal Regulations). Presently, air compressors are the only equipment under regulation, and no new regulations are currently under consideration.

Noise levels for equipment which might be used during the excavation and construction of the proposed project are presented in Table 6-1. The noise levels presented are at a reference distance of 50 feet. Equipment noise levels vary depending on the make and model of the equipment, the operation being performed, the condition of the equipment, and other variables.

Table 6-1. Construction Equipment Noise Levels

Equipment	Decibels	Equipment	Decibels
Standard Construction Equipment		Light Impact Equipment	
Truck	75 - 90	Jack Hammer	81 - 98
Saw	72 - 81	Jumping Jack	81 - 97
Light Tower	62 - 72		
Cold Planer	79 - 88	Heavy Impact Equipment	
Paving Machine	86 - 88	Hoe rams	95 - 106
Roller	63 - 70	Vibratory Sheetpile driver	90 - 100
Striping machine	75 - 86		
Concrete Truck	75 - 88		
Backhoe/Loader	72 - 83		
Compressor	74 - 87		
Generator	71 - 82		
Crane	75 - 87		
Crane	71 – 93		

Since construction equipment noise levels decrease at a rate of approximately 6 dBA per doubling of distance, at 100 feet the noise levels would be about 6 dBA less than the levels shown in the table. Similarly, at 200 feet the noise levels would be approximately 12 dBA less than shown in the table. Intervening structures or topography can act as a noise barrier to further reduce noise levels.

The State of Hawai'i Department of Health (DOH) maintains community noise control standards that apply to construction noise. The project is not allowed to exceed the stipulated noise limits during standard work hours unless a permit is granted by the DOH; and work cannot be done beyond normal work hours unless a variance is granted by the DOH.

Typically, the noise permit does not restrict construction activities, except for limits on pile drivers and other very noise equipment. The project's application for a noise permit is provided as an appendix to the EA.

The project's application for a noise variance is provided as an appendix to the EA. The application discusses the various measures that would be employed to reduce the impact of nighttime construction activities.

CHAPTER 7 REFERENCES

Federal Highway Administration (FHWA); Procedures for Abatement of Highway Traffic and Construction Noise, Code of Federal Regulations 23CFR 772, 1995

City and County of Honolulu, Department of Planning and Permitting; Email correspondence at info@honoluludpp.org on November 30, 2012 and December 13, 2012.

State of Hawai‘i, Department of Transportation (HDOT), Highways Divisions; Highway Noise Policy and Abatement Guidelines, April, 2011.

State of Hawai‘i, Department of Transportation (HDOT), Highways Divisions; Telephone conversation with Steven Ege, HDOT Acoustics, September 3, 2012.

U.S. Department of Transportation, Federal Highway Administration (FHWA), 1973. *Fundamentals and Abatement of Highway Traffic Noise*. Washington D.C.

U.S. Department of Transportation, Federal Highway Administration (FHWA), 1982. *"Procedures for Abatement of Highway Traffic Noise and Construction Noise."* Washington, D.C.

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U.S. Department of Transportation, Federal Highway Administration (FHWA), 1998, 2004. *FHWA Traffic Noise Model User's Guide*. Washington D.C.

U.S. Department of Transportation. Federal Highway Administration (FHWA). 2006. FHWA Highway Construction Noise Handbook and Roadway Construction Noise Model (version 1.0). Washington, D.C.

U.S. Environmental Protection Agency (EPA), 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety. Report Number 550/9-74-004.

United States Geological Survey (USGS), October 28, 2004. Last access online in November 2012 at: http://seamless.usgs.gov/website/seamless/index.asp.

APPENDIX C CZM APPLICATION

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Hawai CZM Program
Coastal Zone Management

HAWAIʻI CZM PROGRAM
APPLICATION FOR CZM FEDERAL CONSISTENCE REVIEW

Project/Activity Title or Description: Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue

Location: Interstate Route H-1 from Middle Street to vicinity of Ward Avenue

Island: Oʻahu Tax Map Key: NA (State right-of-way)

Applicant and Agent Information

1. Glenn M. Okimoto
Director of Transportation
State Department of Transportation
Name of Applicant

869 Punchbowl Street
Address

Honolulu, HI 96813
City & State Zip Code

808-587-2150 808-587-2167
Daytime Phone Fax Number

glenn.okimoto@hawaii.gov
E-mail Address

2. Jim Hayes
Sr. Supervising Planner
Parsons Brinckerhoff
Name of Agent

1001 Bishop Street, Suite 2400
Address

Honolulu, HI 96813
City & State Zip Code

808-566-2239 808-528-2368
Daytime Phone Fax Number

hayesja@pbworld.com
E-mail Address

CZM Consistence Determination or Certification

x Check the type of application below and sign.

☐ I. Federal Agency Activity (Please sign below)

CZM Consistence Determination: "The proposed activity will be undertaken in a manner consistent to the maximum extent practicable with the enforceable policies of the Hawaiʻi Coastal Zone Management Program."

Signature _____ Date _____
(Applicant or responsible party)

☐ II. Federal Permit or License (Please sign below)

CZM Consistence Certification: "The proposed activity complies with the enforceable policies of the Hawaiʻi's approved management program and will be conducted in a manner consistent with such program."

Signature _____ Date _____
(Applicant or responsible party)

☒ III. Federal Grants and Assistance (Please sign below)

CZM Consistence Determination: "The proposed activity complies with the enforceable policies of the Hawaiʻi's approved management program and will be conducted in a manner consistent with such program."

Signature _____ Date _____
(Applicant or responsible party)

Send To: Office of Planning, P.O. Box 2359, Honolulu, Hawaiʻi 96804

HAWAII CZM PROGRAM
FEDERAL CONSISTENCY ASSESSMENT FORM

RECREATIONAL RESOURCES

Objective: Provide coastal recreational opportunities accessible to the public.

Policies:

1) Improve coordination and funding of coastal recreation planning and management.

2) Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:

   a) Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;

   b) Requiring replacement of coastal resources having significant recreational value, including but not limited to surfing sites and sandy beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the State for recreation when replacement is not feasible or desirable;

   c) Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;

   d) Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

   e) Encouraging expanded public recreational use of county, State, and Federally owned or controlled shoreline lands and waters having recreational value;

   f) Adopting water quality standards and regulating point and non-point sources of pollution to protect and where feasible, restore the recreational value of coastal waters;

   g) Developing new shoreline recreational opportunities, where appropriate, such as artificial reefs for surfing and fishing; and

   h) Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, County planning commissions; and crediting such dedication against the requirements of section 46-6.

RECREATIONAL RESOURCES (continued)

Check either "Yes" or "No" for each of the following questions:		Yes	No
1.	Will the proposed action involve or be near a dedicated public right-of-way?	☒	☐
2.	Does the project site abut the shoreline?	☐	☒
3.	Is the project site near a State or County park?	☒	☐
4.	Is the project site near a perennial stream?	☒	☐
5.	Will the proposed action occur in or affect a surf site?	☐	☒
6.	Will the proposed action occur in or affect a popular fishing area?	☐	☒
7.	Will the proposed action occur in or affect a recreational or boating area?	☐	☒
8.	Is the project site near a sandy beach?	☐	☒
9.	Are there swimming or other recreational uses in the area?	☐	☒

Discussion:

The project includes work on a public roadway. The project site is a public right-of-way, is near (within 500 feet) multiple County parks (including Kamehameha Park, Foster Garden, and Dole Park) and crosses three perennial streams (Kalihi, Kapalama Canal, and Nuuanu Streams); however, the project will not result in a significant adverse affect to any parks and recreational resources in the project area.

None of the parks will be directly affected by the project. The only indirect affects to the parks will be minor, imperceptible, changes to traffic noise levels. In most cases the noise level is predicted to decrease at the parks along the project corridor.

There will be relatively minor modifications to the bridge over Nuuanu Stream, but no changes at the other stream crossings. The minor changes at Nuuanu Stream will not affect the recreational opportunities at Nuuanu Stream. None of the perennial streams are fishing areas.

See attached project overview for project information and figures.

HISTORIC RESOURCES

Objective: Protect, preserve, and where desirable, restore those natural and man-made historic and pre-historic resources in the coastal zone management area that are significant in Hawaiian and American history and culture.

Policies:

1) Identify and analyze significant archaeological resources;

2) Maximize information retention through preservation of remains and artifacts or salvage operations; and

3) Support State goals for protection, restoration, interpretation, and display of historic resources.

Check either "Yes" or "No" for each of the following questions:	Yes	No
1. Is the project site within a historic/cultural district?	☐	☒
2. Is the project site listed on or nominated to the Hawaii or National register of historic places?	☐	☒
3. Does the project site include undeveloped land which has not been surveyed by an archaeologist?	☐	☒
4. Has a site survey revealed any information on historic or archaeological resources?	☒	☐
5. Is the project site within or near a Hawaiian fishpond or historic settlement area?	☒	☐

Discussion:

The project site is not listed on or nominated to be listed on the Hawaii or National Register of historic places. However, within 500 feet of the project site there a multiple properties listed on the Hawaii and/or National Register. The project will require a construction easement on two such sites - Farrington High School and Bishop Museum - in order to complete construction activities. No new features will be placed within those two properties and following construction the areas utilized will be returned to their existing condition.

Historic documents indicate that the area had, in pre-contact traditional Hawaiian times, an expansive network of irrigated taro fields with associated habitation sites that extended from Kou, the settlement area focused around present Honolulu Harbor. The taro fields, or lo‘i, extended from near the shoreline, where fish ponds were present, through the project area, and to the foothills of the Koolau Mountains.

SCENIC AND OPEN SPACE RESOURCES

Objective: Protect, preserve and where desirable, restore or improve the quality of coastal scenic and open space resources.

Policies:

1) Identify valued scenic resources in the coastal zone management area;

2) Insure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;

3) Preserve, maintain and where desirable, improve and restore shoreline open space and scenic resources; and

4) Encourage those developments that are not coastal dependent to locate in inland areas.

Check either "Yes" or "No" for each of the following questions:	**Yes**	**No**
1. Does the project site abut a scenic landmark?	☐	☒
2. Does the proposed action involve the construction of a multi-story structure or structures?	☐	☒
3. Is the project site adjacent to undeveloped parcels?	☐	☒
4. Does the proposed action involve the construction of structures visible between the nearest coastal roadway and the shoreline?	☐	☒
5. Will the proposed action involve construction in or on waters seaward of the shoreline? On or near a beach?	☐	☒

Discussion:

Existing mountain and ocean vistas will be unaffected by the project. The project will not adversely affect scenic and open space resources.

COASTAL ECOSYSTEMS

Objective: Protect valuable coastal ecosystems from disruption and minimize adverse impacts on all coastal ecosystems.

Policies:

1) Improve the technical basis for natural resources management;
2) Preserve valuable coastal ecosystems of significant biological or economic importance;
3) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land water uses, recognizing competing water needs; and
4) Promote water quantity and quality planning and management practices, which reflect the tolerance of fresh water and marine ecosystems and prohibit land and water uses, which violate State, water quality standards.

Check either "Yes" or "No" for each of the following questions:	Yes	No
1. Does the proposed action involve dredge or fill activities?	☐	☒
2. Is the project site within the Shoreline Setback Area (20 to 40 feet inland of the shoreline)?	☐	☒
3. Will the proposed action require some form of effluent discharge into a body of water?	☐	☒
4. Will the proposed action require earthwork beyond clearing and grubbing?	☒	☐
5. Will the proposed action include the construction of special waste treatment facilities, such as injection wells, discharge pipes, or cesspools?	☐	☒
6. Is an intermittent or perennial stream located on or near the project site?	☒	☐
7. Does the project site provide habitat for endangered species of plants, birds, or mammals?	☐	☒
8. Is any such habitat located nearby?	☐	☒
9. Is there a wetland on the project site?	☐	☒
10. Is the project site situated in or abutting a Natural Area Reserve?	☐	☒
11. Is the project site situated in or abutting a Marine Life Conservation District?	☐	☒
12. Is the project site situated in or abutting an estuary?	☐	☒

Discussion:

The project is not within the Shoreline Setback Area but will require earthwork beyond clearing and grubbing and the project crosses three perennial streams. There would be relatively minor modifications to the bridge over Nuuanu Stream, but no changes at the other stream crossings. Two of the streams flow into Honolulu Harbor and the third flows into Keehi Lagoon. All three project crossings are at least 3,300 feet upstream of where they discharge to the harbor or lagoon.

The project will not affect coastal ecosystems.

ECONOMIC USES

Objective: Provide public or private facilities and improvements important to the State's economy in suitable locations.

Policies:

1) Concentrate in appropriate areas the location of coastal dependent development necessary to the State's economy;

2) Insure that coastal dependent development such as harbors and ports, visitor industry facilities, and energy generating facilities are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and

3) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such development and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:

   a) Utilization of presently designated locations is not feasible;
   b) Adverse environmental effects are minimized; and
   c) Important to the State's economy.

Check either "Yes" or "No" for each of the following questions:	Yes	No
1. Does the project involve a harbor or port?	☐	☒
2. Is the project site within a designated tourist destination area?	☐	☒
3. Does the project site include agricultural lands or lands designated for such use?	☐	☒
4. Does the proposed activity relate to commercial fishing or seafood production?	☐	☒
5. Does the proposed activity related to energy production?	☐	☒
6. Does the proposed activity relate to seabed mining?	☐	☒

Discussion:

The project will benefit Honolulu's residents, workers and visitors by alleviating roadway congestion on Interstate Route H-1, thereby improving the transportation network and improving access to community resources. Project construction will also contribute to the local economy by providing construction jobs.

COASTAL HAZARDS

Objective: Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, and subsidence.

Policies:

1) Develop and communicate adequate information on storm wave, tsunami, flood erosion, and subsidence hazard;

2) Control development in areas subject to storm wave, tsunami, flood, erosion, and subsidence hazard;

3) Ensure that developments comply with requirements of the Federal Flood Insurance Program; and

4) Prevent coastal flooding from inland projects.

Check either "Yes" or "No" for each of the following questions:	Yes	No
1. Is the project site on or abutting a sandy beach?	☐	☒
2. Is the project site within a potential tsunami inundation area as depicted on the National Flood Insurance Program flood hazard map?	☐	☒
3. Is the project site within a potential flood inundation area according to a flood hazard map?	☒	☐
4. Is the project site within a potential subsidence hazard areas according to a subsidence hazard map?	☐	☒
5. Has the project site or nearby shoreline areas experienced shoreline erosion?	☐	☒

Discussion:

The project site is not near the coast and is not within a potential tsunami inundation area. Where the project crosses Kalihi Stream, Kalihi Stream is designated as a floodway and some floodzones are adjacent to the floodway upstream and downstream of the crossing. Above the project's crossing of Nuuanu Stream, Nuuanu Stream is designated as a floodway and some floodzones are adjacent to the floodway. Currently Interstate Route H-1 is not considered vulnerable to flooding.

The project will not change conditions affected by natural hazards.

MANAGING DEVELOPMENT

Objective: Improve the development review process, communication, and public participation in the management of coastal resources and hazards.

Policies:

1) Effectively utilize and implement existing law to the maximum extent possible in managing present and future coastal zone development;

2) Facilitate timely processing of application for development permits and resolve overlapping or conflicting permit requirements; and

3) Communicate the potential short- and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the general public to facilitate public participation in the planning and review process.

Check either "Yes" or "No" for each of the following questions:	Yes	No
1. Will the proposed activity require more than two (2) permits or approval? (Provide the status of each.)	☒	☐
2. Does the proposed activity conform with the State and County land use designations for the site?	☒	☐
3. Has or will the public be notified of the proposed activity?	☒	☐
4. Has a draft or final environmental impact statement or an environmental assessment been prepared?	☒	☐

Discussion:

The project conforms with the land use designations for the site and is consistent with government plans, policies, and controls.

Along with the CZM Consistency Assessment, the project requires a National Pollution Discharge Elimination System (NPDES) permit and a Noise Variance for construction activities, and consultations required under the Endangered Species Act (ESA) Section 7 and the National Historic Preservation Act Section 106. Evidence of these coordination activities are attached.

The project will complete a National Environmental Policy Act (NEPA) Categorical Exclusion, and has completed a State of Hawaii HRS Chapter 343 Draft Environmental Assessment.

PUBLIC PARTICIPATION

Objective: Stimulate public awareness, education, and participation in coastal management.

Policies:

1) Maintain a public advisory body to identify coastal management problems and to provide policy advice and assistance to the coastal zone management program;

2) Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal-related issues, developments, and government activities; and

3) Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.

Discussion. Please provide information about the proposal relevant to the Objective and Policies No. 2 and No. 3 above:

The project is over half a mile away from the coast and will not produce any coastal management issues. Therefore, no public participation specifically related to coastal management or processes is planned.

A public informational meeting regarding the project was held on October 25, 2012, and another public meeting was held during the Draft EA review period on February 6, 2013.

BEACH PROTECTION

Objective: Protect beaches for public use and recreation.

Policies:

1) Locate new structures inland from the shoreline setback to conserve open space and to minimize loss of improvements due to erosion;

2) Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and

3) Minimize the construction of public erosion-protection structures seaward of the shoreline.

Discussion. Please provide information about the proposal relevant to the Objective and Policies above:

The project is over half a mile away from the coast and generally includes working within the limits of an existing roadway and in a highly-developed urban area. The project will not result in the construction of any structure that could increase beach or shoreline erosion.

MARINE RESOURCES

Objective: Implement the State's ocean resources management plan.

Policies:

1) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;

2) Assure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;

3) Coordinate the management of marine and coastal resources and activities management to improve effectiveness and efficiency;

4) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;

5) Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and

6) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.

Discussion. Please provide information about the proposal relevant to the Objective and Policies above:

The project does not involve any marine or coastal construction or other aspects that relate to the State's ocean resources management plan. The project will not have an impact on marine resources.

Print Form

ATTACHMENT
PROJECT INFORMATION

The purpose of the proposed project is to (a) improve the road surface (and thereby service) and extend maintenance of the roadway, (b) address traffic congestion, and (c) improve safety.

The proposed project includes the following general tasks:

- Pavement rehabilitation, including reconstruction and repaving, as necessary, from roughly Likelike Highway to Miller Street.
- Replacing the highway lighting system from roughly Middle Street to Vineyard Boulevard On-Ramp.
- Restriping the roadway to generate four through lanes in both directions to the extent possible throughout the project area.
- Installing a concrete glare screen on the median barrier from roughly Likelike Highway to Miller Street.
- Widening the Nuuanu Stream Bridge roughly 5 feet on the makai (downstream) side in order to accommodate four through lanes and one exit lane in the Diamond Head-bound (east-bound) direction.
- Minor modifications to the storm drain system, primarily inlet modifications.
- Minor grading and structural improvements at select and discrete locations throughout the project area.

The project location is shown on attached Figure 1.

Additional project information can be found on the attached Final Environmental Assessment (Final EA) / Finding of No Significant Impact (FONSI).

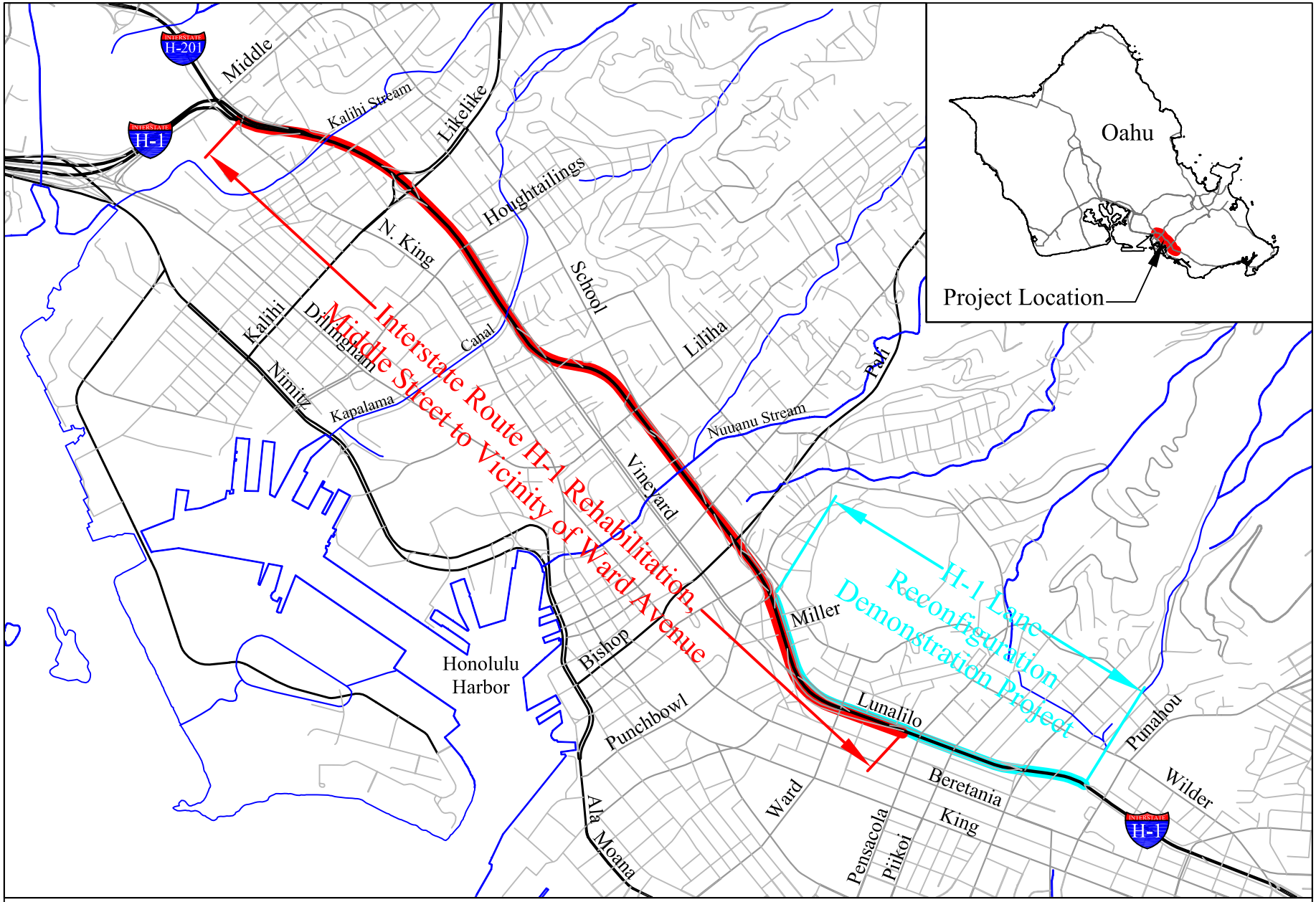

Figure 1: Project Location

Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue
State of Hawaii Department of Transportation, Highways Division

APPENDIX D NOISE PERMIT APPLICATION

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State of Hawaii
Department of Health

Application for Community Noise Permit

Permit is required by Title 11, Administrative Rules, Department of Health, Chapter 46, Community Noise Control.

Part I. Applicant Information

Name of Company			Authorized Individual
State of Hawaii, Department of Transportation, Highways Division			Glenn M. Okimoto
Mailing Address			Title
869 Punchbowl Street			Director of Transportation
City	State	Zipcode	Phone
Honolulu	HI	96813	808-587-2150

Part II. Community Noise Permit Fee Schedule (Annual) *Check one box

☐	Activities involving demolition, construction, extension, additions, or renovation of a single family dwelling	$25
☑	All other construction activities	$50
☐	Operation of stationary noise sources	$50
☐	Equipment related to agricultural activities	$50
☐	Equipment related to industrial activities	$50

Part III. Description of Activity

The rehabilitation of Interstate Route H-1 from Middle Street to the vicinity of Ward Avenue. Work will include paving, replacing lighting, and widening of the Nuuanu Stream Bridge, among other activities, all within the existing right-of-way.

Part IV. Location of Activity *Attach map if necessary

Interstate Route H-1 from Middle Street to vicinity of Ward Avenue. See attached map.

Part V. Equipment to be utilized *Attach list if necessary

Standard road work equipment: trucks, cold planer, paving machine, roller, and striping machine. Also some specialty equipment such as jack hammer, jumping jack, hoe rams, vibratory sheetpile driver, crane, generator, compressor, etc.

Part VI. Estimated duration of construction activity

*Attach activity schedule for construction activities or attenuation of stationary sources.

From	To
July 2013	August 2014

Certification of Individual Authorized to Act for Applicant

I certify that I have knowledge of the facts herein set forth and that the same are true and correct to the best of my knowledge and belief. Acceptance of this permit constitutes an acknowledgement and agreement that the permittee will comply with all rules, regulations and orders of the department and the conditions precedent to the granting of this permit.

Signature	Date
Glenn M. Okimoto	JAN - 9 2013

CNP 01/08

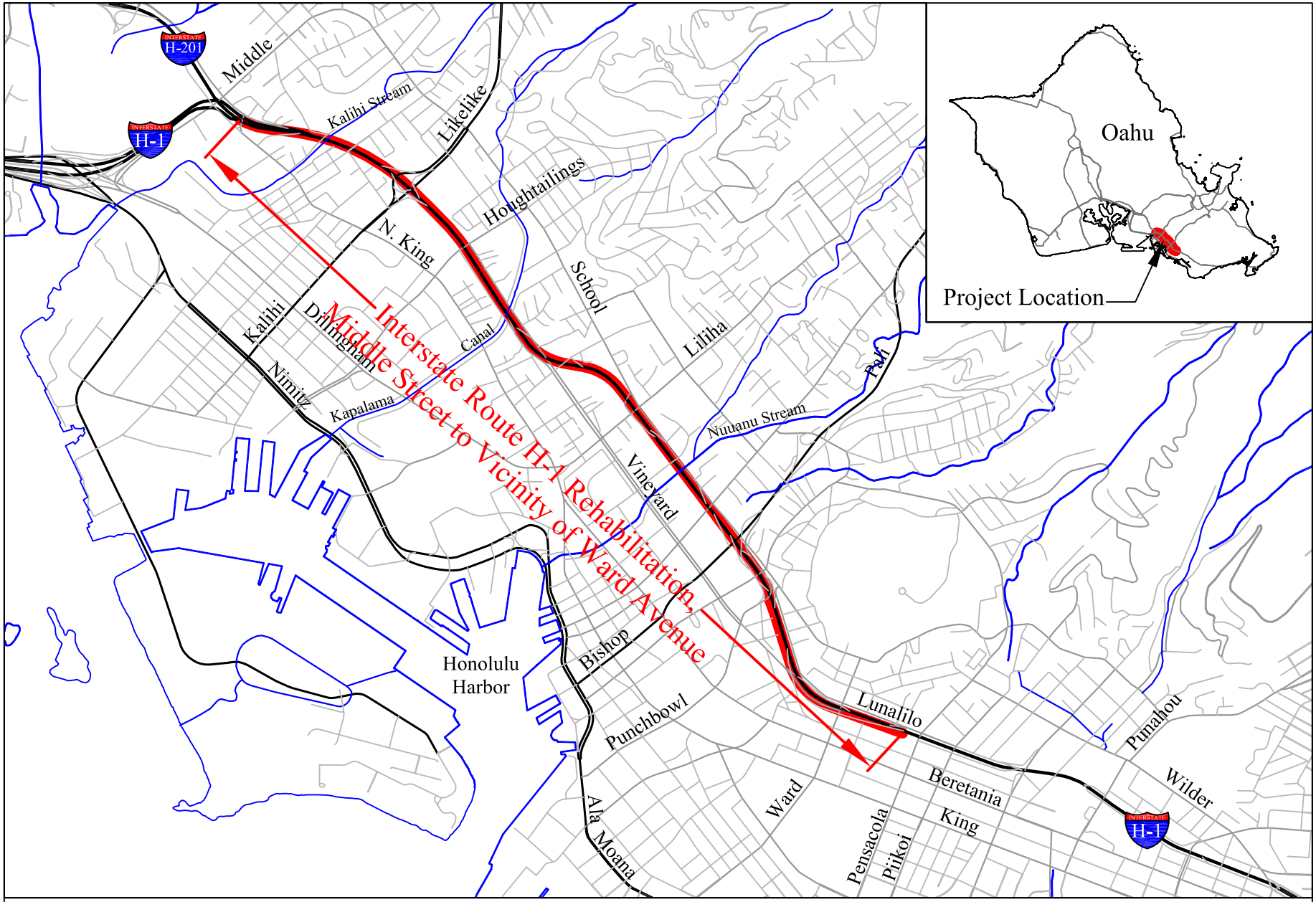
Please make checks payable to: **STATE DEPARTMENT OF HEALTH**

Return this application with the appropriate attachments to: Indoor and Radiological Health Branch
Noise Section
591 Ala Moana Boulevard, Room 133
Honolulu, Hawaii 96813-4921

All fees are non-refundable.
There will be a service fee of $25.00 for any check dishonored by the bank.
If you have any questions call our office at (808) 586-4700.

FOR DEPARTMENT OF HEALTH USE ONLY

Date Received		Permit Number	
Fee Paid		Receipt No.	
Date Approved			
Date Issued		Expiration Date	



Attachment A: Project Location

Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue
State of Hawaii Department of Transportation, Highways Division

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APPENDIX E NOISE VARIANCE APPLICATION

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State of Hawaii
Department of Health
Indoor and Radiological Health (IRH) Branch
Noise Section
591 Ala Moana Boulevard, Room 133
Honolulu, Hawaii 96813
(808) 586-4700

APPLICATION FOR COMMUNITY NOISE VARIANCE

Refer to "Guide to Application for Community Noise Variance" for instructions. Submit attachments if necessary. Application form and attachments must be submitted in triplicate.

1. Applicant Identification

Company Name:	State of Hawai‘i Department of Transportation Highways Division	Telephone:	(808) 587-2150
Authorized Individual:	Glenn M. Okimoto, Ph.D.	Telephone:	(808) 587-2150
Title:	Director of Transportation		
Mailing Address:	869 Punchbowl Street, Room 513 Honolulu, HI 96813		

2. Type and Purpose of activity

The purpose of the proposed project is to (a) improve the road surface (and thereby service) and extend maintenance of the roadway, (b) address traffic congestion, and (c) improve safety.

The proposed project includes the following general tasks:

- Pavement rehabilitation, including reconstruction and repaving, as necessary, from roughly Likelike Highway to Miller Street.
- Replacing the highway lighting system from roughly Middle Street to Vineyard Boulevard On-Ramp.
- Restriping the roadway to generate four through lanes in both directions to the extent possible throughout the project area.
- Installing a concrete glare screen on the median barrier from roughly Likelike Highway to Miller Street.
- Widening the Nuuanu Stream Bridge roughly 5 feet on the makai (downstream) side in order to accommodate four through lanes and one exit lane in the Diamond Head-bound (east-bound) direction.
- Minor modifications to the storm drain system, primarily inlet modifications.
- Minor grading and structural improvements at select and discrete locations throughout the project area.

3. Location of activity

Interstate Route H-1 from Middle Street to Vicinity of Ward Avenue (near the end of the Ward Avenue on-ramp) – a 3.5 mile long section of Interstate Route H-1 through the downtown and Kalihi area. See Attachment A.

4. Time of activity

Requested variance work hours on all days, including holidays, are:

- Monday 6 p.m. to Tuesday 7 a.m.
- Tuesday 6 p.m. to Wednesday 7 a.m.
- Wednesday 6 p.m. to Thursday 7 a.m.
- Thursday 6 p.m. to Friday 7 a.m.
- Friday 6 p.m. to Saturday 9 a.m.
- Saturday 6 p.m., all day and night Sunday, to Monday 7 a.m.

We are requesting the noise variance to allow work throughout all the times above, which are all hours that are considered beyond normal work hours. Some construction work (i.e. bridge widening and shoulder activities such as lighting replacement) may take place at any time of the day (daytime and nighttime, 24-hours a day, 7 days a week), provided the activities require the closure of no more than one through lane for a short period of time or the closure of an auxiliary lane. For example, some of the bridge widening work may be able to take place with only the closure of the auxiliary fourth lane between Liliha Street and Pali Highway.

The pavement repaving and rehabilitation work, and many other tasks, would require through lanes of Interstate Route H-1 to be closed in order to perform the work. Through lanes of Interstate Route H-1 would only be closed when the lane closures would not result in considerable traffic delays. The standard construction period lane closures are summarized below.

Summary of Standard Construction Period Lane Closures

	AM												PM											
Day / Hour:	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
Monday	╳	╳	╳	╱																		╱	╱	╳
Tuesday	╳	╳	╳	╱																		╱	╱	╳
Wednesday	╳	╳	╳	╱																		╱	╱	╳
Thursday	╳	╳	╳	╱																		╱	╱	╳
Friday	╳	╳	╳	╱																			╱	╳
Saturday	╳	╳	╳	╱	╱	╱																	╱	╳
Sunday	╳	╳	╳	╳	╳	╱																╱	╱	╳

Notes:
╳ = Minimum 1 through lane open
╱ = Minimum 2 through lanes open

In additional, there may be occasions when lane closures beyond these standards are necessary. During particular construction operations it may be necessary to close one or two through lanes of traffic for longer periods of time or to close all through lanes for a longer period of time.

5. Estimated duration of construction activity (Specify dates)

From July 1, 2013 To August 1, 2014

6. Schedule of activity (Submit as attachment)

Attachment B provides a schedule for over-all project construction.

7. Description of immediate impact area

Existing land uses along this portion of Interstate Route H-1 include roadways, commercial businesses, office buildings, residential buildings, mixed use buildings, schools, parks, museums, libraries, and other uses. There is very little undeveloped land in the project corridor.

The entire project area is zoned by the State of Hawai‘i as Urban.

HAR Section 11-46-3 Class A, B, and C zoning districts exist in the project area. The zoning districts are illustrated in drawings provided in Attachment C and are described below:

- Class A zoning districts include residential, conservation, preservation, public space, open space, or similar type. In the project area this includes City and County of Honolulu zoning codes R-3.5, R-5, and P-2. Class A zoning districts dominate the western portion of the project area, but are present throughout the area.
- Class B zoning districts include multi-family dwellings, apartment, business, commercial, hotel, resort, or similar type. In the project area this includes City and County of Honolulu zoning codes A-1, A-2, B-1, B-2, and BMX-3. Class B zoning districts dominate in the eastern portion of the project area, but are present throughout the area.
- Class C zoning district includes those areas zoned for industrial use. In the project area this includes City and County of Honolulu zoning code I-2, which is present in only one location at the western end of the proposed project area.

Attachment C illustrates the Class zones surrounding the project area. The areas shown on the maps in Attachment C are based on City and County of Honolulu zoning.

8. List of equipment to be utilized (attach list if necessary)

The following provides a list of equipment that is likely to be used along with the associated operational noise level of that equipment.

Rehabilitation and Restriping

Equipment	**Decibels**	**Equipment**	**Decibels**
Standard Construction Equipment		Light Impact Equipment	
Truck	75 - 90	None	
Saw	72 - 81		
Light Tower	62 - 72	Heavy Impact Equipment	
Cold Planer	79 - 88	None	
Paving Machine	86 - 88		
Roller	63 - 70		

Striping machine	75 - 86

Replacement of Highway Lighting, Storm Drain System Modifications, Minor Grading, and Minor Structural Improvements

Equipment	**Decibels**	**Equipment**	**Decibels**
Standard Construction Equipment		Light Impact Equipment	
Truck	75 - 90	Jack Hammer	81 - 98
Saw	72 - 81	Jumping Jack	81 - 97
Light Tower	62 - 72		
Concrete Truck	75 - 88	Heavy Impact Equipment	
Backhoe/Loader	72 - 83	None	
Compressor	74 - 87		
Generator	71 - 82		
Crane	75 - 87		

Widening of Nuuanu Stream Bridge

Equipment	**Decibels**	**Equipment**	**Decibels**
Standard Construction Equipment		Light Impact Equipment	
Truck	75 - 90	Jack Hammer	81 - 98
Saw	72 - 81	Jumping Jack	81 - 97
Light Tower	62 - 72		
Concrete Truck	75 - 88	Heavy Impact Equipment	
Backhoe/Loader	72 - 83	Hoe rams	95 - 106
Compressor	74 - 87	Vibratory Sheetpile driver	90 - 100
Generator	71 - 82		
Crane	75 - 87		

9. Plans and procedures for the attenuation of noise emission emanating from the activity

To minimize noise impacts to those in the project area the following measures will be employed during construction:

- A public information program will be employed prior to and during construction. The program will consist of:
  - The contractor sending an informational flyer to all addresses within 500 feet of the project area roughly two weeks prior to the start of construction. The flyer will include general project information and the name and phone number of a contractor representative to contact.
  - Providing information to the press on at least a weekly basis.
  - Placing legal advertisements in the newspaper every two weeks identifying the areas where work will occur at night over the next two weeks along with a name and phone number to contact with questions or complaints.

- Updating of HDOT's website at least every two weeks with information regarding the time and location of night work as well as a name and phone number to contact with questions or complaints.

- Quiet work procedures will be employed to attenuate and control noise emissions emanating from the construction site, such as:
  - Either ambient-sensing backup alarms or ground guides will be used for signaling when equipment backs up at night (8:00 p.m. to 6:00 a.m.).
  - Construction activity constraints for night work, where applicable.
  - The use of temporary noise barriers for both day-time and night-time sensitive receptors, where feasible.
  - The strategic placement of stationary equipment such as compressors and generators.
  - All equipment will be maintained in good working order and with appropriate mufflers.
  - A job-site inspector will be designated to whom immediate complaints can be forwarded for prompt response and who will have the general responsibility of monitoring quiet work procedures.
  - Instructional meetings will be held with construction crews and truck drivers to discuss noise abatement procedures, including the use of engine brakes, loading and unloading cargo, shouting, use of signal callers, and other practices as required.

- The selected contractor will have a corrective action program in place that lays out steps and responsibilities to respond to complaints and correct deficiencies.

10. Identify specific provisions of statutes or rules for which the variance is requested (include specific sections)

This variance is requested to perform construction activities during prohibited night and morning hours, Sunday through Sunday, not covered by a community noise permit for construction activities. The specified rules for which the variance is requested are:

- Hawai'i Revised Statutes (HRS) Chapter 342F, Noise Pollution;
- Hawaii Administrative Rules (HAR), Title 11, Chapter 46, Section 7-(j)-(1), which states "No permit shall allow any construction activities which emit noise…before 7 a.m. and after 6 p.m. of the same day, Monday thru Friday,";
- HAR, Title 11, Chapter 46, Section 7-(j)-(2), which states "No permit shall allow any construction activities which emit noise…before 9 a.m. and after 6 p.m., on Saturday."; and
- HAR, Title 11, Chapter 46, Section 7-(j)-(3), which states that "No permit shall allow any construction activities which emit noise…on Sundays and on Holidays."

11. Description of alternatives to the proposed activity

As an alternative to the proposed night and weekend work hours, work could be constrained to normal work hours.

Work on Interstate Route H-1 that requires lane closures is typically not allowed by HDOT during daytime hours. If it was allowed, it would be for very short durations with no more than one lane closed. Even with these restrictions, performing the work during normal work hours would be very disruptive to traffic and mobility throughout Honolulu.

12. Describe why the present or proposed activity cannot be altered to comply with applicable statutes or rules

Altering the proposed night and weekend work hours to daytime hours would be more disruptive to traffic, likely resulting in gridlock conditions on Interstate Route H-1, nearby surface streets, and parallel routes such as Dillingham Boulevard and Nimitz Highway. Gridlock conditions would likely affect travel on the entire southern portion of O‘ahu.

Restricting construction activities to standard times would also significantly lengthen the period of time required to complete the project and subsequently increase construction costs.

13. Description of any adverse environmental effects which cannot be avoided

Noise emissions generated from the proposed construction activity would be inconvenient to nearby residents, visitors, and businesses.

14. Discuss the relationship between short-term (temporary) use of the environment, and the maintenance and enhancement of long-term productivity

During construction, the elevated noise emissions generated by construction of the proposed project would be bothersome and annoying to nearby receptors. While these construction effects are temporary, the long-term benefits of the proposed project include the long-term maintenance of the interstate and its enhancement to 4 through lanes, which would help addresses the current congestion on the interstate.

15. Discuss any irreversible and irretrievable commitments of resources which would be involved in the proposed activity

The project would consume resources such as energy, construction materials, and labor.

16. Discuss any possible impact from noise created by any proposed nighttime activity which may affect the immediate surrounding area

The most common noise source during construction will be engine powered machinery, such as earth-moving equipment, materials handling equipment, and stationary equipment. Mobile equipment (e.g., trucks) operates in a cyclic manner, and stationary equipment (generators and compressors) generate noise at fairly constant levels. However, nighttime activities will vary and be constrained depending on the construction activity and surrounding receptors.

Most commercial businesses and offices in the immediate vicinity are closed during the proposed night work; therefore, no adverse impact to those land uses is foreseen. Some business, offices, and residents will be affected by the proposed night work and its inconvenient noise emissions.

17. Discuss any plans or procedures for notification of people in the surrounding area of any planned nighttime activity

As discussed in question 9, a public information program will be employed prior to and during construction. The program will consist of:

- The contractor sending an informational flyer to all addresses within 500 feet of the project area roughly two weeks prior to the start of construction. The flyer will include general project information and the name and phone number of a contractor representative to contact.
- Providing information to the press on at least a weekly basis.
- Placing legal advertisements in the newspaper every two weeks identifying the areas where work will occur at night over the next two weeks along with a name and phone number to contact with questions or complaints.
- Updating of HDOT's website at least every two weeks with information regarding the time and location of night work as well as a name and phone number to contact with questions or complaints.

18. Describe the purpose of the project as relating to public interest

The project will provide employment to the construction industry while minimizing disruption to traffic. Once completed, the project will restore and increase service, improve safety, and extend the life of the roadway surface.

CERTIFICATION OF INDIVIDUAL AUTHORIZED TO ACT FOR APPLICANT

I Glenn M. Okimoto, certify that I have
Print Name

knowledge of the facts herein set forth and that the same are true and correct to the best of my knowledge and belief.

Signature: _____

Date: JAN 07 2013

FOR DEPARTMENT OF HEALTH USE ONLY

Date received _____

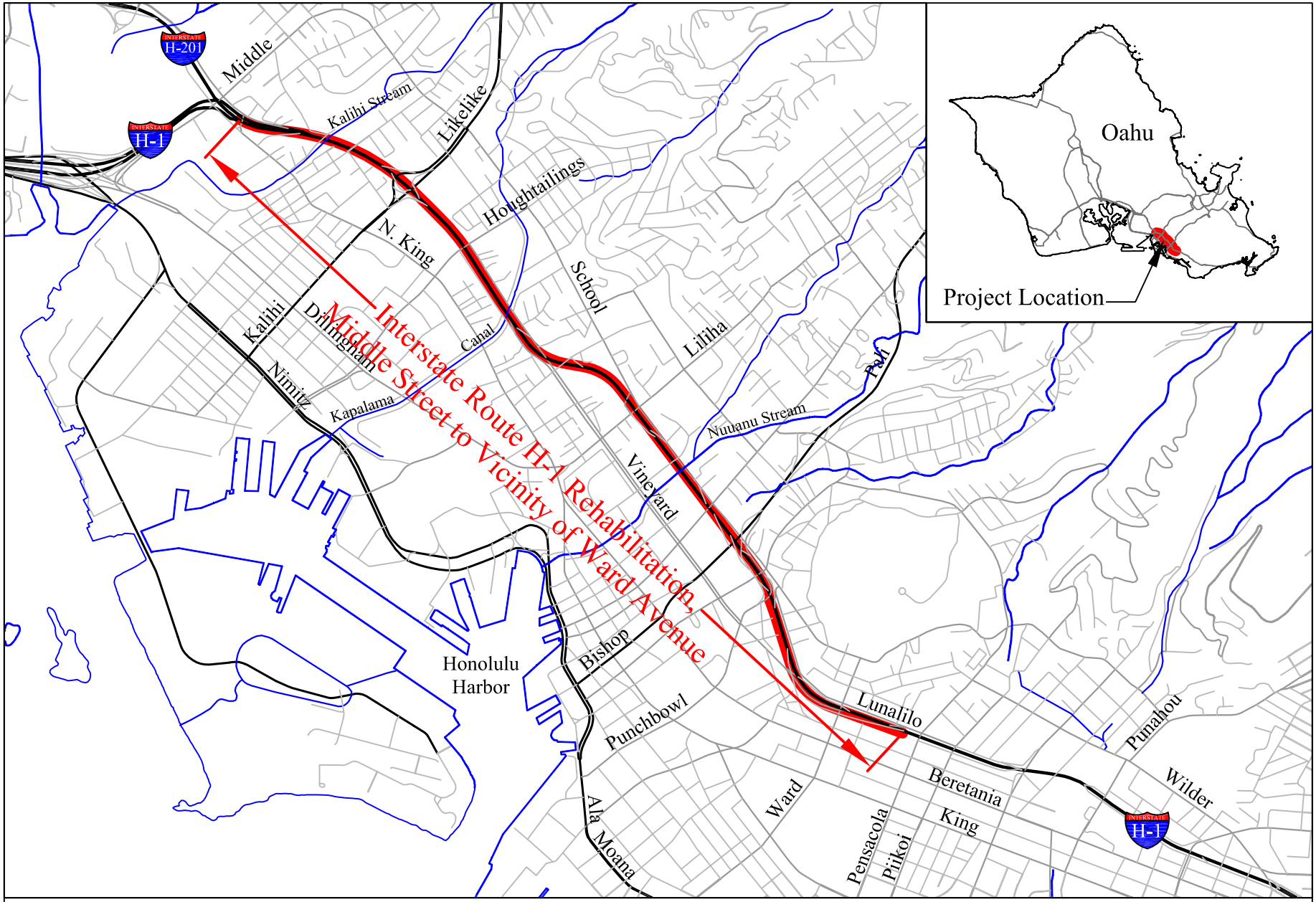
Variance Appl. Number _____

Variance Docket Number _____

Fee Paid _____ Receipt No. _____

Date Issued _____ Exp. Date _____

Attachment A. Project Location



Attachment A: Project Location

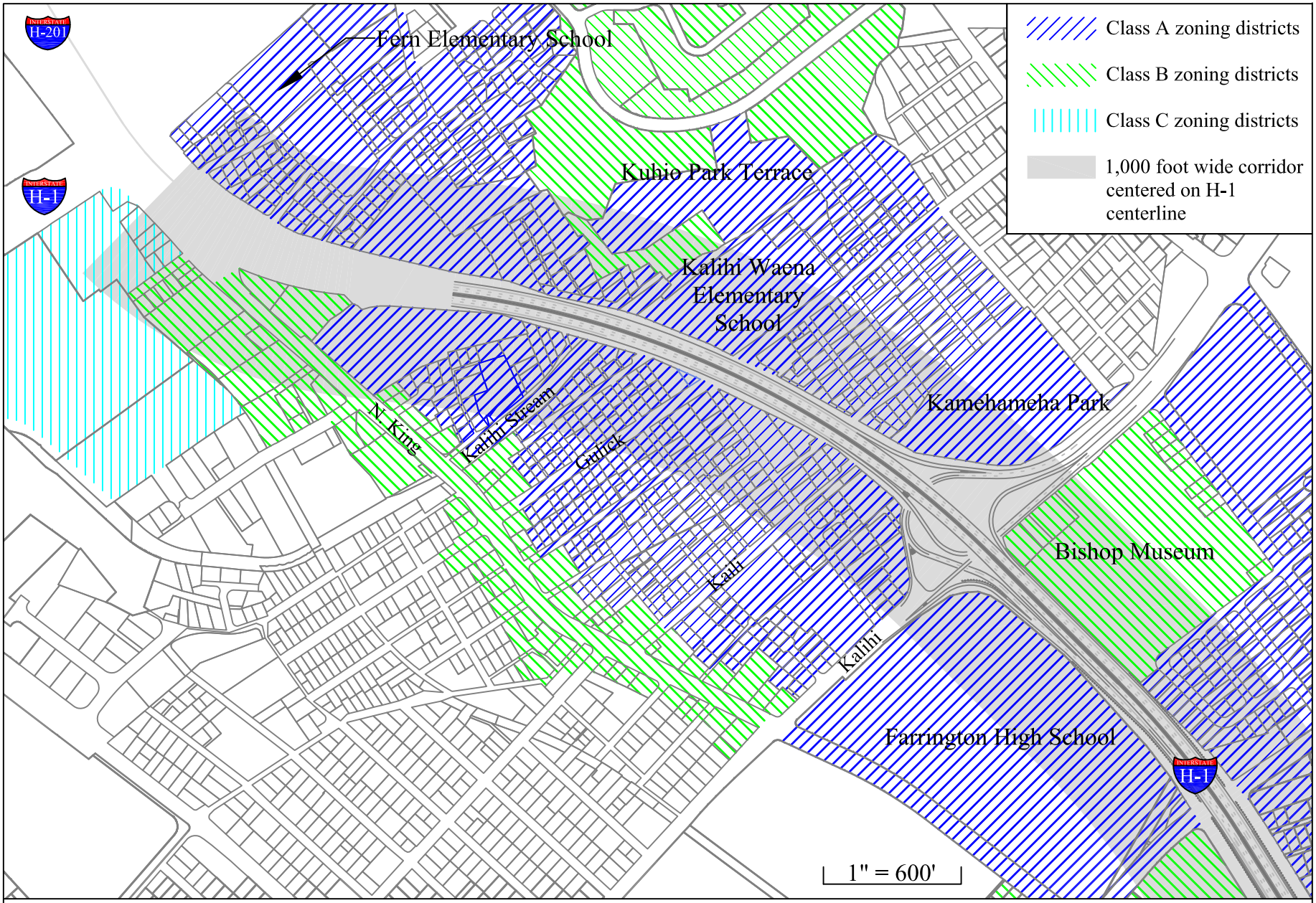
Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue
State of Hawaii Department of Transportation, Highways Division

Attachment B. Schedule of Activity

ATTACHMENT B
Estimated Construction Schedule
Interstate Route H-1 Rehabilitation,
Middle Street to Vicinity of Ward Avenue

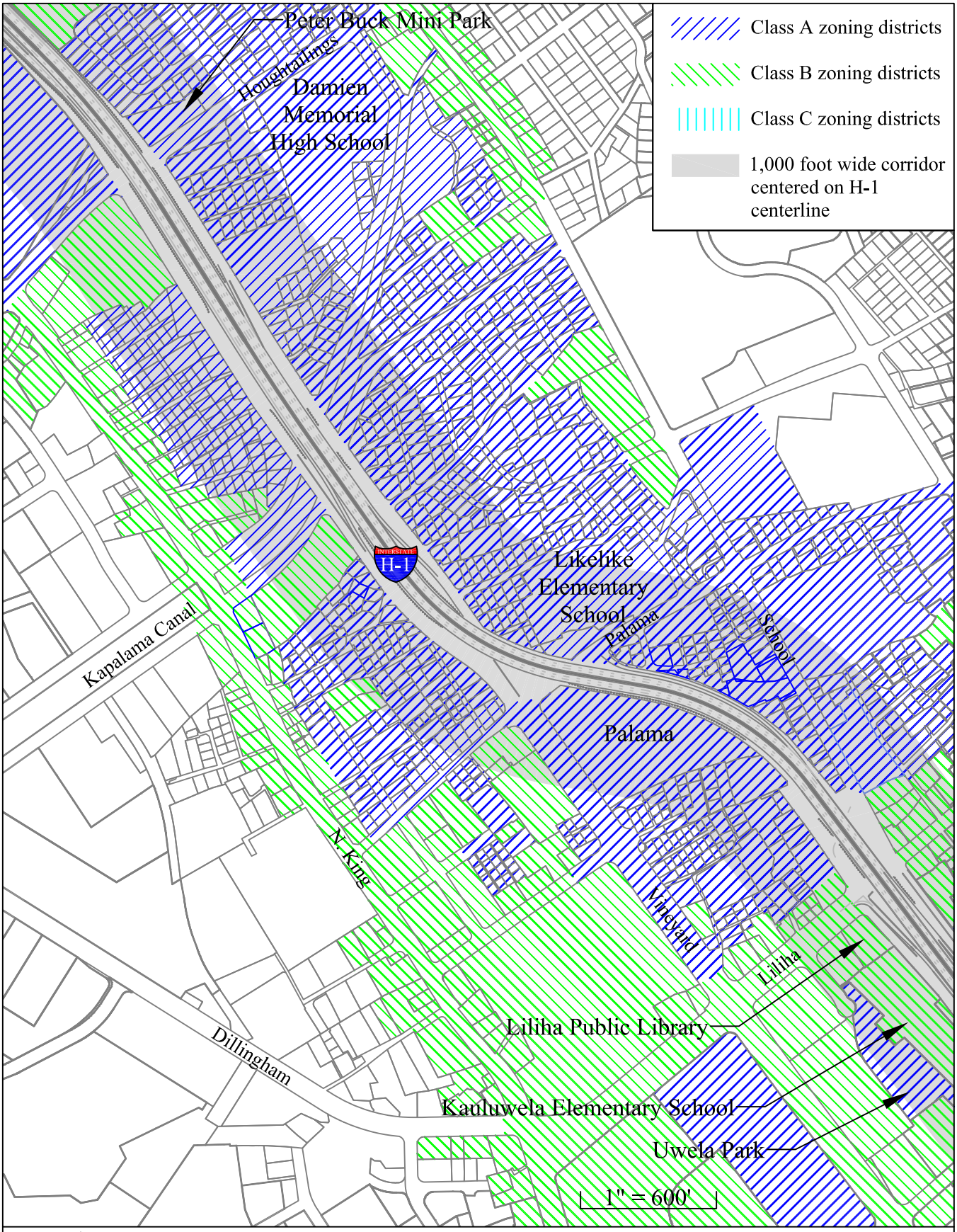
	2013						2014						
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Mobilization and set-up													
Pavement rehabilitation													
Shoulder work, including:													
Lighting													
Drainage modification													
Grade adjustment/retaining walls													
Sign modification													
Safety barrier modifications													
Nu‘uanu Stream Bridge Widening													
Glare screen													
Restriping													

Attachment C. Class Zoning Districts Surrounding Project Area



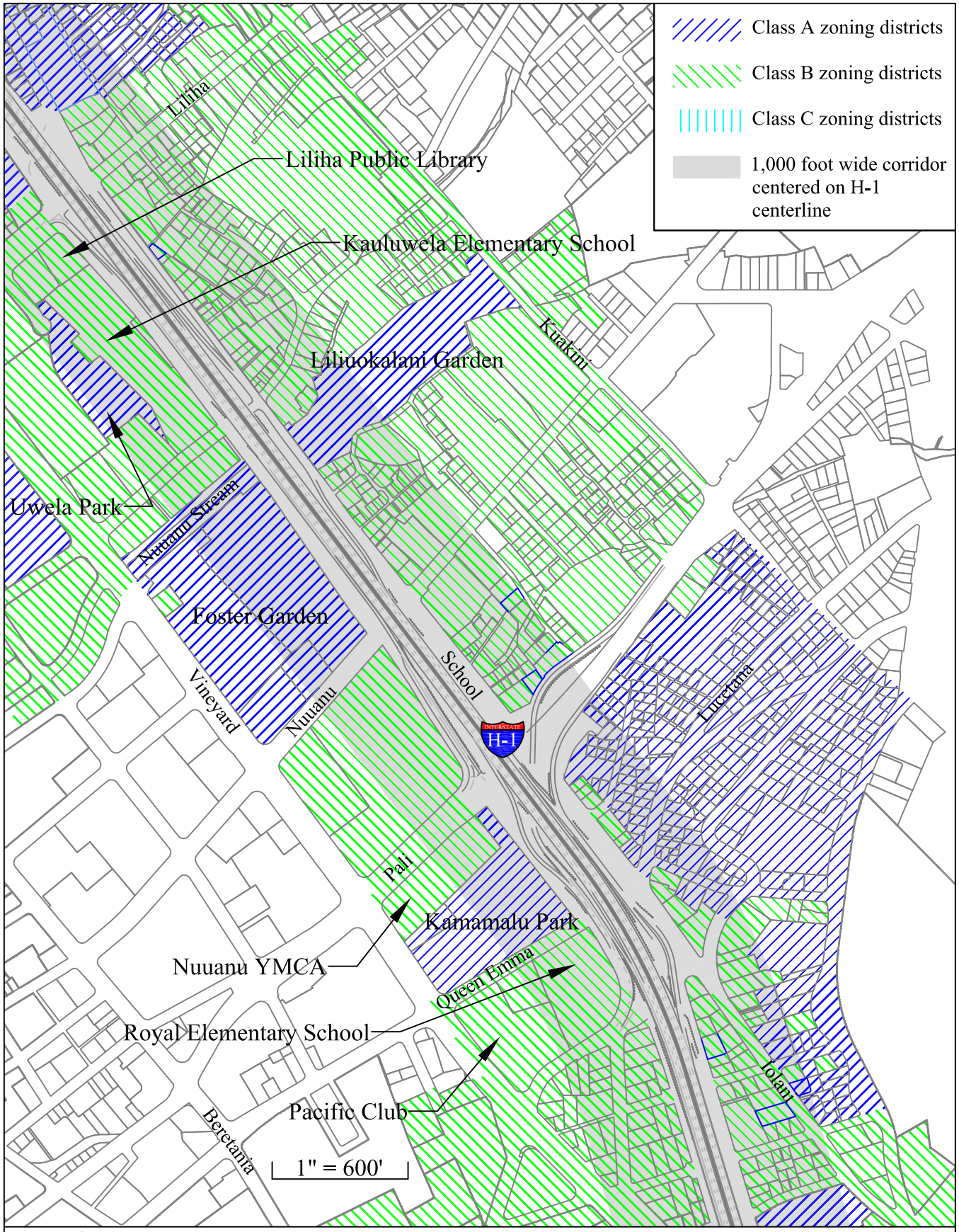
Attachment C
Figure C1: Zoning Districts

Interstate Route H-1 Rehabilitation,
Middle Street to Vicinity of Ward Avenue



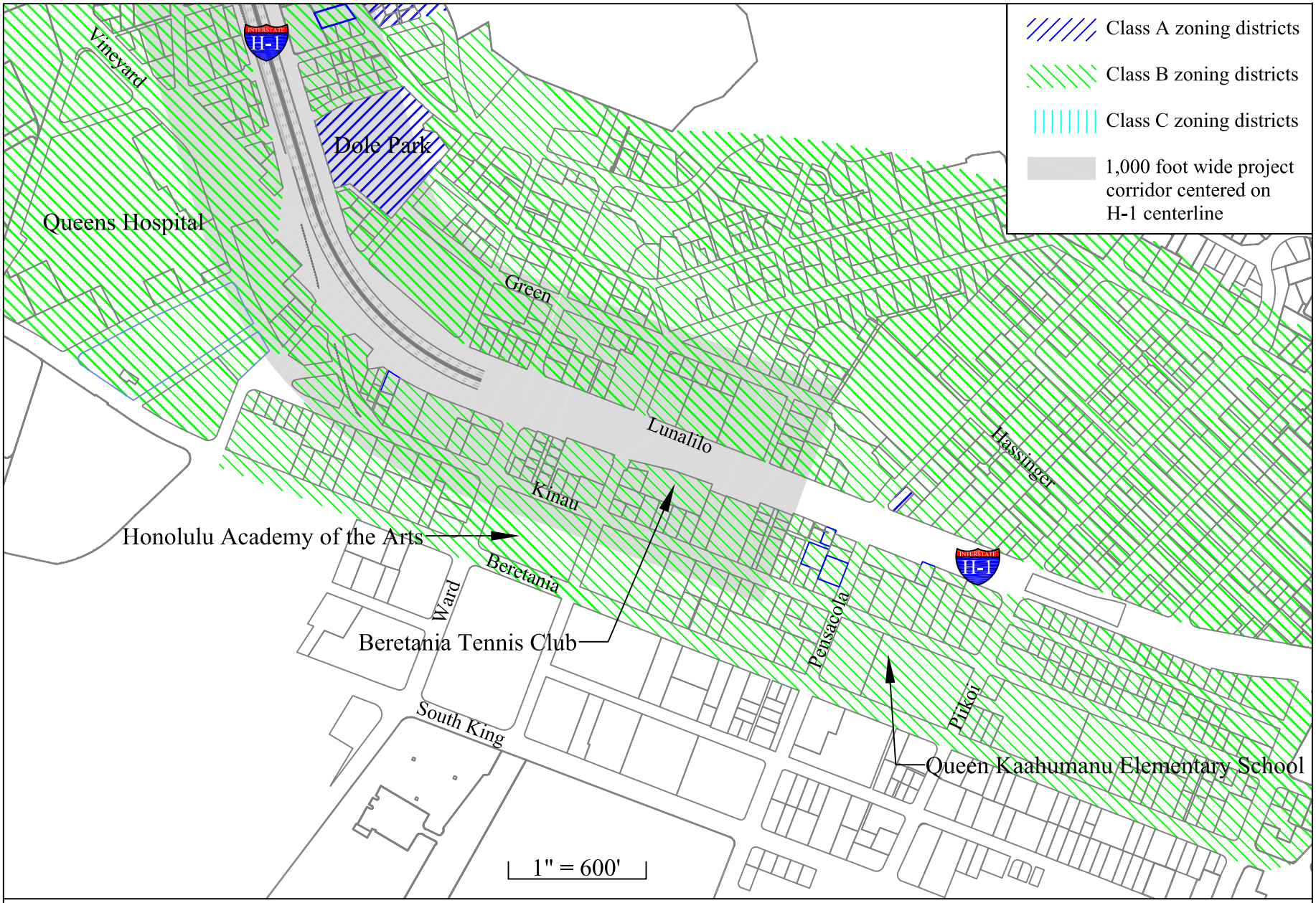
Attachment C
Figure C2: Zoning Districts

Interstate Route H-1 Rehabilitation,
Middle Street to Vicinity of Ward Avenue



Attachment C
Figure C3: Zoning Districts

Interstate Route H-1 Rehabilitation,
Middle Street to Vicinity of Ward Avenue



Attachment C
Figure C4: Zoning Districts

Interstate Route H-1 Rehabilitation,
Middle Street to Vicinity of Ward Avenue

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APPENDIX F TRAFFIC CAPACITY EVALUATION

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TRAFFIC CAPACITY EVALUATION

Interstate Route H-1

Rehabilitation

Middle Street to Vicinity of Ward Avenue

FAIP No. IM-H1-1(269)

Honolulu, Oahu, Hawaii

December 2012

PARSONS BRINCKERHOFF

Over a Century of Engineering Excellence

TRAFFIC CAPACITY EVALUATION

Interstate Route H-1

Rehabilitation

Middle Street to Vicinity of Ward Avenue

FAIP No. IM-H1-1(269)

Honolulu, Oahu, Hawaii

December 2012

Prepared for:

Hawaii Department of Transportation
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I. EXECUTIVE SUMMARY

Interstate Route H-1 (H-1 Lunalilo Freeway) between Middle Street and the vicinity of Ward Avenue is proposed to undergo rehabilitation that would include: resurfacing, weakened pavement reconstruction, restriping, highway lighting replacement, bridge parapet reconstruction, bridge widening, and grade adjustment walls. The restriping would improve traffic flow and add a much needed fourth through lane in both directions through this corridor.

The project would improve the public's mobility on this vital transportation link in Oahu's primary urban center. The necessary construction would reduce travel times and further the pavement's service life expectancy.

The added fourth through lane would increase Interstate Route H-1's capacity. The added lane outweighs the loss of capacity due to decreasing lane widths and lateral clearances. In the existing condition, 12 of the 18 ramp segments (including overlap segments) operate at Level of Service (LOS) E or F during the AM peak hour and 13 ramp segments operate at LOS E or F during the PM peak hour. The proposed project would generally improve operations at 14 ramp segments during the AM peak hour and at 16 ramp segments during the PM peak hour.

At the eastbound Middle Street merge, the average queuing would be improved to 1,740 feet from 3,490 feet on H-201 Moanalua Freeway and to 3,370 feet from 6,750 feet H-1 Freeway during AM peak hour.

Following analysis and evaluation of the proposed project, the following recommendations should be implemented, should the project move forward:

1. The posted speed limit should be lowered to 45 mph throughout the project limits. Advisory signs should be posted suggesting a speed of 35 mph around curves.
2. At the eastbound Middle Street merge, the H-201 Moanalua Freeway outer lane should merge with the inner lane of H-1 Lunalilo Freeway, which is similar to how they merge now.
3. At the westbound Likelike Highway (Kalihi Street) on-ramp, the long auxiliary lane that connects the H-1 Lunalilo Freeway to the airport Viaduct should be reduced to a merge with a 250-ft tapered on-ramp lane that is adjacent to the mainline. The

vehicles accessing the H-1 Lunalilo Freeway from Likelike Highway/Kalihi Street will enter the tapered on-ramp lane to merge into the H-1 Lunalilo Freeway mainline. Micro-simulation analysis showed that although the delay will increase for vehicles entering the freeway, the on-ramp queuing would not back up significantly.

4. Due to loss of shoulders, improved incident management such as enhanced Freeway Service Patrol should be considered.

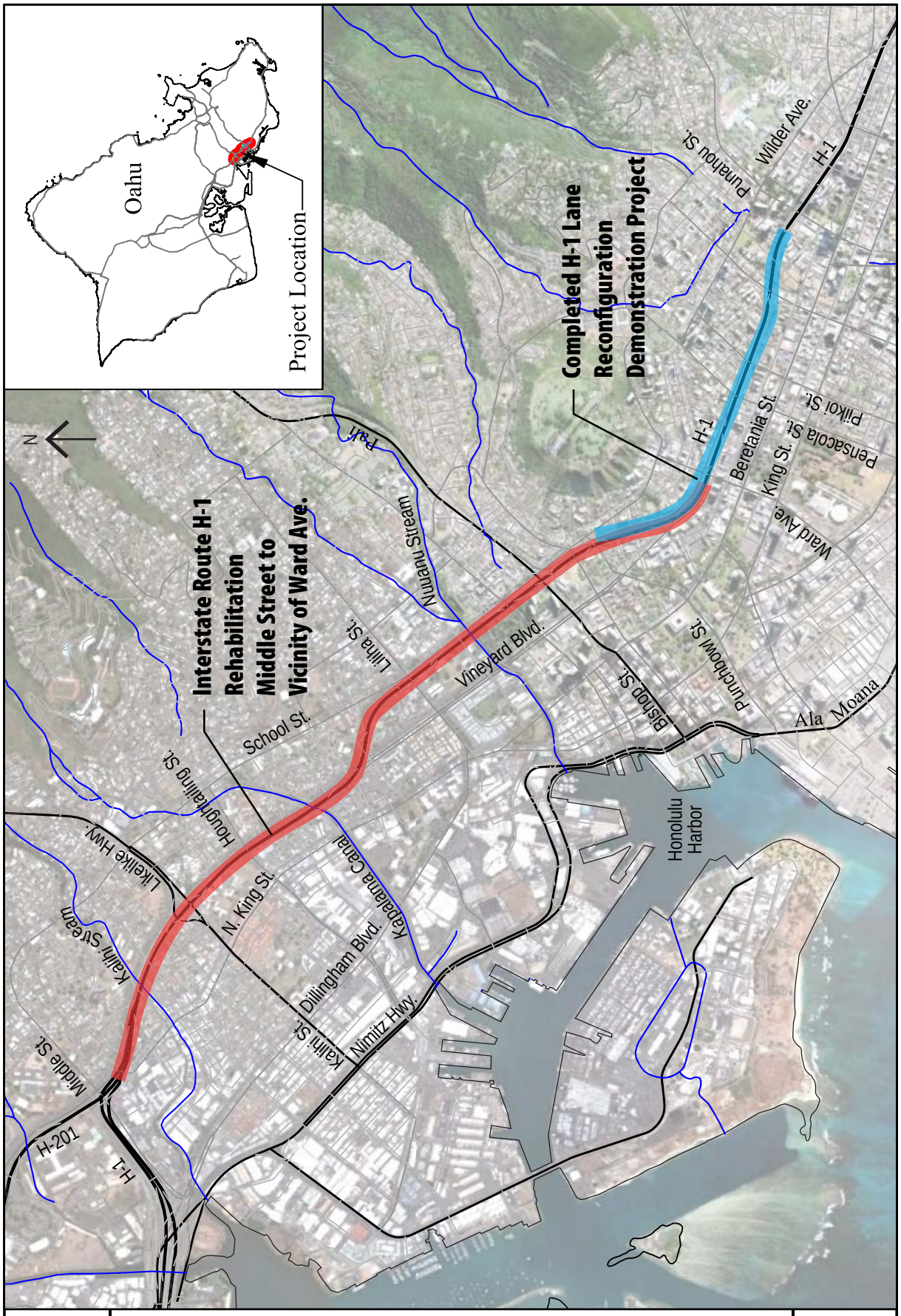
II. INTRODUCTION

As Oahu's principal east-west thoroughfare, stretching from Kalaeloa in the west to Kahala in the east, Interstate Route H-1 (H-1 Lunalilo Freeway) connects communities across the island. The proposed "Interstate Route H-1 Rehabilitation, Middle Street to the vicinity of Ward Avenue" project covers a portion of the H-1 Lunalilo Freeway that provides direct access to downtown Honolulu and serves as a critical link to areas within and beyond Oahu's primary urban center (Figure 1). It is a National Highway System (NHS) route and classified as an Urban Freeway, which experiences extremely heavy traffic volumes during the morning, mid-day, and afternoon peak hours.

This section of H-1 Lunalilo Freeway was constructed between 1958 and 1966 in a series of six construction contracts. Like many other aging interstate routes, while it has been re-surfaced many times since initial construction, the existing condition exhibits moderate to severe signs of pavement distress due to its heavy use. Based on a windshield survey conducted in October 2011, common pavement failures that were observed include alligator cracking, pothole patching, and rutting. Generally, these types of pavement failures can be associated with poor drainage, fatigue from repetition of heavy truck loads, or inadequacies of the pavement base. Although most of the failures were localized to a single lane, a few of the distressed areas spanned several adjacent lanes. The project would rehabilitate the moderate and severely distressed areas and resurface the remainder of the freeway to improve the riding surface. The other proposed improvements include: highway lighting replacement, bridge parapet reconstruction, bridge widening, and grade adjustment wall construction.

Along with the pavement rehabilitation of H-1 Lunalilo Freeway, Hawaii State Department of Transportation (HDOT) also plans to restripe the freeway to four 10-foot wide through lanes in order to address increasing congestion in this corridor. The project would retain auxiliary lanes where the right-of-way permits. A similar demonstration striping project along westbound H-1 Lunalilo Freeway between Punahou Street and Pali Highway and eastbound between Ward Avenue and Keeaumoku Street was completed in 2012 and is under evaluation.

If approved, the project is expected to begin construction in the summer of 2013 and be complete by the summer of 2014.



Project Location

Figure 1

III. EXISTING CONDITIONS

As shown in Figure 1, a H-1 Lunalilo Freeway Lane Reconfiguration Demonstration project was completed just to the east of the proposed project. Existing freeway lanes westbound between Punahou Street and Pali Highway and eastbound between Ward Avenue and Keeaumoku Street were restriped. The three existing through lanes were narrowed and an additional outside (right) lane was created. The demonstration project narrowed lanes to 10 feet wide and narrowed the median and shoulders to two to four feet wide. The lanes were previously 12 feet wide and shoulder widths were up to five feet wide. A restriping project also narrowed the eastbound H-1 Lunalilo Freeway lanes between the Liliha Street on-ramp and Pali Highway off-Ramp (Exit 21A) in 2006.

A. Existing Freeway System

H-1 Lunalilo Freeway, between Middle Street and the vicinity of Ward Avenue, is a restricted access freeway that runs east-west through the primary urban center. Overall the H-1 Freeway runs from Kapolei in the west to the Kahala/Waialae area in the east. The project area is 3.2 miles long (Milepost 18.95 to 22.13) and is a six-lane roadway with varying lane widths and shoulder widths. There are 25 on/off-ramps within this 3.2-mile section of H-1 Lunalilo Freeway. Total ramp density averages roughly three ramps-per-mile in each direction. The right-of-way through the project area varies widely from 120'-140' (near the Aala Street Extension Overpass) to 300' (near the Pali Highway and Puowaina Interchange). The posted speed limit is 50 mph.

H-1 Freeway is the primary east-west thoroughfare for commuters traveling between west Oahu and downtown Honolulu and points further east. This corridor experiences extremely heavy traffic volumes during the morning, mid-day, and afternoon peak hours. This section of the H-1 Lunalilo Freeway provides access to the Central Business District and numerous private and public schools in the vicinity, including the University of Hawaii campus (at Manoa).

There are generally three through lanes in each direction throughout the proposed project area. With the presence of 25 on/off-ramps, the outermost (right) lane in each direction acts as a merge/weave lane, effectively providing only two lanes to service through-traffic. Additional auxiliary lanes are provided at several locations, including:

- Eastbound:
    - H-1 Airport Viaduct to Likelike Highway/Kalihi Street off-ramp
    - Likelike Highway/Kalihi Street on-ramp to Vineyard (Olomea Street) Boulevard off-ramp
    - Liliha Street on-ramp to Pali Highway off-ramp
    - Pali Highway on-ramp to Kinau Street off-ramp
- Westbound:
    - Lunalilo Street on-ramp to Vineyard Boulevard off-ramp
    - Halona (Vineyard) Street on-ramp to LIkelike Highway/Kalihi Street off-ramp
    - Likelike Highway/Kalihi Street on-ramp toH-1 Airport Viaduct.

Abutting land use within this section of the H-1 Lunalilo Freeway is highly urbanized and consists of both commercial and residential properties, including high-rise apartments and condominiums, schools, churches, and libraries.

1. Existing Interchange System

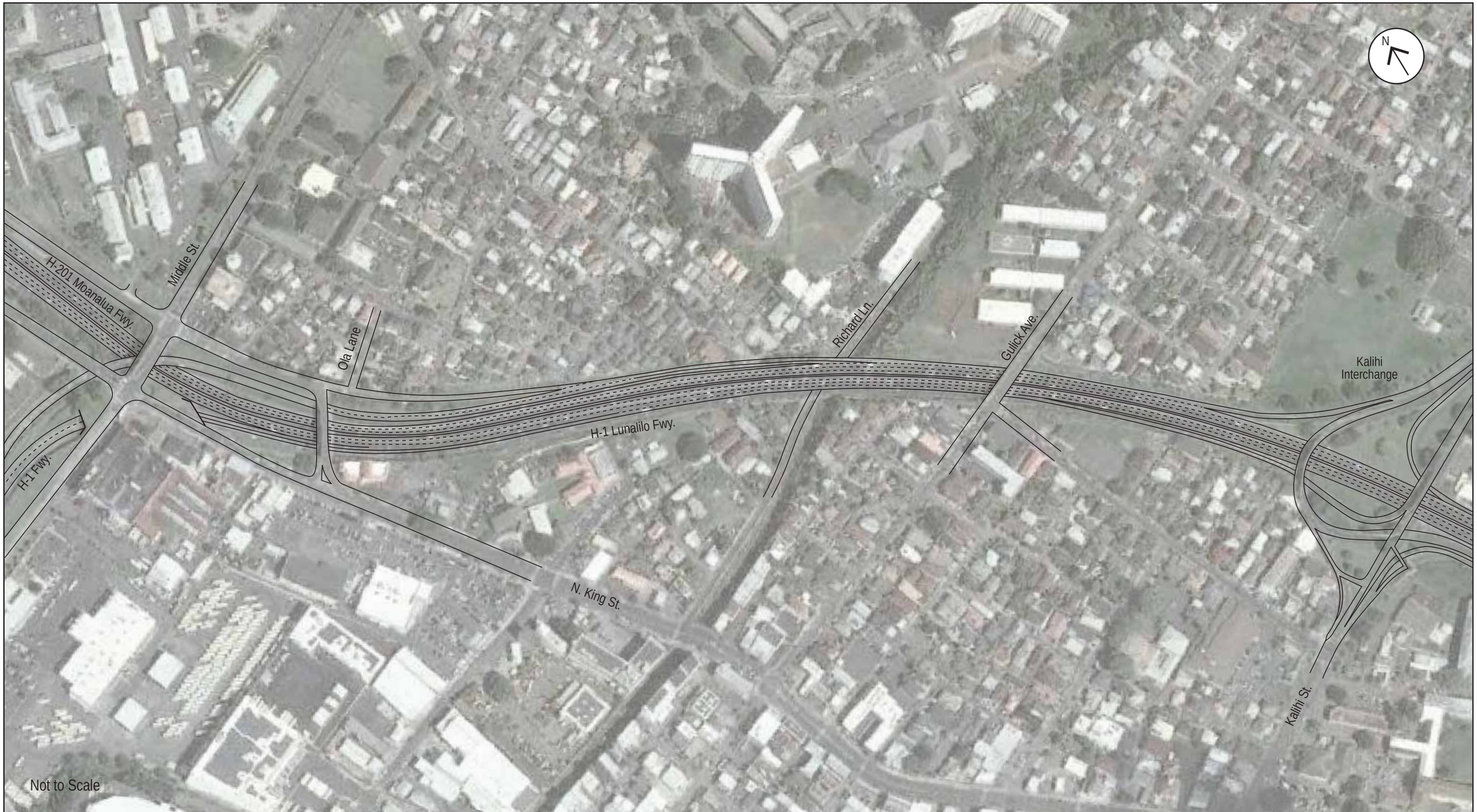
Figures 2-5 illustrate the existing study corridor lane configurations. The study corridor is shown as four segments in order to show the detail along the freeway.

a) Kahauiki Interchange (Middle Street merge)

The Kahauiki Interchange includes the Middle Street merge area. The interchange is similar to a Diamond interchange. Eastbound H-201 Moanalua Freeway traffic is merged with eastbound H-1 Lunalilo Freeway traffic. Westbound H-1 Lunalilo Freeway traffic diverges from westbound H-201 Moanalua Freeway traffic.

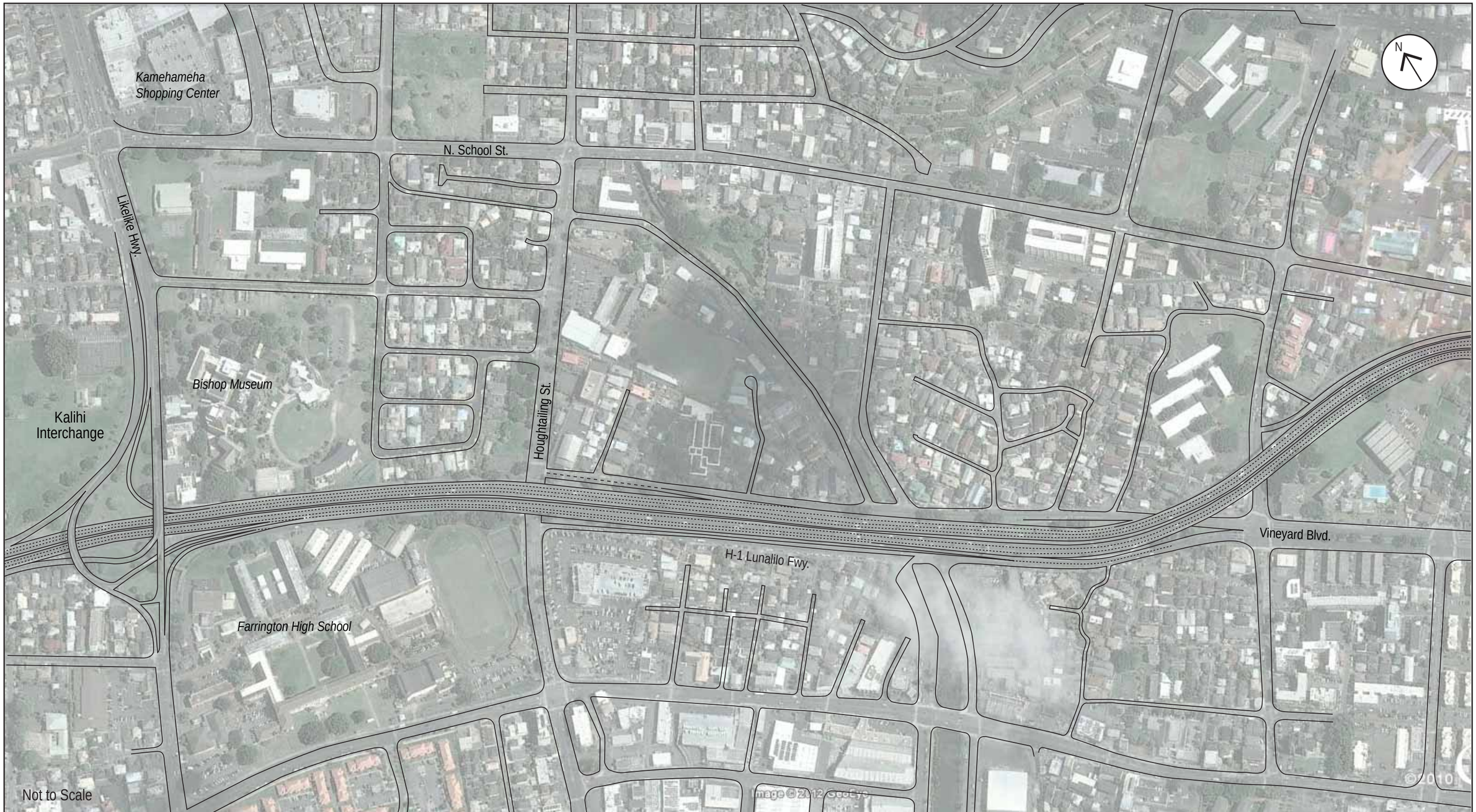
b) Kalihi Interchange (Likelike Highway)

The Kalihi Interchange attracts trips to the Kamehameha Shopping Center, Kamehameha Schools (Kapalama Campus), Farrington High School, Kalihi Valley, and the Likelike Highway which provides north-south access to Kailua and Kaneohe. This interchange has a similar configuration to a single-point urban interchange.



Segment 1 Existing Lane Configurations

Figure
2



Segment 2 Existing Lane Configurations

Figure
3

Segment 3 Existing Lane Configurations

Figure
4

Segment 4 Existing Lane Configurations

Figure
5

c) Vineyard/Palama/Houghtailing Interchange

The Vineyard/Palama/Houghtailing junction isn't a traditional interchange. The freeway passes over both Houghtailing Street and Palama Street in the vicinity and provides access to off-ramps and on-ramps to the intersecting streets.

d) Pali Interchange

The Pali Interchange connects H-1 Lunalilo Freeway with Pali Highway northbound and southbound traffic. It also provides southbound Pali Highway off-ramp access to southbound Punchbowl Street and northbound Punchbowl Street on-ramp access to northbound Pali Highway. The interchange configuration is similar to that of three-leg directional interchange.

e) Puowaina (Kinau/Vineyard) Interchange

The Puowaina Interchange connects H-1 Lunalilo Freeway with Ward Avenue, Vineyard Boulevard, Kinau Street, and Lunalilo Street. Lunalilo Street and Kinau Street act similarly to frontage roads for the H-1 Lunalilo Freeway at this interchange. This interchange offers access from Ward Avenue to eastbound H-1 Lunalilo Freeway. H-1 Lunalilo Freeway traffic is provided access westbound Vineyard Boulevard eastbound Kinau Street.

Appendix A includes the available traffic count data for the entire project limits.

B. Existing Traffic Volumes

Continuous traffic counts were conducted by the Hawaii Department of Transportation (HDOT) on Thursday, March 12 and Thursday, April 23, 2009, at the above-mentioned locations.

Additional counts were collected by HDOT at the following on-ramps and off-ramps during various weekdays in 2009:

- Eastbound on-ramp to H-201 Moanalua Freeway between Funston Road and H-1 diverge
- Eastbound off-ramp to northbound Likelike Highway/Kalihi Street
- Eastbound on-ramp from northbound and southbound Likelike Highway/Kalihi Street
- Eastbound off-ramp to Olomea Street
- Eastbound on-ramp from Liliha Street

- Eastbound off-ramp to Pali Highway
- Eastbound off-ramp to Punchbowl Street
- Eastbound on-ramp from Pali Highway
- Eastbound off-ramp to Kinau Street
- Eastbound on-ramp from Vineyard Boulevard
- Eastbound on-ramp from Ward Avenue
- Westbound off-ramp from H-201 Moanalua Freeway between Funston Road and H-1 merge
- Westbound off-ramp to northbound and southbound Middle Street
- Westbound off-ramp to Middle Street and H-1 Lunalilo Freeway
- Westbound on-ramp from southbound Likelike Highway/Kalihi Street
- Westbound off-ramp to northbound Likelike Highway/Kalihi Street
- Westbound off-ramp to westbound Halona Street
- Westbound on-ramp from westbound Halona Street
- Westbound off-ramp to Palama Street
- Westbound on-ramp from North School Street
- Westbound off-ramp to westbound North School Street
- Westbound on-ramp from northbound Punchbowl Street
- Westbound off-ramp to northbound Pali Highway
- Westbound off-ramp to Vineyard Boulevard
- Westbound on-ramp from Lunalilo Street

The traffic volumes were summarized into AM and PM peak hour volumes as shown in Figures 6-9. The study AM and PM peak hours were 6:00-7:00 a.m. and 5:00-6:00 p.m., respectively, in the eastbound direction and 6:30-7:30 a.m. and 5:00-6:00 p.m., respectively, in the westbound direction.

The percentage of trucks on H-1 Lunalilo Freeway ranges from 2.8% (west of Ward Avenue) to 3.4% (at the Kapalama Drainage Canal). The six-lane Route 92, Nimitz Highway, which is parallel to this section of H-1, is the major truck route due to its proximity to shipping ports and industrial areas. The percentage of trucks on Nimitz Highway is 5.5%.

A queuing analysis was performed in order to document the existing conditions at two key locations that were identified for the project: the Middle Street merge in the eastbound direction and at the Likelike Highway/Kalihi Street southbound on-ramp to H-1 Lunalilo Freeway westbound.

At the Middle Street merge, in the eastbound direction, the H-1 Lunalilo Freeway feeds two lanes into the merge with H-201 Moanalua Freeway, which brings three lanes into the merge. The left H-1 Lunalilo Freeway lane must merge into the right H-201 Moanalua Freeway lane and thus, reduces the number of lanes from five to four. The merge is further complicated by the fact that the outside fourth lane is an exit-only auxiliary lane for the off-ramp at Likelike Highway/Kalihi Street. The critical time period at this location is the AM peak hour (6:00-7:00 a.m.) due to the large volume of commuter traffic heading from Central and West Oahu toward the Central Business District.

The combination of the two freeways creates turbulence and a bottleneck that causes spillover onto both facilities in the upstream direction. Queuing observations were made on both the H-1 Freeway and H-201 Moanalua Freeway on Tuesday, October 23, and Thursday, October 25, 2012. On the H-1 Freeway, during the AM peak period, the average “back of queue” length was observed to be 7,050 feet and the maximum “back of queue” length was observed to be 10,650 feet. Both of these measurements were taken with the gore point for the eastbound Middle Street merge as the starting point.

Likewise, the gore point for the eastbound Middle Street merge was used as the starting point for the H-201 Moanalua Freeway “back of queue” length measurements. During the AM peak period, the average “back of queue” length was observed to be 3,800 feet and the maximum “back of queue” length was observed to be 5,000 feet. Table 1 summarizes the queuing observations at the Middle Street merge in the eastbound direction. These queuing observations along with traffic volumes and vehicle running speeds were used to calibrate the VISSIM analysis.

Table 1: Eastbound Queuing Summary at Middle Street Merge

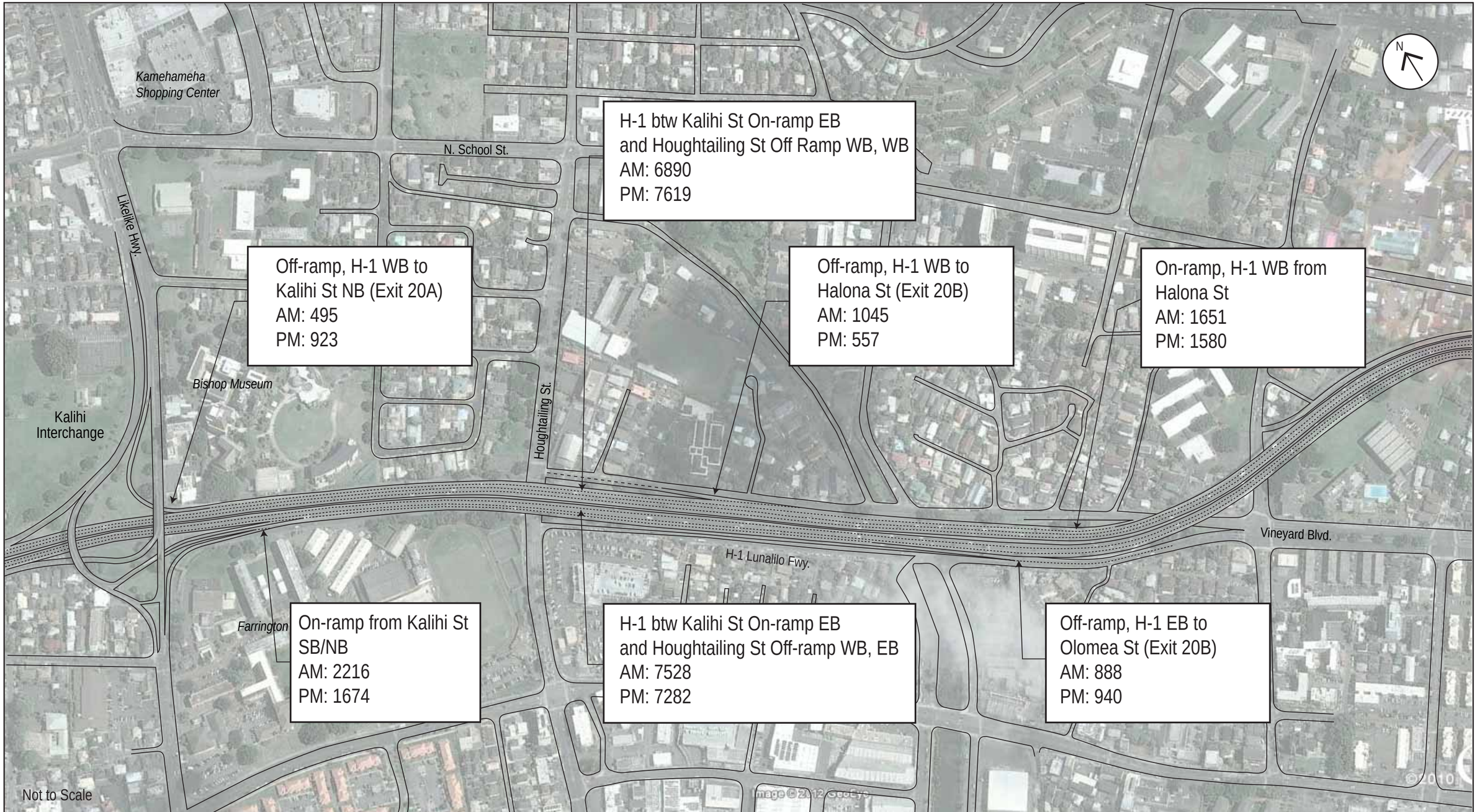
	Avg. BOQ** (ft.)	Avg. BOQ Landmark	Max. BOQ (ft.)	Max. BOQ Landmark	Observations
H-1 Viaduct					
AM(6:30AM-8:30AM)	7,050	100 ft West of Lagoon Dr. , and close to Infiniti and Audi dealer	10,650	100 ft East of Camp Catlin Rd, and close to Advantage Rent A-Car	1. Cannot see any spot before #12 2. Traffic accident in Middle Lane at 8:20 AM
MD(1:30PM-2:30PM)	No congestion or queuing in MD				
PM(4:30PM-6:00PM)	2,500	Just Past off-ramp to Nimitz Highway and Kamehameha highway (near Marukai Wholesale Mart)	4,650	At Exit to Nimitz Highway	
Moanalua Freeway					
AM(6:30AM-8:30AM)	3,800	Middle of Kikowaena St Overpass and Funston Rd overpass, and at Exit of N King St to Funston Rd.	5,000	off-Ramp to N King St, and near Moanalua Gardens Foundations	
MD(1:30PM-2:30PM)	No congestion or queuing in MD				
PM(4:30PM-6:00PM)	No congestion or queuing in PM				

Note: Queuing starting from Middle Street merge eastbound gore point.

** Back of Queue

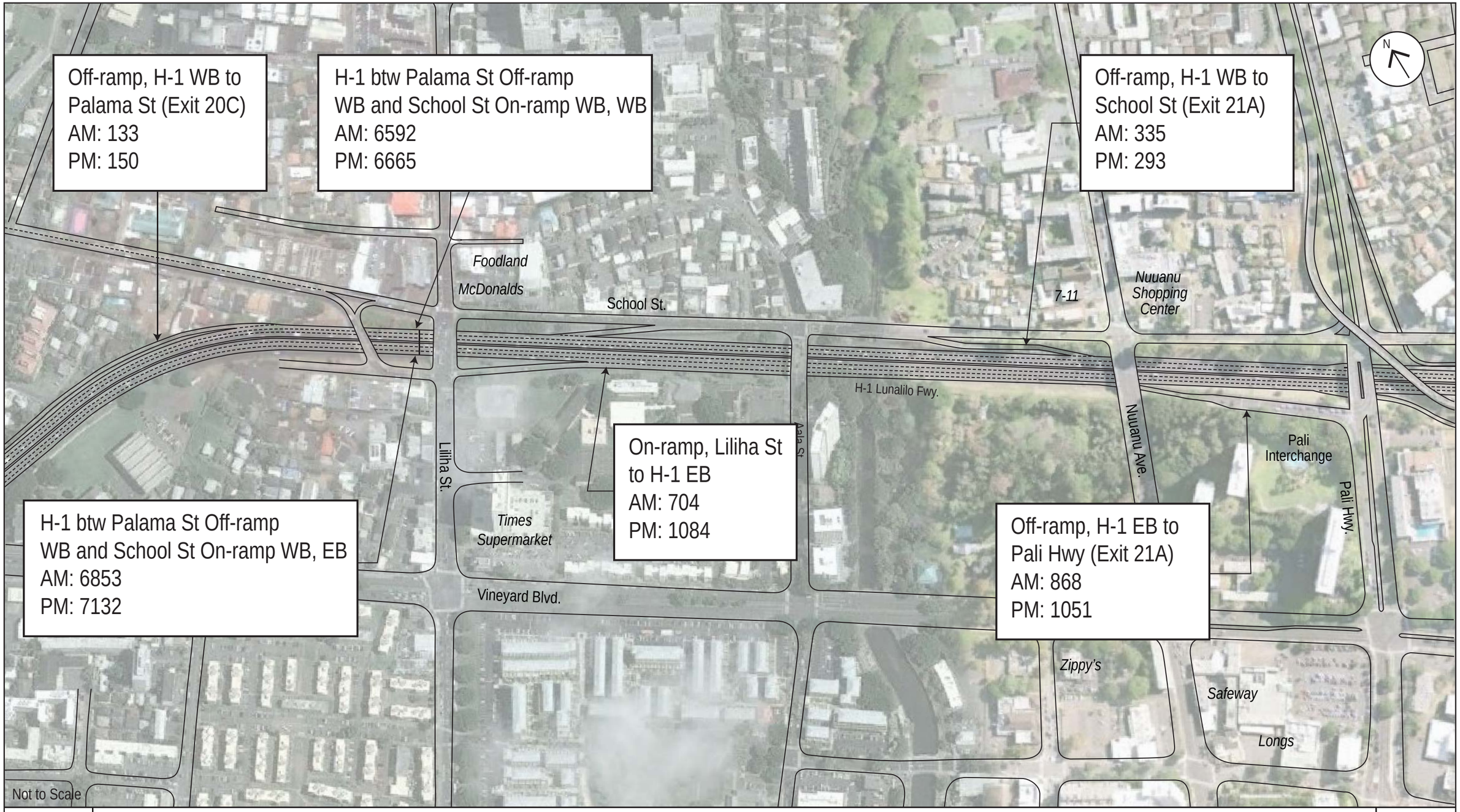
Segment 1 Existing Peak Hour Traffic Volumes

Figure
6



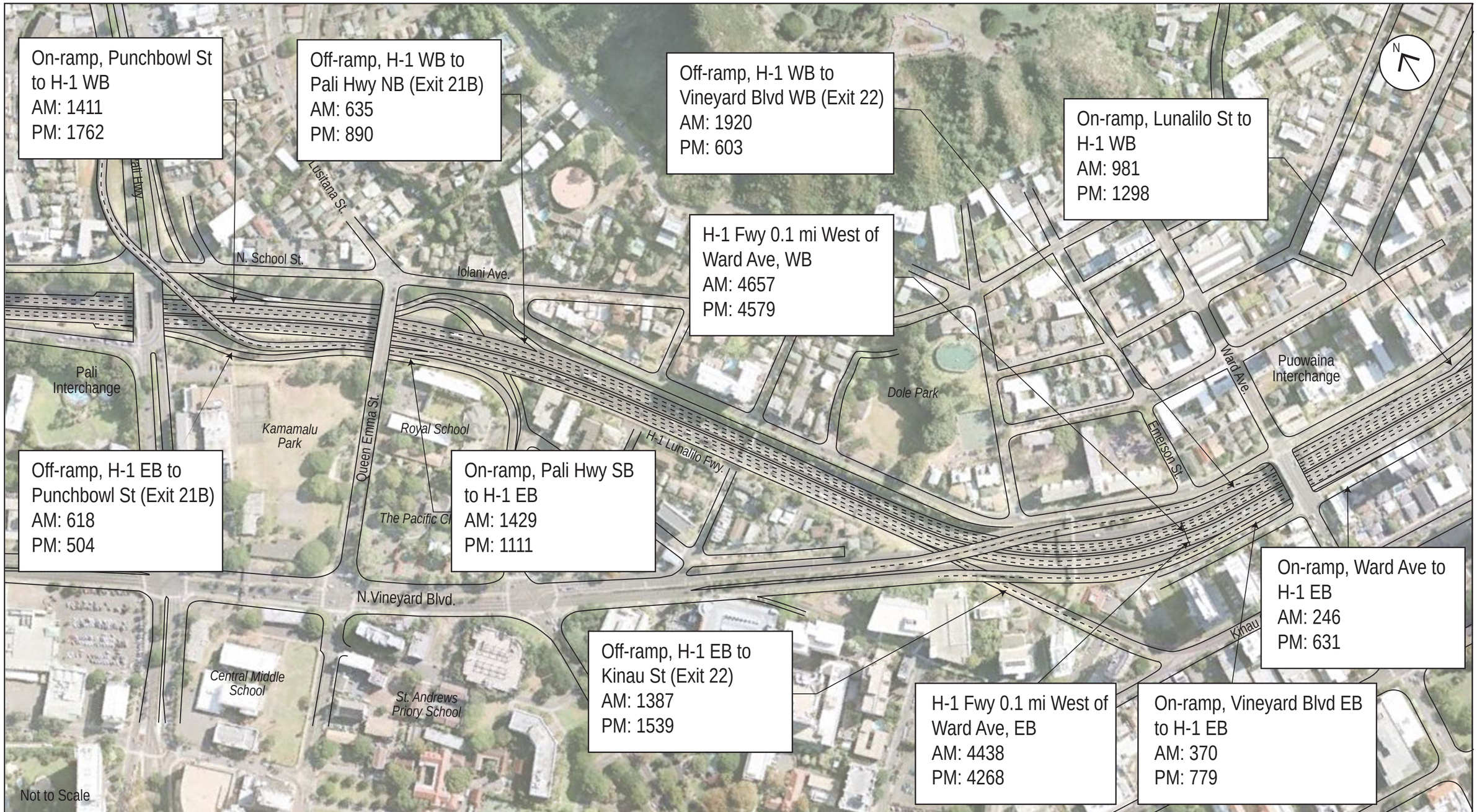
Segment 2 Existing Peak Hour Traffic Volumes

Figure 7



Segment 3 Existing Peak Hour Traffic Volumes

Figure
8



Segment 4 Existing Peak Hour Traffic Volumes

Figure 9

C. Existing Traffic Operations

The study corridor freeway ramp and weaving segments were analyzed using the methodologies for ramp and weaving segments outlined in the 2010 Highway Capacity Manual (HCM). Operating conditions for a ramp or weaving segment are expressed as a qualitative measure known as Level of Service (LOS) with letter designations ranging from A through F, with LOS A representing free-flow conditions and LOS F representing over-capacity conditions. Level of Service criteria are described in Appendix B. Ramp and weaving segment analysis worksheets are located in Appendix C. The results of the freeway segment analysis are summarized in Table 2.

Table 2: Existing Peak Hour Level of Service

Segment	Direction	Type	AM		PM	
			LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)
Middle St. On-Ramp to Kalihi Off-Ramp	EB	Weaving	F	--	E	43.0
Kalihi On-Ramp to Palama Off-Ramp	EB	Weaving	F	--	F	--
Liliha On-Ramp to Pali Off-Ramp	EB	Weaving	E	43.5	F	--
Punchbowl Off-Ramp EB	EB	Off-Ramp	F	46.3	F	49.1
Pali On-Ramp to Kinau Off-Ramp	EB	Weaving	E	35.2	E	35.3
Vineyard Blvd On-Ramp	EB	On-Ramp	B	14.9	C	20.8
Lunalilo On-Ramp to Vineyard Blvd Off-Ramp	WB	Weaving	F	--	D	29.5
Pali Hwy Off-Ramp	WB	Off-Ramp	D	29.8	D	30.0
Punchbowl On-Ramp	WB	On-Ramp	D	39.3	F	41.9
N School Off-Ramp	WB	Off-Ramp	D	29.3	D	28.8
Palama Off-Ramp	WB	Off-Ramp	F	40.6	F	41.3
Halona (Vineyard) On-Ramp to Halona (Houghtailing) Off-Ramp	WB	Weaving	F	--	F	--
Kalihi Off-Ramp	WB	Off-Ramp	F	43.5	F	50.8
Kalihi On-Ramp to Middle St. Off-Ramp	WB	Weaving	F	--	F	--
Middle St. Off-Ramp	WB	Off-Ramp	B	13.0	A	8.8

-- Demand exceeds capacity

pc/mi/ln = passenger cars/mile/lane

In addition to the Highway Capacity Software (HCS) ramp and weaving segment analysis, VISSIM (a microscopic simulation program for multi-modal traffic flow modeling) analysis was utilized in order to best document the existing conditions at two key locations that were identified within the study corridor: the Middle Street merge in the eastbound direction; and the southbound Likelike Highway/Kalihi Street on-ramp to H-1 Lunalilo Freeway westbound. The VISSIM analysis was used to represent the baseline conditions at these two locations. Tables 3 and 4 detail the Measures of Effectiveness (MOEs) recorded through the VISSIM analysis.

Table 3: Middle Street Merge Eastbound MOEs

Link	Segment Name	H1 Weaving Analysis AM Peak Hour			
Sum of Density (pc/mi/ln)		Lane			
Link	Section	1	2	3	4
1	EB H1 after Likelike Off-ramp	118.4	113.4	96.8	
2	EB Likelike Off-ramp	16.7			
4	H1 Airport before Middle Street Merge	111.2	116.1		
5	EB H201 at Middle Street Merge	113.4	105.1	141.2	
7	EB H201 before Middle Street Merge	55.3	54.6	65.9	
10	EB H1 before Likelike Off-ramp	**115.3**	**106.5**	**134.1**	**95.2**
18	H1 Airport along Likelike Off-ramp	166.3			
LOS		Lane			
Link	Section	1	2	3	4
1	EB H1 after Likelike Off-ramp	**F**	**F**	**F**	
2	EB Likelike Off-ramp	**B**			
4	H1 Airport before Middle Street Merge	**F**	**F**		
5	EB H201 at Middle Street Merge	**F**	F	F	
7	EB H201 before Middle Street Merge	**F**	**F**	**F**	
10	EB H1 before Likelike Off-ramp	**F**	F	F	F
18	H1 Airport along Likelike Off-ramp	**F**			
Average of Speed (mph)		Lane			
Link	Section	1	2	3	4
1	EB H1 after Likelike Off-ramp	12.82	14.06	19.84	
2	EB Likelike Off-ramp	41.19			
4	H1 Airport before Middle Street Merge	9.12	7.94		
5	EB H201 at Middle Street Merge	14.17	16.76	8	
7	EB H201 before Middle Street Merge	30	28.72	14.8	
10	EB H1 before Likelike Off-ramp	**13.8**	**16.44**	**8.54**	**12.95**
18	H1 Airport along Likelike Off-ramp	7.42			
Sum of Volume (pc/hr/ln)		Lane			
Link	Section	1	2	3	4
1	EB H1 after Likelike Off-ramp	1517.74	1594.1	1919.8	
2	EB Likelike Off-ramp	689.27			
4	H1 Airport before Middle Street Merge	1014.39	922.12		
5	EB H201 at Middle Street Merge	1606.55	1761	1129.39	
7	EB H201 before Middle Street Merge	**1659.5**	**1567.62**	**975.12**	
10	EB H1 before Likelike Off-ramp	**1591.37**	**1750.13**	**1145.5**	**1233.15**
18	H1 Airport along Likelike Off-ramp	1233.99			
Travel Times (s)					
Link	Section	Time			
1	H1 airport viaduct to Likelike Offramp	**952**			
2	H1 airport viaduct to H1 EB after Likelike Offramp	**977**			
3	H201 to Likelike Offramp	**746**			
4	H201 to H1 EB after Likelike Offramp	**375**			
	Queue Length (ft)				
	H201 before merge Average	**3494**			
	H201 before merge Max	**5150**			
	H1 airport before merge Average	**6751**			
	H1 airport before merge Max	**9936**			
Note: Lane 1 is the left most lane on each link					

Table 3 records the AM peak hour since it is the critical time period at this location. As shown in the table, in the existing condition, all lanes operate at LOS F except for the eastbound Likelike (Kalihi) off-ramp which operates at LOS B in the AM peak hour.

Table 4: Kalihi Street On-ramp to H-1 Westbound MOEs

Link	Segment Name	H1 Weaving Analysis PM Peak Hour			
Sum of Density (pc/mi/ln)		Lane			
Link	Section	1	2	3	4
1	WB H201 North of Offramp to H1	30.6	26.7	21.8	
2	WB Offramp to H1	27.4	29.7		
3	WB Merge Area from Kalihi St	44.1	41.6	50.4	30.4
4	WB Onramp from Kalihi St	29.2			
5	WB H1 under Kalihi St	35.7	38.8	62.2	
6	WB Offramp to Kalihi St	1.3			
7	WB H1 before Kalihi St	24.4	31.2	59.1	0.9
10	WB H1 Between Kalihi and H1 Offramp	36.4	32.7	35.7	28.2
LOS		Lane			
Link	Section	1	2	3	4
1	WB H201 North of Offramp to H1	D	D	C	
2	WB Offramp to H1	D	D		
3	WB Merge Area from Kalihi St	E	E	F	D
4	WB Onramp from Kalihi St	D			
5	WB H1 under Kalihi St	E	E	F	
6	WB Offramp to Kalihi St	A			
7	WB H1 before Kalihi St	C	D	F	A
10	WB H1 Between Kalihi and H1 Offramp	E	D	E	D
Average of Speed (mph)		Lane			
Link	Section	1	2	3	4
1	WB H201 North of Offramp to H1	63.3	64.6	65.7	
2	WB Offramp to H1	42.5	43.1		
3	WB Merge Area from Kalihi St	52.4	43.5	39.3	46.0
4	WB Onramp from Kalihi St	35.0			
5	WB H1 under Kalihi St	59.5	50.9	39.0	
6	WB Offramp to Kalihi St	38.3			
7	WB H1 before Kalihi St	63.1	59.4	51.9	56.4
10	WB H1 Between Kalihi and H1 Offramp	59.4	58.3	54.0	55.1
Sum of Volume (pc/hr/ln)		Lane			
Link	Section	1	2	3	4
1	WB H201 North of Offramp to H1	1935	1728	1436	
2	WB Offramp to H1	1165	1280		
3	WB Merge Area from Kalihi St	2309	1812	1980	1399
4	WB Onramp from Kalihi St	1022			
5	WB H1 under Kalihi St	2126	1976	2427	
6	WB Offramp to Kalihi St	50			
7	WB H1 before Kalihi St	1538	1849	3068	50
10	WB H1 Between Kalihi and H1 Offramp	2164	1907	1928	1554
Travel Times (s)					
Link	Section	Time			
1	Ramp To Ramp	36.8			
2	Ramp to H201	36.6			
3	Freeway to Ramp	18.8			
4	Freeway to Freeway (201)	16.9			
Queue Length (ft)					
Average=		1.4			
Max=		127.0			

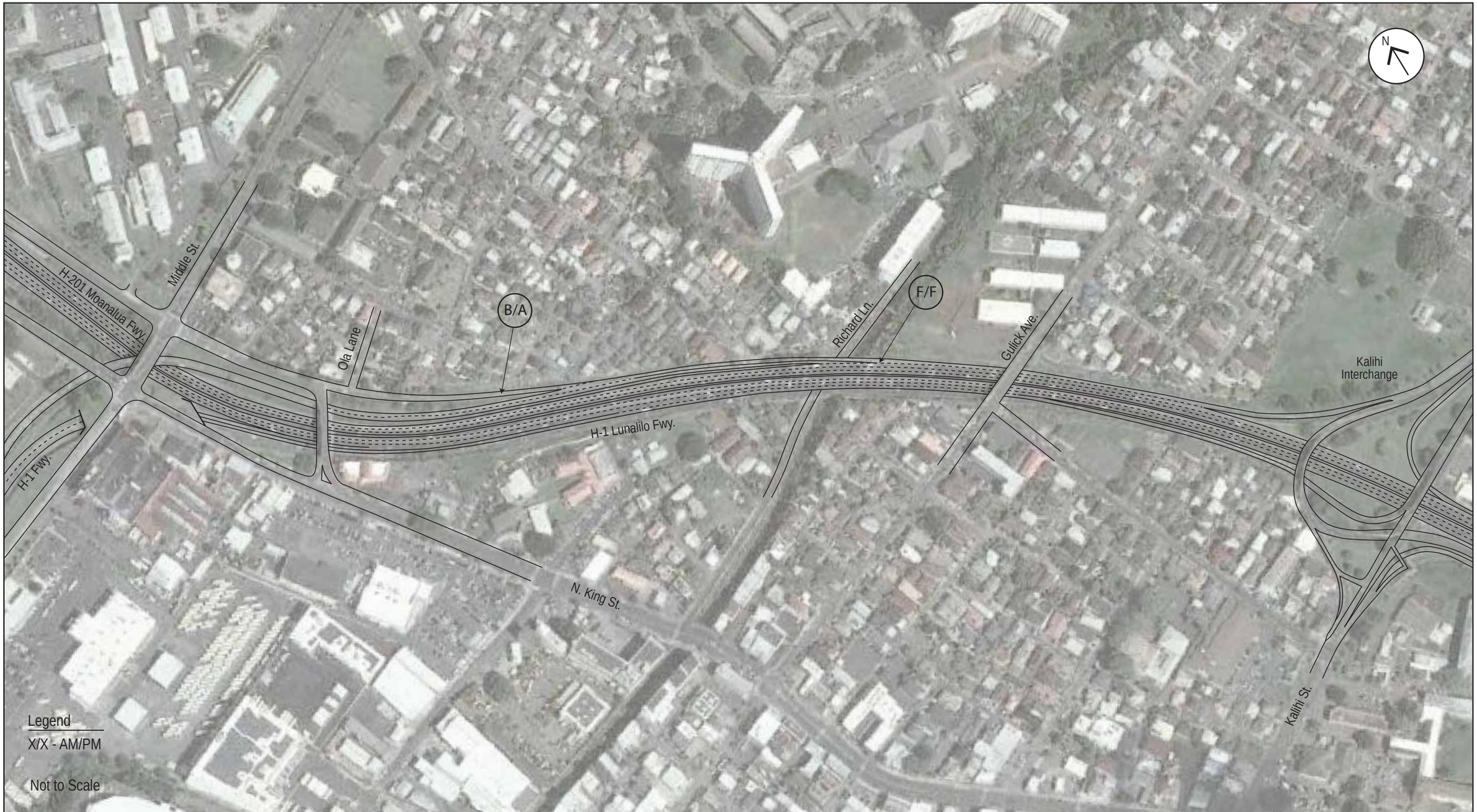
Note: Lane 1 is the left most lane on each link

The weaving analysis for the southbound Likelike Highway/Kalihi Street on-ramp to H-1 Lunalilo Freeway westbound was analyzed during the PM peak hour, which is the critical time period for this weaving movement in the existing condition. As shown in Table 4, most of the inside lanes on the H-1 Lunalilo Freeway tend to operate at LOS D or E, while lane 3 (the one that interacts most with the weaving turbulence from the auxiliary lane) operate at LOS F. The auxiliary lane operates at LOS D.

D. Summary of Existing Traffic Operations

During the AM and PM peak hours especially, the H-1 Lunalilo Freeway is a heavily utilized facility. Demand routinely surpasses capacity and bottlenecks form at locations with heavy turbulence (caused by lane reductions or ramp and weaving movements) that quickly propagates upstream. As shown in Table 2, 10 of the 15 ramp and weaving segments operate at LOS E or F in the AM and PM peak hour.

Figures 10-13 illustrate the existing peak hour LOS at the various ramps and weaving segments along the study corridor.



Segment 1 Existing Peak Hour Level of Service

Figure
10

Segment 2 Existing Peak Hour Level of Service

Figure
11

Segment 3 Existing Peak Hour Level of Service

Figure
12

Segment 4 Existing Peak Hour Level of Service

Figure
13

IV. PROPOSED CONDITIONS

The proposed project would rehabilitate the areas of moderate and severely distressed roadway. The proposed project also will: (a) correct pavement deficiencies, (b) install a glare screen on the median divider, (c) install new pavement markings, and (d) upgrade the highway lighting system.

The proposed conditions also generally involve restriping the eastbound and westbound freeway directions in order to create four 10-foot wide through lanes (in each direction) versus three 12-foot wide through lanes in the existing condition. Lateral clearances would be about two feet.

Volumes were assumed to be the same as in the existing condition. The comparison was made solely on the basis of the existing lane configurations versus the proposed lane configurations.

Two key locations were identified where ramp and weaving segment modifications demanded obvious consideration and care. The first key location was identified to be the eastbound Middle Street merge mentioned above. The second key location involved the interaction of the westbound freeway and the southbound Likelike Highway/Kalihi Street On-ramp.

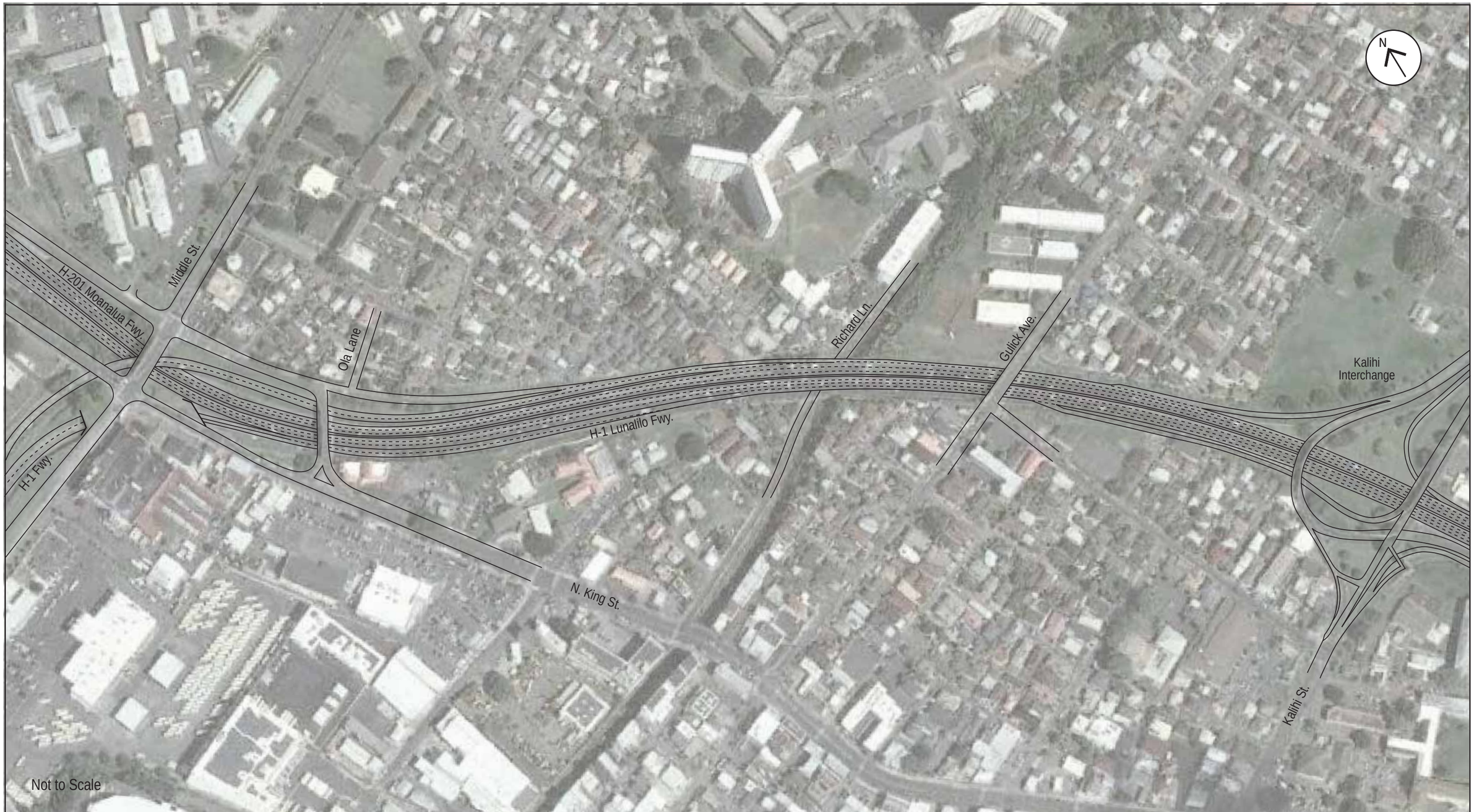
A. Proposed Condition Assessment Methodology

As with the existing condition, HCS analysis was used to determine proposed condition operations for the ramp and weaving segments of the H-1 Lunalilo Freeway.

For the two identified key locations, VISSIM analysis was also utilized to determine the efficacy of the proposed condition lane configurations for the project. VISSIM is a full-featured microscopic simulation model with the ability to obtain detailed state variable information on each vehicle on time scales with better than second-by-second accuracy. The priority rules feature of VISSIM appears to allow complex modeling of junction behavior, including waeving and merging situations. Measures of Effectiveness (MOEs) that will be examined include average running speed, queuing, and travel time information.

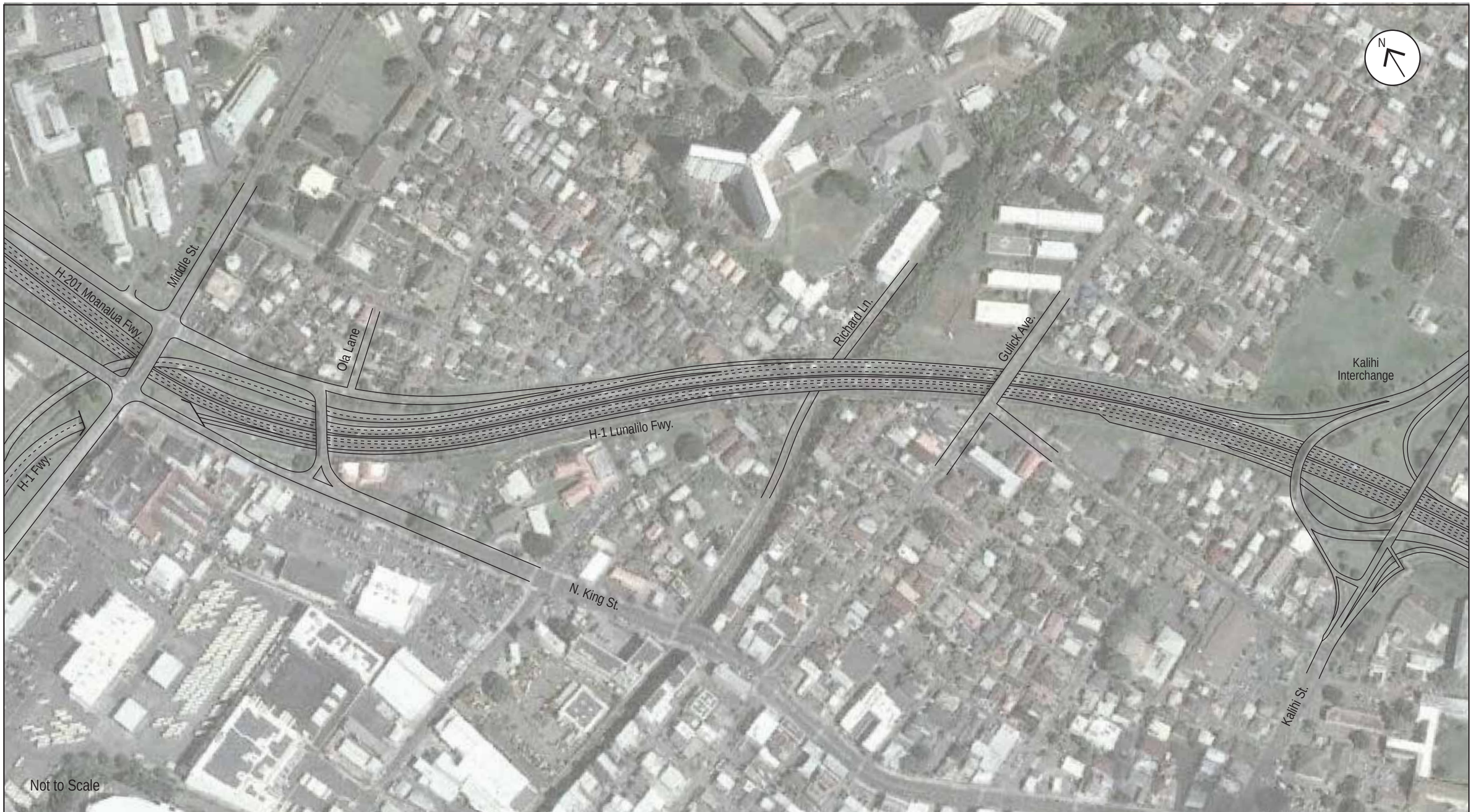
B. Proposed Geometry

The geometry for the proposed condition is that as described below. The study corridor is shown as four segments in order to show the detail along the freeway. The two different schematic alternatives for segment 1 (where the H-201 Moanalua Freeway and H-1 Lunalilo Freeway merge) are shown in Figures 14 and 15. Figures 16-18 depict the schematic design for the remaining segments.



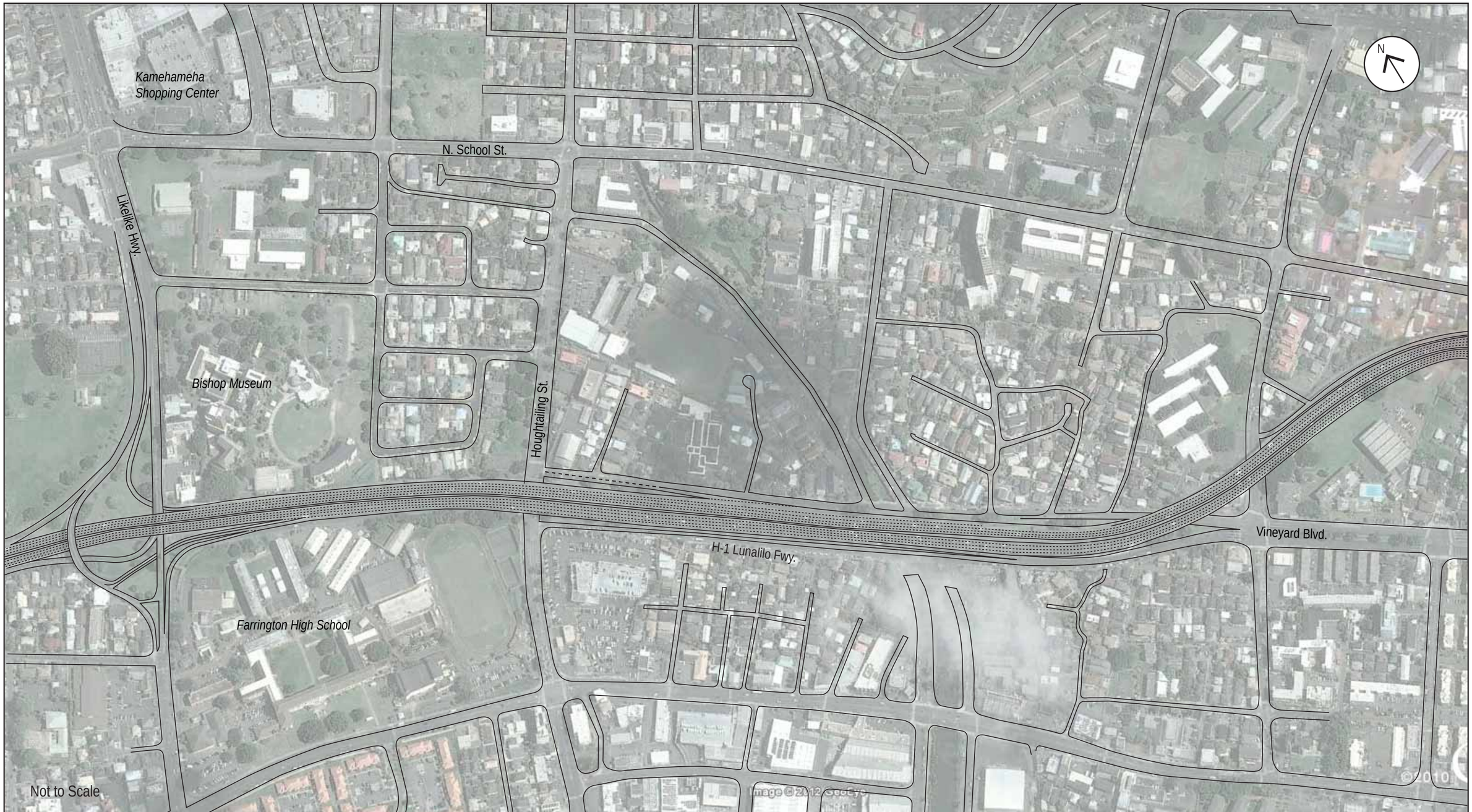
Segment 1 Alternative 1 Proposed Lane Configurations

Figure
14



Segment 1 Alternative 2 Proposed Lane Configurations

Figure
15



Segment 2 Proposed Lane Configurations

Figure
16

Segment 3 Proposed Lane Configurations

Figure
17

Segment 4 Proposed Lane Configurations

Figure 18

C. Key Location #1 – Middle Street Merge Eastbound

Two different alternatives were considered in regards to the lane configuration for the H-1 Lunalilo Freeway eastbound traffic lanes between Middle Street and the Kalihi Interchange.

Both alternatives address the auxiliary lane created by the inside, or left lane of H-1 Lunalilo Freeway merging with the outside, or right lane of H-201 Moanalua Freeway. The H-201 Moanalua Freeway provides three eastbound through lanes at this junction and the H-1 Lunalilo Freeway provides two lanes.

The two alternatives were analyzed and compared to determine which one provided the best operations for both the H-201 Moanalua Freeway and H-1 Lunalilo Freeway facilities in the freeway segment between Middle Street and the Kalihi Interchange as well as upstream for both facilities.

Two pairs of travel time lengths were considered in the analysis of the H-201 Moanalua Freeway traffic and the H-1 Lunalilo Freeway traffic. For the H-201 Moanalua Freeway traffic, the travel time from a point just west of the merge with H-1 Lunalilo Freeway to a point at the beginning of the eastbound Likelike Highway/Kalihi Street off-ramp was considered. A second travel time from the same point just west of the merge to a point just east of the Kalihi Interchange was considered. Likewise, for the H-1 Lunalilo Freeway traffic the travel time from a point just west of the merge with H-201 Moanalua Freeway to a point at the beginning of the eastbound Likelike Highway/Kalihi Street off-ramp was considered. A second travel time from the same point just west of the merge to a point just east of the Kalihi Interchange was considered.

1. Alternative #1 – H-1 Outer Lane Merge

a) Proposed Roadway System

For the first alternative, the two H-1 Lunalilo Freeway lanes merge together and then the resulting one lane becomes the fourth through lane on H-1 Lunalilo Freeway in the eastbound direction through Kalihi Interchange and beyond. The three H-201 Moanalua Freeway lanes do not merge and remain through lanes past the Kalihi Interchange. The eastbound Likelike Highway/Kalihi Street off-ramp branches off the outside through lane.

This configuration has obvious benefits for the three lanes originating from the H-201 Moanalua Freeway since none of the H-1 Lunalilo Freeway traffic must merge into the three lanes from the

H-201 Moanalua Freeway in order to maintain a course eastbound on the combined four-lane facility.

There is a drawback, however, for the H-1 Lunalilo Freeway traffic. Since both lanes must merge and become one lane, the turbulence will cause queuing upstream of the merge area on the H-1 Freeway in the direction of Honolulu International Airport.

b) Proposed Traffic Operations

As can be seen from comparison of Tables 3 and 5, the Middle Street merge eastbound Alternative #1 lane configurations are projected to improve both the travel time and maximum queue lengths on the H-201 Moanalua Freeway facility.

The travel time from the H-201 Moanalua Freeway just west of the merge to the eastbound Likelike Highway/Kalihi Street off-ramp is projected to improve from 746 seconds in the existing condition to 248 seconds in the Alternative #1 condition. The average queue length on H-201 Moanalua Freeway, beginning at the merge, is projected to decrease from 3,490 feet in the existing condition to 1,920 feet in the alternative #1 condition.

Table 5: Middle Street Merge Eastbound Alternative #1 MOEs

Link	Segment Name	H1 Weaving Analysis AM Peak Hour			
Sum of Density (pc/mi/ln)		Lane			
Link	Section	1	2	3	4
1	EB H1 after Likelike Off-ramp	38.8	30.9	25.7	16.5
2	EB Likelike Off-ramp	23.5			
4	H1 Airport before Middle Street Merge	168.0	146.6		
5	EB H201 at Middle Street Merge	54.5	84.6	93.1	
7	EB H201 before Middle Street Merge	84.7	100.2	55.8	
10	EB H1 before Likelike Off-ramp	**67.1**	**99.1**	**97.4**	**71.7**
18	H1 Airport along Likelike Off-ramp	106.5			
LOS		**Lane**			
Link	Section	**1**	**2**	**3**	**4**
1	EB H1 after Likelike Off-ramp	**E**	**D**	**C**	B
2	EB Likelike Off-ramp	**C**			
4	H1 Airport before Middle Street Merge	**F**	**F**		
5	EB H201 at Middle Street Merge	**F**	F	F	
7	EB H201 before Middle Street Merge	**F**	**F**	**F**	
10	EB H1 before Likelike Off-ramp	**F**	F	F	F
18	H1 Airport along Likelike Off-ramp	**F**			
Average of Speed (mph)		**Lane**			
Link	Section	**1**	**2**	**3**	**4**
1	EB H1 after Likelike Off-ramp	50.91	51.38	51.33	52.15
2	EB Likelike Off-ramp	41.96			
4	H1 Airport before Middle Street Merge	3.96	6.17		
5	EB H201 at Middle Street Merge	35.91	21.99	15.69	
7	EB H201 before Middle Street Merge	23.09	17.23	30.21	
10	EB H1 before Likelike Off-ramp	**29.6**	**16.53**	**16.28**	**21.96**
18	H1 Airport along Likelike Off-ramp	14.59			
Sum of Volume (pc/hr/ln)		**Lane**			
Link	Section	**1**	**2**	**3**	**4**
1	EB H1 after Likelike Off-ramp	1975.05	1585.58	1319.16	859.53
2	EB Likelike Off-ramp	986.19			
4	H1 Airport before Middle Street Merge	665.13	904.73		
5	EB H201 at Middle Street Merge	1955.67	1859.7	1461.21	
7	EB H201 before Middle Street Merge	**1955.56**	**1725.94**	**1684.64**	
10	EB H1 before Likelike Off-ramp	**1987.36**	**1637.55**	**1586.23**	**1573.9**
18	H1 Airport along Likelike Off-ramp	1553.39			
	Travel Times (s)				
Link	Section	Time			
1	H1 airport viaduct to Likelike Offramp	**1098**			
2	H1 airport viaduct to H1 EB after Likelike Offramp	**1058**			
3	H201 to Likelike Offramp	**248**			
4	H201 to H1 EB after Likelike Offramp	**300**			
	Queue Length (ft)				
	H201 before merge Average	**1919**			
	H201 before merge Max	**3699**			
	H1 airport before merge Average	**8370**			
	H1 airport before merge Max	**11032**			
Note: Lane 1 is the left most lane on each link					

The travel time and maximum queue lengths on the H-1 Freeway facility, however, are projected to increase with alternative #1. The travel time from the H-1 Lunalilo Freeway just

west of the merge to the eastbound Likelike Highway/Kalihi Street off-ramp is projected to increase from 952 seconds to 1,098 seconds. The average maximum queue length on the H-1 Freeway, beginning at the merge, is projected to increase from approximately 6,750 feet in the existing condition to 8,370 feet in the alternative #1 condition.

The operation on H-1 Freeway degrades with alternative #1 due to the merging of the two H-1 Lunalilo Freeway lanes prior to interaction with the H-201 Moanalua Freeway. This also explains the improvement on the H-201 Moanalua Freeway (which experiences less turbulence from the H-1 Lunalilo Freeway lanes).

2. Alternative #2 – H-1 Lunalilo Freeway Inner Lane Merge

a) Proposed Roadway System

For the second alternative, the inside H-1 Lunalilo Freeway lane would merge with the outside H-201 Moanalua Freeway lane. This condition is similar to the existing condition. The outside H-1 Lunalilo Freeway lane becomes an add lane and continues as the fourth eastbound through lane for the newly merged H-1 Lunalilo Freeway. The eastbound off-ramp to Likelike Highway/Kalihi Street branches off of this fourth through lane. In the existing condition, the eastbound off-ramp to Likelike Highway/Kalihi Street is an auxiliary lane that disappears from the freeway's mainline at the off-ramp.

b) Proposed Traffic Operations

As can be seen from comparison of Tables 3 and 6, the Middle Street merge eastbound Alternative #2 lane configuration is projected to improve both the travel time and average queue lengths on both the H-201 Moanalua Freeway and H-1 Freeway facilities. The travel time from the H-201 Moanalua Freeway just west of the merge to the eastbound Likelike Highway/Kalihi Street off-ramp is projected to improve from 746 seconds in the existing condition to 359 seconds in the Alternative #2 condition. The average queue length on H-201 Moanalua Freeway, beginning at the merge, is projected to decrease from 3,494 feet in the existing condition to 1,741 feet in the Alternative #2 condition.

The travel time from the H-1 Freeway just west of the merge to the eastbound Likelike Highway/Kalihi Street off-ramp is projected to decrease from 952 seconds to 247 seconds. The average queue length on the H-1 Freeway, beginning at the merge, is projected to decrease from 6,750 feet in the existing condition to 3,370 feet in the Alternative #2 condition.

Table 6: Middle Street Merge Eastbound Alternative #2 MOEs

Link	Segment Name	H1 Weaving Analysis			
		AM Peak Hour			
Sum of Density (pc/mi/ln)		Lane			
Link	Section	1	2	3	4
1	EB H1 after Likelike Off-ramp	11.4	35.2	35.5	35.4
2	EB Likelike Off-ramp	28.5			
4	H1 Airport before Middle Street Merge	50.1	21.8		
5	EB H201 at Middle Street Merge	44.9	37.4	43.2	
7	EB H201 before Middle Street Merge	47.5	40.2	42.8	
10	EB H1 before Likelike Off-ramp	**50.7**	**50.1**	**57.6**	**72.3**
18	H1 Airport along Likelike Off-ramp	23.2			
LOS		**Lane**			
Link	Section	**1**	**2**	**3**	**4**
1	EB H1 after Likelike Off-ramp	**B**	**E**	**E**	E
2	EB Likelike Off-ramp	**D**			
4	H1 Airport before Middle Street Merge	**F**	**C**		
5	EB H201 at Middle Street Merge	**E**	E	E	
7	EB H201 before Middle Street Merge	**F**	**E**	**E**	
10	EB H1 before Likelike Off-ramp	**F**	F	F	F
18	H1 Airport along Likelike Off-ramp	**C**			
Average of Speed (mph)		**Lane**			
Link	Section	**1**	**2**	**3**	**4**
1	EB H1 after Likelike Off-ramp	53.65	51.53	50.78	48.08
2	EB Likelike Off-ramp	40.31			
4	H1 Airport before Middle Street Merge	27.53	50.54		
5	EB H201 at Middle Street Merge	50.73	50.66	42.87	
7	EB H201 before Middle Street Merge	46.51	47.11	13.67	
10	EB H1 before Likelike Off-ramp	**42.18**	**36.49**	**30.4**	**18.58**
18	H1 Airport along Likelike Off-ramp	43.06			
Sum of Volume (pc/hr/ln)		**Lane**			
Link	Section	**1**	**2**	**3**	**4**
1	EB H1 after Likelike Off-ramp	613.1	1813.54	1801.14	1702.24
2	EB Likelike Off-ramp	1147.44			
4	H1 Airport before Middle Street Merge	1380.59	1101.3		
5	EB H201 at Middle Street Merge	2275.43	1896.73	1852.72	
7	EB H201 before Middle Street Merge	**2208.52**	**1896.14**	**585.59**	
10	EB H1 before Likelike Off-ramp	**2138.14**	**1829.6**	**1751.84**	**1343.04**
18	H1 Airport along Likelike Off-ramp	999.91			
	Travel Times (s)				
Link	Section	Time			
1	H1 airport viaduct to Likelike Off-ramp	**247**			
2	H1 airport viaduct to H1 EB after Likelike Off-ramp	**356**			
3	H201 to Likelike Off-ramp	**359**			
4	H201 to H1 EB after Likelike Off-ramp	**212**			
	Queue Length (ft)				
	H201 before merge Middle Street Avg	**1741**			
	H201 before merge Middle Street Max	**5951**			
	H1 airport before merge Middle Street Avg	**3372**			
	H1 airport before merge Middle Street Max	**6128**			
Note: Lane 1 is the left most lane on each link					

3. Selection of a Middle Street Merge Eastbound Configuration

Table 7 summarizes the travel time and the queuing under the existing conditions and under the proposed alternative conditions. Due to the different ways in which the H-1 Airport Viaduct traffic interacts with the H-201 Moanalua Freeway traffic, the travel time from H-201 Moanalua Freeway for Alternative #1 to the eastbound Likelike Highway/Kalihi Street off-ramp will be shorter than for Alternative #2. In Alternative #1, the H-201 Moanalua Freeway traffic is largely unaffected by H-1 Airport Viaduct until it approaches the Richard Lane Underpass and by that time the H-1 Airport Viaduct traffic has already merged with itself to become one lane. In contrast, for Alternative #2, H-201 Moanalua Freeway traffic interacts with the left H-1 Airport Viaduct traffic lane almost immediately after the merge until just west of Richard Lane. At that point, H-201 Moanalua Freeway traffic must make the same lane change, as in Alternative #1, to the right-most lane in order to arrive at the Likelike Highway/Kalihi Street eastbound off-ramp.

Table 7 Travel Time and Queuing Summary

Travel Time (seconds)				
Link	Section	Existing	Alternative 1	Alternative 2
1	H1 airport viaduct to Likelike Offramp	952	1098	247
2	H1 airport viaduct to H1 EB after Kalihi Street Offramp	977	1058	356
3	H201 to Likelike Offramp	746	248	359
4	H201 to H1 EB after Kalihi Street Offramp	375	300	212
Queue (feet)				
Link	Section	Existing	Alternative 1	Alternative 2
1	H201 before merge Average	3494	1919	1741
2	H201 before merge Max	5150	3699	5951
3	H1 airport before merge Average	6751	8370	3372
4	H1 airport before merge Max	9936	11032	6128

The travel time advantage switches, however, when the aim of H-201 Moanalua Freeway traffic is to arrive at a point just east of the Kalihi Interchange. In this case, Alternative #1 takes a little longer than Alternative #2 because of the extended time period of congestion caused by Alternative #1's H-1 Airport Viaduct lane configuration.

Alternative #1 improves operation on the H-201 Moanalua Freeway, but operation actually degrades on the H-1 Freeway, upstream of the merge.

Because operation is projected to improve on both the H-201 Moanalua Freeway and H-1 facilities, Alternative #2 is the recommended alternative. Alternative #2 is also very similar to the existing condition and therefore will meet driver expectancy.

D. Key Location #2 – Kalihi Street On-ramp Westbound

One area that was deemed deserving of special study was the interaction of the Likelike Highway/Kalihi Street southbound on-ramp to H-1 Lunalilo Freeway westbound. In the existing condition, this ramp becomes an auxiliary lane so that it doesn't have to merge with through traffic immediately. The auxiliary lane eventually becomes an off-ramp, where it continues as H-1 Lunalilo Freeway westbound, or diverges a second time to Middle Street (northbound and southbound).

1. Proposed Roadway System

In the proposed plan, a fourth westbound through lane carries past the southbound Likelike Highway/Kalihi Street on-ramp and becomes the auxiliary lane, modifying the on-ramp's access to the freeway to a yield condition as opposed to the current "free," add-on condition. However, the southbound Likelike Highway/Kalihi Street's proposed configuration includes a short, 250-foot portion of the tapered on-ramp after the gore point that would help ease the merge onto the mainline.

2. Proposed Traffic Operations

A queue is anticipated to develop on the Likelike Highway/Kalihi Street on-ramp, however, this queue is not anticipated to require further mitigation. VISSIM analysis shows that maximum queue length on the southbound Likelike Highway/Kalihi Street on-ramp is anticipated to be 270 feet in the PM peak hour, which has been identified as the critical peak period. By comparison, in the existing condition, the maximum queue length is 127 feet. The on-ramp has a long, 1,500-foot "run up" lane that would prevent the anticipated maximum queue from causing major turbulence or spillover onto Likelike Highway/Kalihi Street upstream of the freeway.

Table 8 details the MOEs for the Likelike Highway/Kalihi Street on-ramp proposed alternative.

Table 8 Kalihi Street On-ramp to H-1 Westbound Alternative MOEs

Link	Segment Name	H1 Weaving Analysis PM Peak Hour				
Sum of Density (pc/mi/ln)		Lane				
Link	Section	1	2	3	4	5
1	WB H201 North of off-ramp to H1	32.7	30.3	21.5		
2	WB off-ramp to H1	26.8	31.2			
3	WB Merge Area from Kalihi St	33.3	36.2	43.8	33.4	20.7
4	WB on-ramp from Kalihi St	29.6				
5	WB H1 under Kalihi St	23.9	30.1	42.8	25.7	
6	WB off-ramp to Kalihi St	1.0				
7	WB H1 before Kalihi St	21.5	24.5	38.7	24.3	0.7
10	WB H1 Between Kalihi and H1 off-ramp	35.5	37.0	41.3	30.7	
LOS		Lane				
Index	Section	1	2	3	4	5
1	WB H201 North of off-ramp to H1	D	D	C		
2	WB off-ramp to H1	D	D			
3	WB Merge Area from Kalihi St	D	E	E	D	C
4	WB on-ramp from Kalihi St	D				
5	WB H1 under Kalihi St	C	D	E	C	
6	WB off-ramp to Kalihi St	A				
7	WB H1 before Kalihi St	C	C	E	C	A
10	WB H1 Between Kalihi and H1 off-ramp	E	E	E	D	
Sum of Speed (mph)		Lane				
Link	Section	1	2	3	4	5
1	WB H201 North of off-ramp to H1	61.4	61.1	61.9		
2	WB off-ramp to H1	41.6	42.5			
3	WB Merge Area from Kalihi St	54.8	50.1	43.0	39.0	38.6
4	WB on-ramp from Kalihi St	34.3				
5	WB H1 under Kalihi St	61.6	59.2	51.6	45.5	
6	WB off-ramp to Kalihi St	38.9				
7	WB H1 before Kalihi St	61.9	60.6	58.6	60.4	55.0
10	WB H1 Between Kalihi and H1 off-ramp	56.6	53.6	46.5	43.7	
Sum of Volume (pc/hr/ln)		Lane				
Link	Section	1	2	3	4	5
1	WB H201 North of off-ramp to H1	2009	1852	1330		
2	WB off-ramp to H1	1116	1324			
3	WB Merge Area from Kalihi St	2009	1983	1918	1341	
4	WB on-ramp from Kalihi St	1015				
5	WB H1 under Kalihi St	1473	1780	2208	1171	
6	WB off-ramp to Kalihi St	38				
7	WB H1 before Kalihi St	1328	1484	2268	1468	39
10	WB H1 Between Kalihi and H1 off-ramp	1827	1814	1882	1303	800
Travel Times (s)						
Link	Section	Time				
1	Ramp To Ramp	44.8				
2	Ramp to H201	41.9				
3	Freeway to Ramp	21.5				
4	Freeway to Freeway (201)	18.0				
Queue Length (ft)						
Average=	8.2					
Max=	270.0					

Note: Lane 1 is the left most lane on each link

As shown in Table 8, the Likelike Highway/Kalihi Street on-ramp to H-1 Lunalilo Freeway westbound alternative lane configuration is not projected to improve the travel time or maximum queue lengths on the H-1 facility or the Kalihi on-ramp. However, neither facility's operation degrades significantly. The travel time from the Likelike Highway/Kalihi Street on-ramp to the H-1 Freeway off-ramp increases from 37 seconds in the existing condition to 45 seconds in the proposed condition. Vehicles that travel from Likelike Highway/Kalihi Street on-ramp to Moanalua Freeway would have to merge first and then find an acceptable gap to make the lane change, as opposed to the existing free-on followed by lane change condition. Under the proposed condition the travel time is expected to increase to 42 seconds from 37 seconds. The travel time from the H-1 Lunalilo Freeway just east of the Likelike Highway/Kalihi Street on-ramp to the H-1 Freeway off-ramp increases from 19 seconds in the existing condition to 22 seconds in the proposed condition.

For the on-ramp, the travel time and maximum queue length are anticipated to increase considering that the Likelike Highway/Kalihi Street on-ramp is an added lane in the existing condition and would be transformed into a short acceleration lane with a yield condition in the proposed condition. The improvement on the H-1 Lunalilo Freeway facility in the immediate vicinity for the inside lanes of the freeway and the resulting improvement in upstream traffic operation outweighs the comparably small degradation of operation at the weaving segment and on the on-ramp itself.

The proposed lane configurations improve the operation of the H-1 Lunalilo Freeway upstream of the Likelike Highway/Kalihi Street on-ramp without degrading the operation of the Likelike Highway/Kalihi Street on-ramp significantly. In the existing condition, this weaving segment operates at LOS D in the PM peak hour. In the proposed condition, this ramp segment is also projected to operate at LOS D in the PM peak hour. However, the pavement rehabilitation and restriping should improve operation of the westbound H-1 Lunalilo Freeway.

E. Summary of Proposed Corridor-wide Traffic Operations

Figures 19-23 illustrate the proposed peak hour LOS of the various ramps and weaving segments within the study corridor.

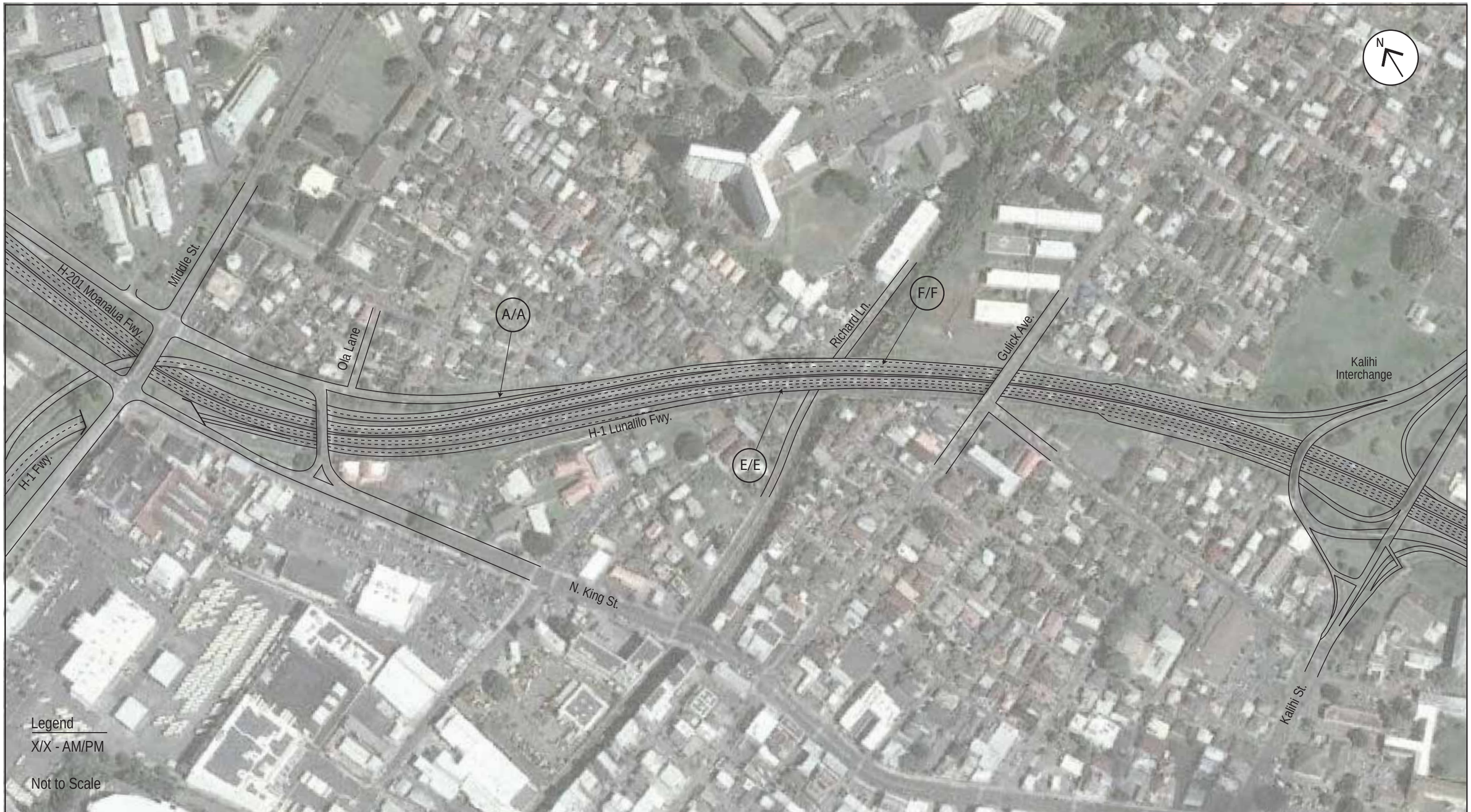
Table 9 details the ramp and weaving segment analysis performed for the entire 3.2-mile project segment.

Table 9: Projected Peak Hour LOS With Project

Segment	Direction	Type	AM		PM	
			LOS	Density (pc/mi/ln)	LOS	Density (pc/mi/ln)
Middle St. On-Ramp to Kalihi Off-Ramp	EB	Weaving	E	42.0	E	39.6
Kalihi On-Ramp to Palama Off-Ramp	EB	Weaving	E	40.0	D	35.0
Liliha On-Ramp to Pali Off-Ramp	EB	Weaving	D	33.7	E	36.1
Punchbowl Off-Ramp EB	EB	Off-Ramp	D	34.4	D	35.0
Pali On-Ramp to Kinau Off-Ramp	EB	Weaving	C	27.5	C	27.6
Vineyard Blvd On-Ramp	EB	On-Ramp	A	8.0	B	14.1
Lunalilo On-Ramp to Vineyard Blvd Off-Ramp	WB	Weaving	F	--	D	29.5
Pali Hwy Off-Ramp	WB	Off-Ramp	C	23.6	C	24.7
Punchbowl On-Ramp	WB	On-Ramp	D	31.2	D	33.9
N School Off-Ramp	WB	Off-Ramp	C	21.9	C	21.3
Palama Off-Ramp	WB	Off-Ramp	C	27.4	C	27.8
Halona (Vineyard) On-Ramp to Halona (Houghtailing) Off-Ramp	WB	Weaving	E	38.3	E	36.7
Kalihi Off-Ramp	WB	Off-Ramp	D	30.7	E	36.3
Kalihi On-Ramp to Middle St. Off-Ramp	WB	Weaving	F	--	F	--
Middle St. Off-Ramp	WB	Off-Ramp	A	7.4	A	6.8

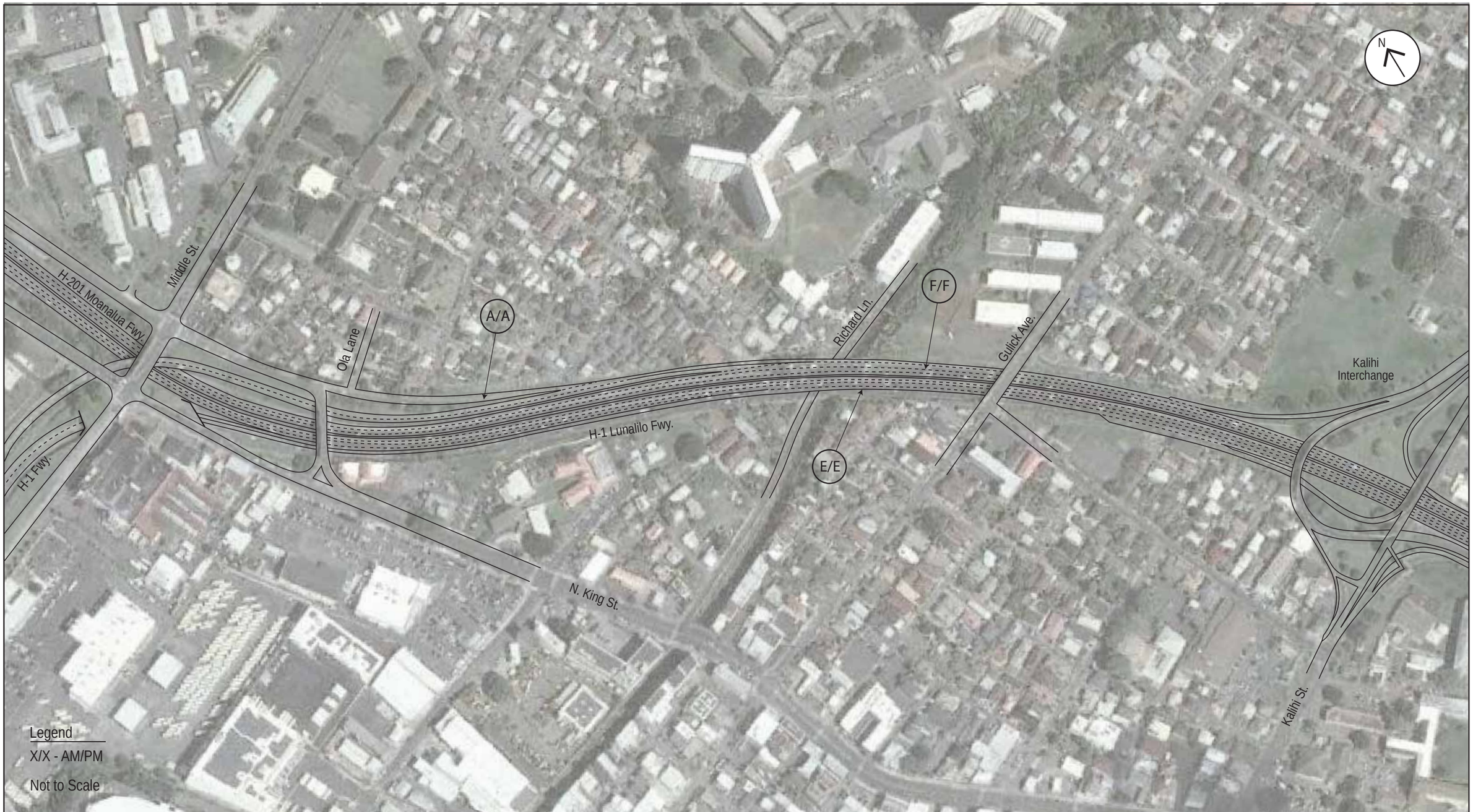
-- Demand exceeds capacity

pc/mi/ln = passenger cars/mile/lane



Segment 1 Alternative 1 Proposed Peak Hour Level of Service

Figure
19



Segment 1 Alternative 2 Proposed Peak Hour Level of Service

Figure
20

Segment 2 Proposed Peak Hour Level of Service

Figure

21

Segment 3 Proposed Peak Hour Level of Service

Figure
22

Segment 4 Proposed Peak Hour Level of Service

Figure 23

V. CONCLUSION AND RECOMMENDATIONS

A. Conclusion

The proposed H-1 Lunalilo Freeway improvements would improve the public's mobility on this vital transportation link in Oahu's primary urban center. The proposed project would improve travel times, reduce queuing and further the pavement's service life expectancy.

The added fourth through lane would increase the H-1 Lunalilo Freeway capacity. The added lane outweighs the loss of capacity due to decreasing the lane widths and lateral clearances. In the existing condition, 12 of the 18 ramp segments (including overlap segments) operate at LOS E or F during the AM peak hour and 13 ramp segments operate at LOS E or F during the PM peak hour. The proposed project would generally improve operations at 14 ramp segments during the AM peak hour and at 16 ramp segments during the PM peak hour.

At the Middle Street merge, the average queuing would be improved to 1,740 feet from 3,490 on H-201 Moanalua Freeway and to 3,370 feet from 6,750 feet on H-1 Freeway during AM peak hour.

Stalled vehicles that can currently find spaces to park on the shoulder would block the travel lanes due to loss of shoulders. This may potentially create a bottleneck conditions during peak hours.

B. Recommendations

The recommendations include the following:

1. The posted speed limit should be lowered to 45 mph throughout the project limits. Advisory signs should be posted suggesting a speed of 35 mph around curves.
2. At the eastbound Middle Street merge, the H-201 Moanalua Freeway right, outer lane should merge with the left, inner lane of H-1 Lunalilo Freeway, which is similar to how they merge now.
3. At the westbound Likelike Highway/Kalihi Street on-ramp, the long auxiliary lane that connects to H-1 Airport Viaduct would be reduced to a merge with a portion of the tapered on-ramp that is adjacent to the mainline traffic. The vehicles accessing the H-1 Lunalilo Freeway from Likelike Highway/Kalihi Street would enter the tapered on-ramp and merge onto the H-1 Lunalilo Freeway mainline. Micro-simulation

analysis showed that, although the delay would increase for vehicles entering the freeway, the on-ramp queuing would not back up significantly.

4. Due to loss of shoulders, improved incident management such as enhanced Freeway Service Patrol should be considered.

APPENDIX A TRAFFIC COUNT DATA

Run Date: 2010/07/30

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72020100385 | **Town:** Oahu | **Final AADT:** 76400
Functional Class: URBAN:PRINCIPAL ARTERIAL - INTERSTATE | **Count Type:** VOLUME | **Route No:** H-201
Location: H201:On ramp fr Funston Rd to End of Rte | **Counter Type:** Tube | **DIR 1:** +MP **DIR 2:** -MP

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 04/23/2009															
12:00-12:15	264	292	556	06:00-06:15	899	552	1451	12:00-12:15	871	738	1609	06:00-06:15	738	847	1585
12:15-12:30	193	245	438	06:15-06:30	1038	672	1710	12:15-12:30	827	784	1611	06:15-06:30	799	855	1654
12:30-12:45	203	222	425	06:30-06:45	1065	797	1862	12:30-12:45	941	876	1817	06:30-06:45	868	1019	1887
12:45-01:00	160	208	368	06:45-07:00	841	801	1642	12:45-01:00	900	798	1698	06:45-07:00	887	1063	1950
01:00-01:15	134	159	293	07:00-07:15	706	773	1479	01:00-01:15	882	792	1674	07:00-07:15	859	988	1847
01:15-01:30	108	135	243	07:15-07:30	609	796	1405	01:15-01:30	866	745	1611	07:15-07:30	846	979	1825
01:30-01:45	114	143	257	07:30-07:45	691	836	1527	01:30-01:45	917	836	1753	07:30-07:45	840	931	1771
01:45-02:00	100	127	227	07:45-08:00	597	813	1410	01:45-02:00	980	920	1900	07:45-08:00	780	810	1590
02:00-02:15	105	124	229	08:00-08:15	792	823	1615	02:00-02:15	988	899	1887	08:00-08:15	704	814	1518
02:15-02:30	114	146	260	08:15-08:30	840	807	1647	02:15-02:30	999	937	1936	08:15-08:30	699	789	1488
02:30-02:45	108	142	250	08:30-08:45	889	791	1680	02:30-02:45	1086	954	2040	08:30-08:45	665	726	1391
02:45-03:00	87	87	174	08:45-09:00	854	738	1592	02:45-03:00	943	1026	1969	08:45-09:00	613	704	1317
03:00-03:15	80	75	155	09:00-09:15	849	651	1500	03:00-03:15	995	1070	2065	09:00-09:15	633	712	1345
03:15-03:30	72	73	145	09:15-09:30	850	630	1480	03:15-03:30	833	1085	1918	09:15-09:30	623	721	1344
03:30-03:45	96	82	178	09:30-09:45	916	691	1607	03:30-03:45	557	1069	1626	09:30-09:45	683	706	1389
03:45-04:00	114	85	199	09:45-10:00	963	691	1654	03:45-04:00	581	991	1572	09:45-10:00	650	649	1299
04:00-04:15	107	86	193	10:00-10:15	972	772	1744	04:00-04:15	561	955	1516	10:00-10:15	537	558	1095
04:15-04:30	156	122	278	10:15-10:30	916	737	1653	04:15-04:30	588	884	1472	10:15-10:30	482	535	1017
04:30-04:45	209	103	312	10:30-10:45	876	716	1592	04:30-04:45	459	656	1115	10:30-10:45	529	564	1093
04:45-05:00	298	153	451	10:45-11:00	970	802	1772	04:45-05:00	521	825	1346	10:45-11:00	411	407	818
05:00-05:15	348	172	520	11:00-11:15	871	767	1638	05:00-05:15	559	781	1340	11:00-11:15	341	358	699
05:15-05:30	481	240	721	11:15-11:30	874	759	1633	05:15-05:30	606	889	1495	11:15-11:30	315	361	676
05:30-05:45	636	338	974	11:30-11:45	857	727	1584	05:30-05:45	859	878	1737	11:30-11:45	349	436	785
05:45-06:00	813	470	1283	11:45-12:00	846	755	1601	05:45-06:00	780	860	1640	11:45-12:00	311	404	715

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	06:15 AM to 07:15 AM		
AM - PEAK HR VOLUME	3650	3043	6693
AM - K FACTOR (%)			5.58
AM - D (%)	54.53	45.47	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	06:00 AM to 07:00 AM	07:30 AM to 08:30 AM	
AM - PEAK HR VOLUME	3843	3279	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	03:00 PM to 04:00 PM		
PM - PEAK HR VOLUME	2966	4215	7181
PM - K FACTOR (%)			5.98
PM - D (%)	41.30	58.70	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	06:00 PM to 07:00 PM	03:00 PM to 04:00 PM	
PM - PEAK HR VOLUME	3292	4215	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	10:00 AM to 11:00 AM		
AM - PEAK HR VOLUME	3734	3027	6761
AM - K FACTOR (%)			5.63
AM - D (%)	55.23	44.77	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	02:15 PM to 03:15 PM		
PM - PEAK HR VOLUME	4023	3987	8010
PM - K FACTOR (%)			6.67
PM - D (%)	50.22	49.78	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	4016	3816	7832
DIRECTIONAL PEAK			
PEAK HR TIME	01:45 PM to 02:45 PM	02:00 PM to 03:00 PM	
PEAK HR VOLUME	4053	3816	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	20,581	17,897	38,478
AM 12-HR PERIOD (00:00-12:00)	25,681	21,926	47,607
PM 6-HR PERIOD (12:00-18:00)	19,099	21,248	40,347
PM 12-HR PERIOD (12:00-24:00)	34,261	38,184	72,445
24 HOUR PERIOD	59,942	60,110	120,052
D (%)	49.93	50.07	100.00

Run Date: 2010/07/21

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72000H1-20A
Town: Oahu
Final AADT: 9100
Functional Class: URBAN:PRINCIPAL ARTERIAL - INTERSTATE
Count Type: VOLUME
Route No: H-1
Location: OFF RAMP, H-1 EB TO KALIHI STREET NB
Counter Type: Tube
DIR 1: +MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/08/2009															
12:00-12:15	39	0	39	06:00-06:15	156	0	156	12:00-12:15	148	0	148	06:00-06:15	245	0	245
12:15-12:30	21	0	21	06:15-06:30	212	0	212	12:15-12:30	133	0	133	06:15-06:30	225	0	225
12:30-12:45	23	0	23	06:30-06:45	212	0	212	12:30-12:45	142	0	142	06:30-06:45	237	0	237
12:45-01:00	19	0	19	06:45-07:00	226	0	226	12:45-01:00	122	0	122	06:45-07:00	144	0	144
01:00-01:15	17	0	17	07:00-07:15	257	0	257	01:00-01:15	139	0	139	07:00-07:15	136	0	136
01:15-01:30	12	0	12	07:15-07:30	219	0	219	01:15-01:30	130	0	130	07:15-07:30	104	0	104
01:30-01:45	12	0	12	07:30-07:45	189	0	189	01:30-01:45	143	0	143	07:30-07:45	111	0	111
01:45-02:00	9	0	9	07:45-08:00	142	0	142	01:45-02:00	147	0	147	07:45-08:00	126	0	126
02:00-02:15	5	0	5	08:00-08:15	152	0	152	02:00-02:15	173	0	173	08:00-08:15	102	0	102
02:15-02:30	14	0	14	08:15-08:30	152	0	152	02:15-02:30	245	0	245	08:15-08:30	107	0	107
02:30-02:45	5	0	5	08:30-08:45	117	0	117	02:30-02:45	229	0	229	08:30-08:45	96	0	96
02:45-03:00	9	0	9	08:45-09:00	144	0	144	02:45-03:00	239	0	239	08:45-09:00	84	0	84
03:00-03:15	13	0	13	09:00-09:15	157	0	157	03:00-03:15	249	0	249	09:00-09:15	79	0	79
03:15-03:30	10	0	10	09:15-09:30	104	0	104	03:15-03:30	238	0	238	09:15-09:30	101	0	101
03:30-03:45	18	0	18	09:30-09:45	125	0	125	03:30-03:45	200	0	200	09:30-09:45	106	0	106
03:45-04:00	18	0	18	09:45-10:00	133	0	133	03:45-04:00	221	0	221	09:45-10:00	69	0	69
04:00-04:15	18	0	18	10:00-10:15	134	0	134	04:00-04:15	243	0	243	10:00-10:15	71	0	71
04:15-04:30	21	0	21	10:15-10:30	131	0	131	04:15-04:30	229	0	229	10:15-10:30	66	0	66
04:30-04:45	28	0	28	10:30-10:45	132	0	132	04:30-04:45	224	0	224	10:30-10:45	54	0	54
04:45-05:00	40	0	40	10:45-11:00	113	0	113	04:45-05:00	237	0	237	10:45-11:00	48	0	48
05:00-05:15	54	0	54	11:00-11:15	120	0	120	05:00-05:15	239	0	239	11:00-11:15	62	0	62
05:15-05:30	76	0	76	11:15-11:30	120	0	120	05:15-05:30	215	0	215	11:15-11:30	29	0	29
05:30-05:45	91	0	91	11:30-11:45	128	0	128	05:30-05:45	244	0	244	11:30-11:45	40	0	40
05:45-06:00	112	0	112	11:45-12:00	140	0	140	05:45-06:00	258	0	258	11:45-12:00	45	0	45

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	06:30 AM to 07:30 AM		
AM - PEAK HR VOLUME	914	0	914
AM - K FACTOR (%)			7.83
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	06:30 AM to 07:30 AM		
AM - PEAK HR VOLUME	914	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	05:30 PM to 06:30 PM		
PM - PEAK HR VOLUME	972	0	972
PM - K FACTOR (%)			8.33
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	05:30 PM to 06:30 PM		
PM - PEAK HR VOLUME	972	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	06:30 AM to 07:30 AM		
AM - PEAK HR VOLUME	914	0	914
AM - K FACTOR (%)			7.83
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	05:30 PM to 06:30 PM		
PM - PEAK HR VOLUME	972	0	972
PM - K FACTOR (%)			8.33
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	886	0	886
DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	886	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	3,715	0	3,715
AM 12-HR PERIOD (00:00-12:00)	4,399	0	4,399
PM 6-HR PERIOD (12:00-18:00)	4,787	0	4,787
PM 12-HR PERIOD (12:00-24:00)	7,274	0	7,274
24 HOUR PERIOD	11,673	0	11,673
D (%)	100.00	0.00	100.00

Run Date: 2010/07/21

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72000H1-20D
Town: Oahu
Final AADT: 19500
Functional Class: OTHER
Count Type: VOLUME
Route No: H-1
Location: ON RAMP, KALIHI STREET SB/NB (R-2A _R-2
Counter Type: Tube
DIR 1: +MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/08/2009															
12:00-12:15	59	0	59	06:00-06:15	392	0	392	12:00-12:15	329	0	329	06:00-06:15	366	0	366
12:15-12:30	35	0	35	06:15-06:30	507	0	507	12:15-12:30	277	0	277	06:15-06:30	380	0	380
12:30-12:45	46	0	46	06:30-06:45	631	0	631	12:30-12:45	312	0	312	06:30-06:45	318	0	318
12:45-01:00	46	0	46	06:45-07:00	686	0	686	12:45-01:00	349	0	349	06:45-07:00	320	0	320
01:00-01:15	45	0	45	07:00-07:15	772	0	772	01:00-01:15	348	0	348	07:00-07:15	313	0	313
01:15-01:30	39	0	39	07:15-07:30	647	0	647	01:15-01:30	343	0	343	07:15-07:30	323	0	323
01:30-01:45	30	0	30	07:30-07:45	607	0	607	01:30-01:45	398	0	398	07:30-07:45	272	0	272
01:45-02:00	32	0	32	07:45-08:00	626	0	626	01:45-02:00	384	0	384	07:45-08:00	258	0	258
02:00-02:15	30	0	30	08:00-08:15	600	0	600	02:00-02:15	394	0	394	08:00-08:15	252	0	252
02:15-02:30	27	0	27	08:15-08:30	592	0	592	02:15-02:30	446	0	446	08:15-08:30	231	0	231
02:30-02:45	28	0	28	08:30-08:45	577	0	577	02:30-02:45	450	0	450	08:30-08:45	181	0	181
02:45-03:00	26	0	26	08:45-09:00	508	0	508	02:45-03:00	397	0	397	08:45-09:00	218	0	218
03:00-03:15	24	0	24	09:00-09:15	405	0	405	03:00-03:15	415	0	415	09:00-09:15	267	0	267
03:15-03:30	36	0	36	09:15-09:30	358	0	358	03:15-03:30	421	0	421	09:15-09:30	195	0	195
03:30-03:45	32	0	32	09:30-09:45	363	0	363	03:30-03:45	400	0	400	09:30-09:45	191	0	191
03:45-04:00	50	0	50	09:45-10:00	422	0	422	03:45-04:00	390	0	390	09:45-10:00	190	0	190
04:00-04:15	53	0	53	10:00-10:15	355	0	355	04:00-04:15	419	0	419	10:00-10:15	209	0	209
04:15-04:30	55	0	55	10:15-10:30	366	0	366	04:15-04:30	452	0	452	10:15-10:30	158	0	158
04:30-04:45	107	0	107	10:30-10:45	358	0	358	04:30-04:45	459	0	459	10:30-10:45	129	0	129
04:45-05:00	154	0	154	10:45-11:00	363	0	363	04:45-05:00	487	0	487	10:45-11:00	119	0	119
05:00-05:15	149	0	149	11:00-11:15	326	0	326	05:00-05:15	423	0	423	11:00-11:15	88	0	88
05:15-05:30	208	0	208	11:15-11:30	326	0	326	05:15-05:30	484	0	484	11:15-11:30	83	0	83
05:30-05:45	306	0	306	11:30-11:45	379	0	379	05:30-05:45	351	0	351	11:30-11:45	75	0	75
05:45-06:00	389	0	389	11:45-12:00	314	0	314	05:45-06:00	366	0	366	11:45-12:00	65	0	65

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	06:30 AM to 07:30 AM		
AM - PEAK HR VOLUME	2736	0	2736
AM - K FACTOR (%)			9.71
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	06:30 AM to 07:30 AM		
AM - PEAK HR VOLUME	2736	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:30 PM to 05:30 PM		
PM - PEAK HR VOLUME	1853	0	1853
PM - K FACTOR (%)			6.58
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:30 PM to 05:30 PM		
PM - PEAK HR VOLUME	1853	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	06:30 AM to 07:30 AM		
AM - PEAK HR VOLUME	2736	0	2736
AM - K FACTOR (%)			9.71
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:30 PM to 05:30 PM		
PM - PEAK HR VOLUME	1853	0	1853
PM - K FACTOR (%)			6.58
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	1687	0	1687
DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	1687	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	11,480	0	11,480
AM 12-HR PERIOD (00:00-12:00)	13,486	0	13,486
PM 6-HR PERIOD (12:00-18:00)	9,494	0	9,494
PM 12-HR PERIOD (12:00-24:00)	14,695	0	14,695
24 HOUR PERIOD	28,181	0	28,181
D (%)	100.00	0.00	100.00

Run Date: 2010/07/20

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72000H1-20G
Town: Oahu
Final AADT: 8800
Functional Class: URBAN:PRINCIPAL ARTERIAL - INTERSTATE
Count Type: VOLUME
Route No: H-1
Location: OFF RAMP, H-1 EB TO OLOMEA STREET (loop
Counter Type: Tube
DIR 1: +MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/08/2009															
12:00-12:15	34	0	34	06:00-06:15	222	0	222	12:00-12:15	197	0	197	06:00-06:15	220	0	220
12:15-12:30	32	0	32	06:15-06:30	242	0	242	12:15-12:30	179	0	179	06:15-06:30	273	0	273
12:30-12:45	24	0	24	06:30-06:45	203	0	203	12:30-12:45	204	0	204	06:30-06:45	221	0	221
12:45-01:00	14	0	14	06:45-07:00	221	0	221	12:45-01:00	187	0	187	06:45-07:00	230	0	230
01:00-01:15	17	0	17	07:00-07:15	228	0	228	01:00-01:15	204	0	204	07:00-07:15	135	0	135
01:15-01:30	12	0	12	07:15-07:30	220	0	220	01:15-01:30	193	0	193	07:15-07:30	155	0	155
01:30-01:45	14	0	14	07:30-07:45	222	0	222	01:30-01:45	230	0	230	07:30-07:45	109	0	109
01:45-02:00	11	0	11	07:45-08:00	244	0	244	01:45-02:00	227	0	227	07:45-08:00	110	0	110
02:00-02:15	12	0	12	08:00-08:15	280	0	280	02:00-02:15	207	0	207	08:00-08:15	118	0	118
02:15-02:30	14	0	14	08:15-08:30	232	0	232	02:15-02:30	243	0	243	08:15-08:30	100	0	100
02:30-02:45	11	0	11	08:30-08:45	254	0	254	02:30-02:45	263	0	263	08:30-08:45	94	0	94
02:45-03:00	10	0	10	08:45-09:00	271	0	271	02:45-03:00	226	0	226	08:45-09:00	95	0	95
03:00-03:15	8	0	8	09:00-09:15	244	0	244	03:00-03:15	228	0	228	09:00-09:15	106	0	106
03:15-03:30	19	0	19	09:15-09:30	254	0	254	03:15-03:30	222	0	222	09:15-09:30	119	0	119
03:30-03:45	21	0	21	09:30-09:45	281	0	281	03:30-03:45	231	0	231	09:30-09:45	93	0	93
03:45-04:00	44	0	44	09:45-10:00	242	0	242	03:45-04:00	229	0	229	09:45-10:00	88	0	88
04:00-04:15	27	0	27	10:00-10:15	228	0	228	04:00-04:15	197	0	197	10:00-10:15	82	0	82
04:15-04:30	31	0	31	10:15-10:30	225	0	225	04:15-04:30	242	0	242	10:15-10:30	92	0	92
04:30-04:45	55	0	55	10:30-10:45	243	0	243	04:30-04:45	214	0	214	10:30-10:45	69	0	69
04:45-05:00	78	0	78	10:45-11:00	257	0	257	04:45-05:00	218	0	218	10:45-11:00	56	0	56
05:00-05:15	111	0	111	11:00-11:15	237	0	237	05:00-05:15	225	0	225	11:00-11:15	47	0	47
05:15-05:30	130	0	130	11:15-11:30	232	0	232	05:15-05:30	216	0	216	11:15-11:30	51	0	51
05:30-05:45	166	0	166	11:30-11:45	243	0	243	05:30-05:45	235	0	235	11:30-11:45	31	0	31
05:45-06:00	208	0	208	11:45-12:00	239	0	239	05:45-06:00	261	0	261	11:45-12:00	33	0	33

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	08:00 AM to 09:00 AM		
AM - PEAK HR VOLUME	1037	0	1037
AM - K FACTOR (%)			6.97
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	08:00 AM to 09:00 AM		
AM - PEAK HR VOLUME	1037	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	05:30 PM to 06:30 PM		
PM - PEAK HR VOLUME	989	0	989
PM - K FACTOR (%)			6.65
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	05:30 PM to 06:30 PM		
PM - PEAK HR VOLUME	989	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	08:45 AM to 09:45 AM		
AM - PEAK HR VOLUME	1050	0	1050
AM - K FACTOR (%)			7.06
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	05:30 PM to 06:30 PM		
PM - PEAK HR VOLUME	989	0	989
PM - K FACTOR (%)			6.65
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	09:00 AM to 10:00 AM		
PEAK HR VOLUME	1021	0	1021
DIRECTIONAL PEAK			
PEAK HR TIME	09:00 AM to 10:00 AM		
PEAK HR VOLUME	1021	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	5,764	0	5,764
AM 12-HR PERIOD (00:00-12:00)	6,867	0	6,867
PM 6-HR PERIOD (12:00-18:00)	5,278	0	5,278
PM 12-HR PERIOD (12:00-24:00)	8,005	0	8,005
24 HOUR PERIOD	14,872	0	14,872
D (%)	100.00	0.00	100.00

Run Date: 2010/07/20

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72000H1-20Q
Functional Class: OTHER
Location: ON RAMP, LILIHA STREET TO H-1 EB

Town: Oahu
Count Type: VOLUME
Counter Type: Tube

Final AADT: 13400
Route No: H-1
DIR 1: +MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/08/2009															
12:00-12:15	28	0	28	06:00-06:15	105	0	105	12:00-12:15	264	0	264	06:00-06:15	284	0	284
12:15-12:30	31	0	31	06:15-06:30	129	0	129	12:15-12:30	236	0	236	06:15-06:30	280	0	280
12:30-12:45	19	0	19	06:30-06:45	196	0	196	12:30-12:45	232	0	232	06:30-06:45	256	0	256
12:45-01:00	27	0	27	06:45-07:00	274	0	274	12:45-01:00	231	0	231	06:45-07:00	226	0	226
01:00-01:15	25	0	25	07:00-07:15	339	0	339	01:00-01:15	243	0	243	07:00-07:15	192	0	192
01:15-01:30	8	0	8	07:15-07:30	368	0	368	01:15-01:30	250	0	250	07:15-07:30	216	0	216
01:30-01:45	11	0	11	07:30-07:45	369	0	369	01:30-01:45	248	0	248	07:30-07:45	164	0	164
01:45-02:00	18	0	18	07:45-08:00	391	0	391	01:45-02:00	237	0	237	07:45-08:00	156	0	156
02:00-02:15	16	0	16	08:00-08:15	354	0	354	02:00-02:15	251	0	251	08:00-08:15	180	0	180
02:15-02:30	13	0	13	08:15-08:30	297	0	297	02:15-02:30	303	0	303	08:15-08:30	166	0	166
02:30-02:45	10	0	10	08:30-08:45	253	0	253	02:30-02:45	293	0	293	08:30-08:45	181	0	181
02:45-03:00	8	0	8	08:45-09:00	227	0	227	02:45-03:00	284	0	284	08:45-09:00	155	0	155
03:00-03:15	9	0	9	09:00-09:15	233	0	233	03:00-03:15	271	0	271	09:00-09:15	144	0	144
03:15-03:30	15	0	15	09:15-09:30	228	0	228	03:15-03:30	323	0	323	09:15-09:30	135	0	135
03:30-03:45	13	0	13	09:30-09:45	170	0	170	03:30-03:45	292	0	292	09:30-09:45	129	0	129
03:45-04:00	13	0	13	09:45-10:00	225	0	225	03:45-04:00	328	0	328	09:45-10:00	124	0	124
04:00-04:15	17	0	17	10:00-10:15	202	0	202	04:00-04:15	314	0	314	10:00-10:15	94	0	94
04:15-04:30	23	0	23	10:15-10:30	227	0	227	04:15-04:30	313	0	313	10:15-10:30	84	0	84
04:30-04:45	34	0	34	10:30-10:45	219	0	219	04:30-04:45	358	0	358	10:30-10:45	57	0	57
04:45-05:00	30	0	30	10:45-11:00	231	0	231	04:45-05:00	389	0	389	10:45-11:00	58	0	58
05:00-05:15	60	0	60	11:00-11:15	243	0	243	05:00-05:15	393	0	393	11:00-11:15	57	0	57
05:15-05:30	58	0	58	11:15-11:30	226	0	226	05:15-05:30	382	0	382	11:15-11:30	39	0	39
05:30-05:45	88	0	88	11:30-11:45	226	0	226	05:30-05:45	336	0	336	11:30-11:45	32	0	32
05:45-06:00	98	0	98	11:45-12:00	219	0	219	05:45-06:00	305	0	305	11:45-12:00	36	0	36

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:15 AM to 08:15 AM		
AM - PEAK HR VOLUME	1482	0	1482
AM - K FACTOR (%)			8.64
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:15 AM to 08:15 AM		
AM - PEAK HR VOLUME	1482	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:30 PM to 05:30 PM		
PM - PEAK HR VOLUME	1522	0	1522
PM - K FACTOR (%)			8.88
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:30 PM to 05:30 PM		
PM - PEAK HR VOLUME	1522	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:15 AM to 08:15 AM		
AM - PEAK HR VOLUME	1482	0	1482
AM - K FACTOR (%)			8.64
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:30 PM to 05:30 PM		
PM - PEAK HR VOLUME	1522	0	1522
PM - K FACTOR (%)			8.88
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	1131	0	1131
DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	1131	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	5,951	0	5,951
AM 12-HR PERIOD (00:00-12:00)	6,623	0	6,623
PM 6-HR PERIOD (12:00-18:00)	7,076	0	7,076
PM 12-HR PERIOD (12:00-24:00)	10,521	0	10,521
24 HOUR PERIOD	17,144	0	17,144
D (%)	100.00	0.00	100.00

Run Date: 2010/07/21

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72000H1-21A
Town: Oahu
Final AADT: 9000
Functional Class: URBAN:PRINCIPAL ARTERIAL - INTERSTATE
Count Type: VOLUME
Route No: H-1
Location: OFF RAMP, H-1 EB TO PALI HIGHWAY
Counter Type: Tube
DIR 1: +MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/08/2009															
12:00-12:15	36	0	36	06:00-06:15	228	0	228	12:00-12:15	251	0	251	06:00-06:15	216	0	216
12:15-12:30	26	0	26	06:15-06:30	233	0	233	12:15-12:30	248	0	248	06:15-06:30	196	0	196
12:30-12:45	32	0	32	06:30-06:45	202	0	202	12:30-12:45	216	0	216	06:30-06:45	231	0	231
12:45-01:00	22	0	22	06:45-07:00	205	0	205	12:45-01:00	246	0	246	06:45-07:00	219	0	219
01:00-01:15	13	0	13	07:00-07:15	198	0	198	01:00-01:15	238	0	238	07:00-07:15	184	0	184
01:15-01:30	10	0	10	07:15-07:30	162	0	162	01:15-01:30	224	0	224	07:15-07:30	155	0	155
01:30-01:45	18	0	18	07:30-07:45	203	0	203	01:30-01:45	244	0	244	07:30-07:45	180	0	180
01:45-02:00	14	0	14	07:45-08:00	250	0	250	01:45-02:00	280	0	280	07:45-08:00	147	0	147
02:00-02:15	16	0	16	08:00-08:15	271	0	271	02:00-02:15	260	0	260	08:00-08:15	154	0	154
02:15-02:30	14	0	14	08:15-08:30	233	0	233	02:15-02:30	269	0	269	08:15-08:30	141	0	141
02:30-02:45	11	0	11	08:30-08:45	250	0	250	02:30-02:45	242	0	242	08:30-08:45	141	0	141
02:45-03:00	12	0	12	08:45-09:00	253	0	253	02:45-03:00	267	0	267	08:45-09:00	159	0	159
03:00-03:15	16	0	16	09:00-09:15	243	0	243	03:00-03:15	245	0	245	09:00-09:15	127	0	127
03:15-03:30	14	0	14	09:15-09:30	232	0	232	03:15-03:30	246	0	246	09:15-09:30	127	0	127
03:30-03:45	13	0	13	09:30-09:45	234	0	234	03:30-03:45	214	0	214	09:30-09:45	115	0	115
03:45-04:00	25	0	25	09:45-10:00	261	0	261	03:45-04:00	248	0	248	09:45-10:00	108	0	108
04:00-04:15	38	0	38	10:00-10:15	218	0	218	04:00-04:15	202	0	202	10:00-10:15	99	0	99
04:15-04:30	40	0	40	10:15-10:30	256	0	256	04:15-04:30	218	0	218	10:15-10:30	95	0	95
04:30-04:45	60	0	60	10:30-10:45	268	0	268	04:30-04:45	232	0	232	10:30-10:45	81	0	81
04:45-05:00	72	0	72	10:45-11:00	258	0	258	04:45-05:00	176	0	176	10:45-11:00	59	0	59
05:00-05:15	112	0	112	11:00-11:15	270	0	270	05:00-05:15	196	0	196	11:00-11:15	62	0	62
05:15-05:30	115	0	115	11:15-11:30	256	0	256	05:15-05:30	227	0	227	11:15-11:30	47	0	47
05:30-05:45	154	0	154	11:30-11:45	234	0	234	05:30-05:45	220	0	220	11:30-11:45	54	0	54
05:45-06:00	213	0	213	11:45-12:00	236	0	236	05:45-06:00	211	0	211	11:45-12:00	40	0	40

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	08:00 AM to 09:00 AM		
AM - PEAK HR VOLUME	1007	0	1007
AM - K FACTOR (%)			6.49
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	08:00 AM to 09:00 AM		
AM - PEAK HR VOLUME	1007	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	03:00 PM to 04:00 PM		
PM - PEAK HR VOLUME	953	0	953
PM - K FACTOR (%)			6.15
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	03:00 PM to 04:00 PM		
PM - PEAK HR VOLUME	953	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	10:30 AM to 11:30 AM		
AM - PEAK HR VOLUME	1052	0	1052
AM - K FACTOR (%)			6.78
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	01:30 PM to 02:30 PM		
PM - PEAK HR VOLUME	1053	0	1053
PM - K FACTOR (%)			6.79
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	01:30 PM to 02:30 PM		
PEAK HR VOLUME	1053	0	1053
DIRECTIONAL PEAK			
PEAK HR TIME	01:30 PM to 02:30 PM		
PEAK HR VOLUME	1053	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	5,654	0	5,654
AM 12-HR PERIOD (00:00-12:00)	6,750	0	6,750
PM 6-HR PERIOD (12:00-18:00)	5,620	0	5,620
PM 12-HR PERIOD (12:00-24:00)	8,757	0	8,757
24 HOUR PERIOD	15,507	0	15,507
D (%)	100.00	0.00	100.00

Run Date: 2010/07/21

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72000H1-21B
Town: Oahu
Final AADT: 4600
Functional Class: URBAN:PRINCIPAL ARTERIAL - INTERSTATE
Count Type: VOLUME
Route No: H-1
Location: OFF RAMP, H-1 EB TO PUNCHBOWL STREET
Counter Type: Tube
DIR 1: +MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/08/2009															
12:00-12:15	9	0	9	06:00-06:15	180	0	180	12:00-12:15	124	0	124	06:00-06:15	66	0	66
12:15-12:30	8	0	8	06:15-06:30	157	0	157	12:15-12:30	140	0	140	06:15-06:30	88	0	88
12:30-12:45	3	0	3	06:30-06:45	152	0	152	12:30-12:45	147	0	147	06:30-06:45	111	0	111
12:45-01:00	10	0	10	06:45-07:00	129	0	129	12:45-01:00	147	0	147	06:45-07:00	113	0	113
01:00-01:15	7	0	7	07:00-07:15	93	0	93	01:00-01:15	121	0	121	07:00-07:15	81	0	81
01:15-01:30	5	0	5	07:15-07:30	97	0	97	01:15-01:30	135	0	135	07:15-07:30	60	0	60
01:30-01:45	4	0	4	07:30-07:45	101	0	101	01:30-01:45	151	0	151	07:30-07:45	58	0	58
01:45-02:00	8	0	8	07:45-08:00	158	0	158	01:45-02:00	115	0	115	07:45-08:00	65	0	65
02:00-02:15	9	0	9	08:00-08:15	157	0	157	02:00-02:15	123	0	123	08:00-08:15	41	0	41
02:15-02:30	8	0	8	08:15-08:30	138	0	138	02:15-02:30	132	0	132	08:15-08:30	53	0	53
02:30-02:45	8	0	8	08:30-08:45	152	0	152	02:30-02:45	134	0	134	08:30-08:45	57	0	57
02:45-03:00	5	0	5	08:45-09:00	173	0	173	02:45-03:00	119	0	119	08:45-09:00	33	0	33
03:00-03:15	5	0	5	09:00-09:15	160	0	160	03:00-03:15	90	0	90	09:00-09:15	37	0	37
03:15-03:30	9	0	9	09:15-09:30	168	0	168	03:15-03:30	87	0	87	09:15-09:30	30	0	30
03:30-03:45	10	0	10	09:30-09:45	180	0	180	03:30-03:45	84	0	84	09:30-09:45	30	0	30
03:45-04:00	11	0	11	09:45-10:00	167	0	167	03:45-04:00	77	0	77	09:45-10:00	35	0	35
04:00-04:15	8	0	8	10:00-10:15	166	0	166	04:00-04:15	74	0	74	10:00-10:15	34	0	34
04:15-04:30	20	0	20	10:15-10:30	153	0	153	04:15-04:30	68	0	68	10:15-10:30	20	0	20
04:30-04:45	49	0	49	10:30-10:45	170	0	170	04:30-04:45	65	0	65	10:30-10:45	30	0	30
04:45-05:00	51	0	51	10:45-11:00	146	0	146	04:45-05:00	51	0	51	10:45-11:00	24	0	24
05:00-05:15	59	0	59	11:00-11:15	141	0	141	05:00-05:15	66	0	66	11:00-11:15	13	0	13
05:15-05:30	104	0	104	11:15-11:30	141	0	141	05:15-05:30	61	0	61	11:15-11:30	17	0	17
05:30-05:45	134	0	134	11:30-11:45	123	0	123	05:30-05:45	60	0	60	11:30-11:45	12	0	12
05:45-06:00	172	0	172	11:45-12:00	142	0	142	05:45-06:00	69	0	69	11:45-12:00	13	0	13

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	05:45 AM to 06:45 AM		
AM - PEAK HR VOLUME	661	0	661
AM - K FACTOR (%)			8.45
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	05:45 AM to 06:45 AM		
AM - PEAK HR VOLUME	661	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	06:00 PM to 07:00 PM		
PM - PEAK HR VOLUME	378	0	378
PM - K FACTOR (%)			4.83
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	06:00 PM to 07:00 PM		
PM - PEAK HR VOLUME	378	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	09:15 AM to 10:15 AM		
AM - PEAK HR VOLUME	681	0	681
AM - K FACTOR (%)			8.71
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	12:00 PM to 01:00 PM		
PM - PEAK HR VOLUME	558	0	558
PM - K FACTOR (%)			7.13
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	09:15 AM to 10:15 AM		
PEAK HR VOLUME	681	0	681
DIRECTIONAL PEAK			
PEAK HR TIME	09:15 AM to 10:15 AM		
PEAK HR VOLUME	681	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	3,544	0	3,544
AM 12-HR PERIOD (00:00-12:00)	4,260	0	4,260
PM 6-HR PERIOD (12:00-18:00)	2,440	0	2,440
PM 12-HR PERIOD (12:00-24:00)	3,561	0	3,561
24 HOUR PERIOD	7,821	0	7,821
D (%)	100.00	0.00	100.00

Run Date: 2010/07/21

Hawaii Department of Transportation

Highways Division — Highways Planning Survey Section

2009 Program Count - Summary

Site ID: B72000H1-21C
Town: Oahu
Final AADT: 12600
Functional Class: URBAN:PRINCIPAL ARTERIAL - INTERSTATE
Count Type: VOLUME
Route No: H-1
Location: ON RAMP, PALI HIGHWAY SB TO H-1 EB
Counter Type: Tube
DIR 1: +MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/08/2009															
12:00-12:15	30	0	30	06:00-06:15	204	0	204	12:00-12:15	236	0	236	06:00-06:15	403	0	403
12:15-12:30	26	0	26	06:15-06:30	344	0	344	12:15-12:30	255	0	255	06:15-06:30	340	0	340
12:30-12:45	18	0	18	06:30-06:45	444	0	444	12:30-12:45	225	0	225	06:30-06:45	291	0	291
12:45-01:00	16	0	16	06:45-07:00	437	0	437	12:45-01:00	245	0	245	06:45-07:00	304	0	304
01:00-01:15	15	0	15	07:00-07:15	464	0	464	01:00-01:15	216	0	216	07:00-07:15	229	0	229
01:15-01:30	17	0	17	07:15-07:30	489	0	489	01:15-01:30	265	0	265	07:15-07:30	187	0	187
01:30-01:45	7	0	7	07:30-07:45	473	0	473	01:30-01:45	258	0	258	07:30-07:45	186	0	186
01:45-02:00	9	0	9	07:45-08:00	443	0	443	01:45-02:00	223	0	223	07:45-08:00	191	0	191
02:00-02:15	10	0	10	08:00-08:15	424	0	424	02:00-02:15	274	0	274	08:00-08:15	175	0	175
02:15-02:30	14	0	14	08:15-08:30	418	0	418	02:15-02:30	332	0	332	08:15-08:30	151	0	151
02:30-02:45	15	0	15	08:30-08:45	418	0	418	02:30-02:45	282	0	282	08:30-08:45	143	0	143
02:45-03:00	6	0	6	08:45-09:00	390	0	390	02:45-03:00	387	0	387	08:45-09:00	141	0	141
03:00-03:15	14	0	14	09:00-09:15	311	0	311	03:00-03:15	308	0	308	09:00-09:15	143	0	143
03:15-03:30	20	0	20	09:15-09:30	310	0	310	03:15-03:30	428	0	428	09:15-09:30	120	0	120
03:30-03:45	22	0	22	09:30-09:45	312	0	312	03:30-03:45	390	0	390	09:30-09:45	143	0	143
03:45-04:00	18	0	18	09:45-10:00	398	0	398	03:45-04:00	436	0	436	09:45-10:00	138	0	138
04:00-04:15	26	0	26	10:00-10:15	328	0	328	04:00-04:15	398	0	398	10:00-10:15	82	0	82
04:15-04:30	35	0	35	10:15-10:30	269	0	269	04:15-04:30	463	0	463	10:15-10:30	89	0	89
04:30-04:45	50	0	50	10:30-10:45	293	0	293	04:30-04:45	480	0	480	10:30-10:45	84	0	84
04:45-05:00	59	0	59	10:45-11:00	255	0	255	04:45-05:00	478	0	478	10:45-11:00	58	0	58
05:00-05:15	66	0	66	11:00-11:15	291	0	291	05:00-05:15	467	0	467	11:00-11:15	43	0	43
05:15-05:30	102	0	102	11:15-11:30	253	0	253	05:15-05:30	492	0	492	11:15-11:30	48	0	48
05:30-05:45	167	0	167	11:30-11:45	280	0	280	05:30-05:45	462	0	462	11:30-11:45	39	0	39
05:45-06:00	170	0	170	11:45-12:00	255	0	255	05:45-06:00	443	0	443	11:45-12:00	39	0	39

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM		
AM - PEAK HR VOLUME	1869	0	1869
AM - K FACTOR (%)			8.63
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM		
AM - PEAK HR VOLUME	1869	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:30 PM to 05:30 PM		
PM - PEAK HR VOLUME	1917	0	1917
PM - K FACTOR (%)			8.86
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:30 PM to 05:30 PM		
PM - PEAK HR VOLUME	1917	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM		
AM - PEAK HR VOLUME	1869	0	1869
AM - K FACTOR (%)			8.63
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:30 PM to 05:30 PM		
PM - PEAK HR VOLUME	1917	0	1917
PM - K FACTOR (%)			8.86
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	09:15 AM to 10:15 AM		
PEAK HR VOLUME	1348	0	1348
DIRECTIONAL PEAK			
PEAK HR TIME	09:15 AM to 10:15 AM		
PEAK HR VOLUME	1348	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	8,503	0	8,503
AM 12-HR PERIOD (00:00-12:00)	9,435	0	9,435
PM 6-HR PERIOD (12:00-18:00)	8,443	0	8,443
PM 12-HR PERIOD (12:00-24:00)	12,210	0	12,210
24 HOUR PERIOD	21,645	0	21,645
D (%)	100.00	0.00	100.00

Run Date: 2010/05/24

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72000H1-22A
Town: Oahu
Final AADT: 0
Functional Class: URBAN:PRINCIPAL ARTERIAL - INTERSTATE
Count Type: VOLUME
Route No: H-1
Location: OFF RAMP, H-1 EB TO KINAU STREET
Counter Type: Tube
DIR 1: +MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/08/2009															
12:00-12:15	52	0	52	06:00-06:15	320	0	320	12:00-12:15	369	0	369	06:00-06:15	284	0	284
12:15-12:30	43	0	43	06:15-06:30	348	0	348	12:15-12:30	340	0	340	06:15-06:30	342	0	342
12:30-12:45	45	0	45	06:30-06:45	362	0	362	12:30-12:45	363	0	363	06:30-06:45	332	0	332
12:45-01:00	39	0	39	06:45-07:00	357	0	357	12:45-01:00	349	0	349	06:45-07:00	365	0	365
01:00-01:15	28	0	28	07:00-07:15	304	0	304	01:00-01:15	346	0	346	07:00-07:15	327	0	327
01:15-01:30	39	0	39	07:15-07:30	277	0	277	01:15-01:30	417	0	417	07:15-07:30	291	0	291
01:30-01:45	18	0	18	07:30-07:45	323	0	323	01:30-01:45	386	0	386	07:30-07:45	302	0	302
01:45-02:00	21	0	21	07:45-08:00	419	0	419	01:45-02:00	401	0	401	07:45-08:00	266	0	266
02:00-02:15	26	0	26	08:00-08:15	422	0	422	02:00-02:15	368	0	368	08:00-08:15	258	0	258
02:15-02:30	20	0	20	08:15-08:30	406	0	406	02:15-02:30	409	0	409	08:15-08:30	213	0	213
02:30-02:45	35	0	35	08:30-08:45	340	0	340	02:30-02:45	361	0	361	08:30-08:45	208	0	208
02:45-03:00	25	0	25	08:45-09:00	411	0	411	02:45-03:00	369	0	369	08:45-09:00	215	0	215
03:00-03:15	27	0	27	09:00-09:15	425	0	425	03:00-03:15	360	0	360	09:00-09:15	222	0	222
03:15-03:30	28	0	28	09:15-09:30	414	0	414	03:15-03:30	313	0	313	09:15-09:30	231	0	231
03:30-03:45	40	0	40	09:30-09:45	449	0	449	03:30-03:45	342	0	342	09:30-09:45	207	0	207
03:45-04:00	47	0	47	09:45-10:00	453	0	453	03:45-04:00	320	0	320	09:45-10:00	194	0	194
04:00-04:15	41	0	41	10:00-10:15	481	0	481	04:00-04:15	317	0	317	10:00-10:15	150	0	150
04:15-04:30	70	0	70	10:15-10:30	381	0	381	04:15-04:30	300	0	300	10:15-10:30	138	0	138
04:30-04:45	91	0	91	10:30-10:45	444	0	444	04:30-04:45	272	0	272	10:30-10:45	114	0	114
04:45-05:00	139	0	139	10:45-11:00	418	0	418	04:45-05:00	247	0	247	10:45-11:00	102	0	102
05:00-05:15	170	0	170	11:00-11:15	406	0	406	05:00-05:15	286	0	286	11:00-11:15	71	0	71
05:15-05:30	226	0	226	11:15-11:30	461	0	461	05:15-05:30	279	0	279	11:15-11:30	90	0	90
05:30-05:45	320	0	320	11:30-11:45	368	0	368	05:30-05:45	296	0	296	11:30-11:45	74	0	74
05:45-06:00	345	0	345	11:45-12:00	335	0	335	05:45-06:00	273	0	273	11:45-12:00	63	0	63

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:45 AM to 08:45 AM		
AM - PEAK HR VOLUME	1587	0	1587
AM - K FACTOR (%)			6.50
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:45 AM to 08:45 AM		
AM - PEAK HR VOLUME	1587	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	03:00 PM to 04:00 PM		
PM - PEAK HR VOLUME	1335	0	1335
PM - K FACTOR (%)			5.47
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	03:00 PM to 04:00 PM		
PM - PEAK HR VOLUME	1335	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	09:15 AM to 10:15 AM		
AM - PEAK HR VOLUME	1797	0	1797
AM - K FACTOR (%)			7.36
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	01:15 PM to 02:15 PM		
PM - PEAK HR VOLUME	1572	0	1572
PM - K FACTOR (%)			6.44
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	09:15 AM to 10:15 AM		
PEAK HR VOLUME	1797	0	1797
DIRECTIONAL PEAK			
PEAK HR TIME	09:15 AM to 10:15 AM		
PEAK HR VOLUME	1797	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	9,324	0	9,324
AM 12-HR PERIOD (00:00-12:00)	11,259	0	11,259
PM 6-HR PERIOD (12:00-18:00)	8,083	0	8,083
PM 12-HR PERIOD (12:00-24:00)	13,142	0	13,142
24 HOUR PERIOD	24,401	0	24,401
D (%)	100.00	0.00	100.00

Run Date: 2010/05/24

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72000H1-22B
Town: Oahu
Final AADT: 0
Functional Class: URBAN:PRINCIPAL ARTERIAL - INTERSTATE
Count Type: VOLUME
Route No: H-1
Location: ON RAMP, VINEYARD BLVD EB TO H-1 EB
Counter Type: Tube
DIR 1: +MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/08/2009															
12:00-12:15	29	0	29	06:00-06:15	47	0	47	12:00-12:15	184	0	184	06:00-06:15	307	0	307
12:15-12:30	28	0	28	06:15-06:30	79	0	79	12:15-12:30	171	0	171	06:15-06:30	327	0	327
12:30-12:45	24	0	24	06:30-06:45	106	0	106	12:30-12:45	147	0	147	06:30-06:45	298	0	298
12:45-01:00	14	0	14	06:45-07:00	138	0	138	12:45-01:00	183	0	183	06:45-07:00	217	0	217
01:00-01:15	12	0	12	07:00-07:15	175	0	175	01:00-01:15	150	0	150	07:00-07:15	188	0	188
01:15-01:30	17	0	17	07:15-07:30	204	0	204	01:15-01:30	170	0	170	07:15-07:30	170	0	170
01:30-01:45	9	0	9	07:30-07:45	186	0	186	01:30-01:45	197	0	197	07:30-07:45	165	0	165
01:45-02:00	13	0	13	07:45-08:00	191	0	191	01:45-02:00	201	0	201	07:45-08:00	161	0	161
02:00-02:15	12	0	12	08:00-08:15	172	0	172	02:00-02:15	182	0	182	08:00-08:15	145	0	145
02:15-02:30	14	0	14	08:15-08:30	144	0	144	02:15-02:30	193	0	193	08:15-08:30	129	0	129
02:30-02:45	11	0	11	08:30-08:45	141	0	141	02:30-02:45	203	0	203	08:30-08:45	116	0	116
02:45-03:00	8	0	8	08:45-09:00	123	0	123	02:45-03:00	231	0	231	08:45-09:00	118	0	118
03:00-03:15	8	0	8	09:00-09:15	141	0	141	03:00-03:15	214	0	214	09:00-09:15	158	0	158
03:15-03:30	8	0	8	09:15-09:30	115	0	115	03:15-03:30	233	0	233	09:15-09:30	127	0	127
03:30-03:45	9	0	9	09:30-09:45	149	0	149	03:30-03:45	234	0	234	09:30-09:45	96	0	96
03:45-04:00	11	0	11	09:45-10:00	144	0	144	03:45-04:00	277	0	277	09:45-10:00	95	0	95
04:00-04:15	11	0	11	10:00-10:15	130	0	130	04:00-04:15	269	0	269	10:00-10:15	76	0	76
04:15-04:30	8	0	8	10:15-10:30	160	0	160	04:15-04:30	349	0	349	10:15-10:30	62	0	62
04:30-04:45	11	0	11	10:30-10:45	164	0	164	04:30-04:45	331	0	331	10:30-10:45	52	0	52
04:45-05:00	9	0	9	10:45-11:00	171	0	171	04:45-05:00	367	0	367	10:45-11:00	60	0	60
05:00-05:15	23	0	23	11:00-11:15	164	0	164	05:00-05:15	352	0	352	11:00-11:15	47	0	47
05:15-05:30	28	0	28	11:15-11:30	180	0	180	05:15-05:30	422	0	422	11:15-11:30	38	0	38
05:30-05:45	41	0	41	11:30-11:45	174	0	174	05:30-05:45	393	0	393	11:30-11:45	46	0	46
05:45-06:00	50	0	50	11:45-12:00	169	0	169	05:45-06:00	426	0	426	11:45-12:00	31	0	31

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM		
AM - PEAK HR VOLUME	756	0	756
AM - K FACTOR (%)			5.69
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM		
AM - PEAK HR VOLUME	756	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	05:00 PM to 06:00 PM		
PM - PEAK HR VOLUME	1593	0	1593
PM - K FACTOR (%)			11.99
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	05:00 PM to 06:00 PM		
PM - PEAK HR VOLUME	1593	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM		
AM - PEAK HR VOLUME	756	0	756
AM - K FACTOR (%)			5.69
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	05:00 PM to 06:00 PM		
PM - PEAK HR VOLUME	1593	0	1593
PM - K FACTOR (%)			11.99
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	809	0	809
DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	809	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	3,567	0	3,567
AM 12-HR PERIOD (00:00-12:00)	3,975	0	3,975
PM 6-HR PERIOD (12:00-18:00)	6,079	0	6,079
PM 12-HR PERIOD (12:00-24:00)	9,308	0	9,308
24 HOUR PERIOD	13,283	0	13,283
D (%)	100.00	0.00	100.00

Run Date: 2010/05/24

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72000H1-22C
Town: Oahu
Final AADT: 0
Functional Class: URBAN:PRINCIPAL ARTERIAL - INTERSTATE
Count Type: VOLUME
Route No: H-1
Location: ON RAMP, WARD AVE TO H-1 EB
Counter Type: Tube
DIR 1: +MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/08/2009															
12:00-12:15	36	0	36	06:00-06:15	32	0	32	12:00-12:15	114	0	114	06:00-06:15	158	0	158
12:15-12:30	19	0	19	06:15-06:30	61	0	61	12:15-12:30	129	0	129	06:15-06:30	174	0	174
12:30-12:45	22	0	22	06:30-06:45	54	0	54	12:30-12:45	109	0	109	06:30-06:45	150	0	150
12:45-01:00	10	0	10	06:45-07:00	99	0	99	12:45-01:00	115	0	115	06:45-07:00	126	0	126
01:00-01:15	9	0	9	07:00-07:15	129	0	129	01:00-01:15	120	0	120	07:00-07:15	108	0	108
01:15-01:30	16	0	16	07:15-07:30	176	0	176	01:15-01:30	127	0	127	07:15-07:30	133	0	133
01:30-01:45	13	0	13	07:30-07:45	169	0	169	01:30-01:45	126	0	126	07:30-07:45	111	0	111
01:45-02:00	15	0	15	07:45-08:00	121	0	121	01:45-02:00	154	0	154	07:45-08:00	107	0	107
02:00-02:15	13	0	13	08:00-08:15	107	0	107	02:00-02:15	168	0	168	08:00-08:15	104	0	104
02:15-02:30	10	0	10	08:15-08:30	99	0	99	02:15-02:30	162	0	162	08:15-08:30	99	0	99
02:30-02:45	7	0	7	08:30-08:45	125	0	125	02:30-02:45	147	0	147	08:30-08:45	98	0	98
02:45-03:00	9	0	9	08:45-09:00	115	0	115	02:45-03:00	174	0	174	08:45-09:00	79	0	79
03:00-03:15	8	0	8	09:00-09:15	101	0	101	03:00-03:15	160	0	160	09:00-09:15	84	0	84
03:15-03:30	6	0	6	09:15-09:30	109	0	109	03:15-03:30	177	0	177	09:15-09:30	76	0	76
03:30-03:45	11	0	11	09:30-09:45	102	0	102	03:30-03:45	165	0	165	09:30-09:45	65	0	65
03:45-04:00	6	0	6	09:45-10:00	130	0	130	03:45-04:00	193	0	193	09:45-10:00	69	0	69
04:00-04:15	10	0	10	10:00-10:15	113	0	113	04:00-04:15	181	0	181	10:00-10:15	61	0	61
04:15-04:30	6	0	6	10:15-10:30	120	0	120	04:15-04:30	206	0	206	10:15-10:30	43	0	43
04:30-04:45	8	0	8	10:30-10:45	112	0	112	04:30-04:45	212	0	212	10:30-10:45	55	0	55
04:45-05:00	16	0	16	10:45-11:00	114	0	114	04:45-05:00	197	0	197	10:45-11:00	54	0	54
05:00-05:15	12	0	12	11:00-11:15	128	0	128	05:00-05:15	210	0	210	11:00-11:15	42	0	42
05:15-05:30	27	0	27	11:15-11:30	127	0	127	05:15-05:30	188	0	188	11:15-11:30	37	0	37
05:30-05:45	26	0	26	11:30-11:45	137	0	137	05:30-05:45	182	0	182	11:30-11:45	26	0	26
05:45-06:00	34	0	34	11:45-12:00	138	0	138	05:45-06:00	165	0	165	11:45-12:00	27	0	27

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM		
AM - PEAK HR VOLUME	595	0	595
AM - K FACTOR (%)			6.59
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM		
AM - PEAK HR VOLUME	595	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:15 PM to 05:15 PM		
PM - PEAK HR VOLUME	825	0	825
PM - K FACTOR (%)			9.13
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:15 PM to 05:15 PM		
PM - PEAK HR VOLUME	825	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM		
AM - PEAK HR VOLUME	595	0	595
AM - K FACTOR (%)			6.59
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:15 PM to 05:15 PM		
PM - PEAK HR VOLUME	825	0	825
PM - K FACTOR (%)			9.13
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	651	0	651
DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	651	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	2,718	0	2,718
AM 12-HR PERIOD (00:00-12:00)	3,067	0	3,067
PM 6-HR PERIOD (12:00-18:00)	3,881	0	3,881
PM 12-HR PERIOD (12:00-24:00)	5,967	0	5,967
24 HOUR PERIOD	9,034	0	9,034
D (%)	100.00	0.00	100.00

Run Date: 2010/07/21

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72000H1-19A
Town: Oahu
Final AADT: 2500
Functional Class: URBAN:PRINCIPAL ARTERIAL - INTERSTATE
Count Type: VOLUME
Route No: H-1
Location: OFF RAMP, H-1 WB TO MIDDLE STREET
Counter Type: Tube
DIR 1: -MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/09/2009															
12:00-12:15	15	0	15	06:00-06:15	51	0	51	12:00-12:15	61	0	61	06:00-06:15	57	0	57
12:15-12:30	20	0	20	06:15-06:30	61	0	61	12:15-12:30	83	0	83	06:15-06:30	46	0	46
12:30-12:45	15	0	15	06:30-06:45	59	0	59	12:30-12:45	62	0	62	06:30-06:45	48	0	48
12:45-01:00	10	0	10	06:45-07:00	59	0	59	12:45-01:00	75	0	75	06:45-07:00	58	0	58
01:00-01:15	3	0	3	07:00-07:15	66	0	66	01:00-01:15	69	0	69	07:00-07:15	53	0	53
01:15-01:30	6	0	6	07:15-07:30	63	0	63	01:15-01:30	57	0	57	07:15-07:30	31	0	31
01:30-01:45	12	0	12	07:30-07:45	73	0	73	01:30-01:45	67	0	67	07:30-07:45	33	0	33
01:45-02:00	6	0	6	07:45-08:00	97	0	97	01:45-02:00	65	0	65	07:45-08:00	25	0	25
02:00-02:15	5	0	5	08:00-08:15	97	0	97	02:00-02:15	83	0	83	08:00-08:15	31	0	31
02:15-02:30	5	0	5	08:15-08:30	68	0	68	02:15-02:30	61	0	61	08:15-08:30	26	0	26
02:30-02:45	7	0	7	08:30-08:45	74	0	74	02:30-02:45	58	0	58	08:30-08:45	37	0	37
02:45-03:00	6	0	6	08:45-09:00	57	0	57	02:45-03:00	63	0	63	08:45-09:00	29	0	29
03:00-03:15	5	0	5	09:00-09:15	52	0	52	03:00-03:15	66	0	66	09:00-09:15	28	0	28
03:15-03:30	12	0	12	09:15-09:30	54	0	54	03:15-03:30	71	0	71	09:15-09:30	30	0	30
03:30-03:45	9	0	9	09:30-09:45	63	0	63	03:30-03:45	56	0	56	09:30-09:45	26	0	26
03:45-04:00	18	0	18	09:45-10:00	61	0	61	03:45-04:00	59	0	59	09:45-10:00	33	0	33
04:00-04:15	17	0	17	10:00-10:15	61	0	61	04:00-04:15	54	0	54	10:00-10:15	28	0	28
04:15-04:30	20	0	20	10:15-10:30	58	0	58	04:15-04:30	58	0	58	10:15-10:30	27	0	27
04:30-04:45	18	0	18	10:30-10:45	68	0	68	04:30-04:45	42	0	42	10:30-10:45	24	0	24
04:45-05:00	37	0	37	10:45-11:00	66	0	66	04:45-05:00	50	0	50	10:45-11:00	17	0	17
05:00-05:15	37	0	37	11:00-11:15	64	0	64	05:00-05:15	48	0	48	11:00-11:15	15	0	15
05:15-05:30	35	0	35	11:15-11:30	67	0	67	05:15-05:30	55	0	55	11:15-11:30	23	0	23
05:30-05:45	50	0	50	11:30-11:45	64	0	64	05:30-05:45	54	0	54	11:30-11:45	14	0	14
05:45-06:00	53	0	53	11:45-12:00	68	0	68	05:45-06:00	52	0	52	11:45-12:00	12	0	12

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:45 AM to 08:45 AM		
AM - PEAK HR VOLUME	336	0	336
AM - K FACTOR (%)			7.98
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:45 AM to 08:45 AM		
AM - PEAK HR VOLUME	336	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	03:00 PM to 04:00 PM		
PM - PEAK HR VOLUME	252	0	252
PM - K FACTOR (%)			5.98
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	03:00 PM to 04:00 PM		
PM - PEAK HR VOLUME	252	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:45 AM to 08:45 AM		
AM - PEAK HR VOLUME	336	0	336
AM - K FACTOR (%)			7.98
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	12:15 PM to 01:15 PM		
PM - PEAK HR VOLUME	289	0	289
PM - K FACTOR (%)			6.86
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	12:15 PM to 01:15 PM		
PEAK HR VOLUME	289	0	289
DIRECTIONAL PEAK			
PEAK HR TIME	12:15 PM to 01:15 PM		
PEAK HR VOLUME	289	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	1,571	0	1,571
AM 12-HR PERIOD (00:00-12:00)	1,992	0	1,992
PM 6-HR PERIOD (12:00-18:00)	1,469	0	1,469
PM 12-HR PERIOD (12:00-24:00)	2,220	0	2,220
24 HOUR PERIOD	4,212	0	4,212
D (%)	100.00	0.00	100.00

Run Date: 2010/07/21

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72000H1-20E
Town: Oahu
Final AADT: 5700
Functional Class: URBAN:PRINCIPAL ARTERIAL - INTERSTATE
Count Type: VOLUME
Route No: H-1
Location: ON RAMP, KALIHI STREET SB TO H-1 WB
Counter Type: Tube
DIR 1: -MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/08/2009															
12:00-12:15	18	0	18	06:00-06:15	185	0	185	12:00-12:15	109	0	109	06:00-06:15	135	0	135
12:15-12:30	17	0	17	06:15-06:30	183	0	183	12:15-12:30	115	0	115	06:15-06:30	162	0	162
12:30-12:45	13	0	13	06:30-06:45	185	0	185	12:30-12:45	153	0	153	06:30-06:45	184	0	184
12:45-01:00	15	0	15	06:45-07:00	189	0	189	12:45-01:00	106	0	106	06:45-07:00	151	0	151
01:00-01:15	14	0	14	07:00-07:15	161	0	161	01:00-01:15	134	0	134	07:00-07:15	138	0	138
01:15-01:30	18	0	18	07:15-07:30	173	0	173	01:15-01:30	145	0	145	07:15-07:30	119	0	119
01:30-01:45	9	0	9	07:30-07:45	116	0	116	01:30-01:45	123	0	123	07:30-07:45	78	0	78
01:45-02:00	2	0	2	07:45-08:00	157	0	157	01:45-02:00	128	0	128	07:45-08:00	83	0	83
02:00-02:15	14	0	14	08:00-08:15	145	0	145	02:00-02:15	121	0	121	08:00-08:15	122	0	122
02:15-02:30	14	0	14	08:15-08:30	138	0	138	02:15-02:30	121	0	121	08:15-08:30	72	0	72
02:30-02:45	7	0	7	08:30-08:45	139	0	139	02:30-02:45	137	0	137	08:30-08:45	102	0	102
02:45-03:00	8	0	8	08:45-09:00	127	0	127	02:45-03:00	157	0	157	08:45-09:00	89	0	89
03:00-03:15	12	0	12	09:00-09:15	111	0	111	03:00-03:15	153	0	153	09:00-09:15	84	0	84
03:15-03:30	22	0	22	09:15-09:30	103	0	103	03:15-03:30	154	0	154	09:15-09:30	80	0	80
03:30-03:45	22	0	22	09:30-09:45	113	0	113	03:30-03:45	129	0	129	09:30-09:45	62	0	62
03:45-04:00	30	0	30	09:45-10:00	121	0	121	03:45-04:00	164	0	164	09:45-10:00	66	0	66
04:00-04:15	34	0	34	10:00-10:15	107	0	107	04:00-04:15	127	0	127	10:00-10:15	54	0	54
04:15-04:30	51	0	51	10:15-10:30	126	0	126	04:15-04:30	134	0	134	10:15-10:30	38	0	38
04:30-04:45	62	0	62	10:30-10:45	95	0	95	04:30-04:45	132	0	132	10:30-10:45	41	0	41
04:45-05:00	77	0	77	10:45-11:00	118	0	118	04:45-05:00	124	0	124	10:45-11:00	41	0	41
05:00-05:15	97	0	97	11:00-11:15	130	0	130	05:00-05:15	128	0	128	11:00-11:15	29	0	29
05:15-05:30	117	0	117	11:15-11:30	131	0	131	05:15-05:30	126	0	126	11:15-11:30	32	0	32
05:30-05:45	176	0	176	11:30-11:45	118	0	118	05:30-05:45	119	0	119	11:30-11:45	30	0	30
05:45-06:00	178	0	178	11:45-12:00	104	0	104	05:45-06:00	124	0	124	11:45-12:00	17	0	17

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	06:00 AM to 07:00 AM		
AM - PEAK HR VOLUME	742	0	742
AM - K FACTOR (%)			7.83
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	06:00 AM to 07:00 AM		
AM - PEAK HR VOLUME	742	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	06:00 PM to 07:00 PM		
PM - PEAK HR VOLUME	632	0	632
PM - K FACTOR (%)			6.67
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	06:00 PM to 07:00 PM		
PM - PEAK HR VOLUME	632	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	06:00 AM to 07:00 AM		
AM - PEAK HR VOLUME	742	0	742
AM - K FACTOR (%)			7.83
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	06:15 PM to 07:15 PM		
PM - PEAK HR VOLUME	635	0	635
PM - K FACTOR (%)			6.70
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	12:30 PM to 01:30 PM		
PEAK HR VOLUME	538	0	538
DIRECTIONAL PEAK			
PEAK HR TIME	12:30 PM to 01:30 PM		
PEAK HR VOLUME	538	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	3,275	0	3,275
AM 12-HR PERIOD (00:00-12:00)	4,302	0	4,302
PM 6-HR PERIOD (12:00-18:00)	3,163	0	3,163
PM 12-HR PERIOD (12:00-24:00)	5,172	0	5,172
24 HOUR PERIOD	9,474	0	9,474
D (%)	100.00	0.00	100.00

Run Date: 2010/07/21

Hawaii Department of Transportation

Highways Division — Highways Planning Survey Section

2009 Program Count - Summary

Site ID: B72000H1-20F
Town: Oahu
Final AADT: 8000
Functional Class: URBAN:PRINCIPAL ARTERIAL - INTERSTATE
Count Type: VOLUME
Route No: H-1
Location: OFF RAMP, H-1 WB TO KALIHI STREET NB
Counter Type: Tube
DIR 1: -MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/08/2009															
12:00-12:15	58	0	58	06:00-06:15	81	0	81	12:00-12:15	171	0	171	06:00-06:15	346	0	346
12:15-12:30	56	0	56	06:15-06:30	95	0	95	12:15-12:30	152	0	152	06:15-06:30	259	0	259
12:30-12:45	43	0	43	~~06:30-06:45~~	108	0	108	12:30-12:45	160	0	160	06:30-06:45	274	0	274
12:45-01:00	33	0	33	06:45-07:00	122	0	122	12:45-01:00	139	0	139	06:45-07:00	280	0	280
01:00-01:15	40	0	40	07:00-07:15	128	0	128	01:00-01:15	146	0	146	07:00-07:15	211	0	211
01:15-01:30	26	0	26	07:15-07:30	137	0	137	01:15-01:30	141	0	141	07:15-07:30	212	0	212
01:30-01:45	35	0	35	07:30-07:45	128	0	128	01:30-01:45	169	0	169	07:30-07:45	165	0	165
01:45-02:00	28	0	28	07:45-08:00	122	0	122	01:45-02:00	200	0	200	07:45-08:00	179	0	179
02:00-02:15	27	0	27	08:00-08:15	129	0	129	02:00-02:15	205	0	205	08:00-08:15	167	0	167
02:15-02:30	26	0	26	08:15-08:30	148	0	148	02:15-02:30	243	0	243	08:15-08:30	193	0	193
02:30-02:45	19	0	19	08:30-08:45	137	0	137	02:30-02:45	202	0	202	08:30-08:45	178	0	178
02:45-03:00	17	0	17	08:45-09:00	139	0	139	02:45-03:00	239	0	239	08:45-09:00	168	0	168
03:00-03:15	17	0	17	09:00-09:15	123	0	123	03:00-03:15	215	0	215	09:00-09:15	174	0	174
03:15-03:30	18	0	18	09:15-09:30	132	0	132	03:15-03:30	224	0	224	09:15-09:30	200	0	200
03:30-03:45	15	0	15	09:30-09:45	136	0	136	03:30-03:45	221	0	221	09:30-09:45	166	0	166
03:45-04:00	27	0	27	09:45-10:00	131	0	131	03:45-04:00	206	0	206	09:45-10:00	161	0	161
04:00-04:15	25	0	25	10:00-10:15	135	0	135	04:00-04:15	262	0	262	10:00-10:15	141	0	141
04:15-04:30	24	0	24	10:15-10:30	127	0	127	04:15-04:30	234	0	234	10:15-10:30	125	0	125
04:30-04:45	19	0	19	10:30-10:45	133	0	133	04:30-04:45	292	0	292	10:30-10:45	106	0	106
04:45-05:00	31	0	31	10:45-11:00	156	0	156	04:45-05:00	321	0	321	10:45-11:00	96	0	96
05:00-05:15	36	0	36	11:00-11:15	146	0	146	~~05:00-05:15~~	347	0	347	11:00-11:15	91	0	91
05:15-05:30	36	0	36	11:15-11:30	126	0	126	05:15-05:30	355	0	355	11:15-11:30	91	0	91
05:30-05:45	59	0	59	11:30-11:45	130	0	130	05:30-05:45	461	0	461	11:30-11:45	74	0	74
05:45-06:00	62	0	62	11:45-12:00	140	0	140	05:45-06:00	323	0	323	11:45-12:00	51	0	51

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	08:00 AM to 09:00 AM		
AM - PEAK HR VOLUME	553	0	553
AM - K FACTOR (%)			4.07
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	08:00 AM to 09:00 AM		
AM - PEAK HR VOLUME	553	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	05:00 PM to 06:00 PM		
PM - PEAK HR VOLUME	1486	0	1486
PM - K FACTOR (%)			10.92
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	05:00 PM to 06:00 PM		
PM - PEAK HR VOLUME	1486	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	10:15 AM to 11:15 AM		
AM - PEAK HR VOLUME	562	0	562
AM - K FACTOR (%)			4.13
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	05:00 PM to 06:00 PM		
PM - PEAK HR VOLUME	1486	0	1486
PM - K FACTOR (%)			10.92
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	889	0	889
DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	889	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	3,089	0	3,089
AM 12-HR PERIOD (00:00-12:00)	3,866	0	3,866
PM 6-HR PERIOD (12:00-18:00)	5,628	0	5,628
PM 12-HR PERIOD (12:00-24:00)	9,736	0	9,736
24 HOUR PERIOD	13,602	0	13,602
D (%)	100.00	0.00	100.00

Run Date: 2010/07/20

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72000H1-20H
Town: Oahu
Final AADT: 6900
Functional Class: OTHER
Count Type: VOLUME
Route No: H-1
Location: OFF RAMP, H-1 WB TO HALONA STREET
Counter Type: Tube
DIR 1: -MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/08/2009															
12:00-12:15	53	0	53	06:00-06:15	174	0	174	12:00-12:15	118	0	118	06:00-06:15	164	0	164
12:15-12:30	49	0	49	06:15-06:30	261	0	261	12:15-12:30	124	0	124	06:15-06:30	165	0	165
12:30-12:45	35	0	35	06:30-06:45	252	0	252	12:30-12:45	134	0	134	06:30-06:45	163	0	163
12:45-01:00	26	0	26	06:45-07:00	274	0	274	12:45-01:00	142	0	142	06:45-07:00	200	0	200
01:00-01:15	27	0	27	07:00-07:15	282	0	282	01:00-01:15	126	0	126	07:00-07:15	150	0	150
01:15-01:30	14	0	14	07:15-07:30	237	0	237	01:15-01:30	114	0	114	07:15-07:30	140	0	140
01:30-01:45	14	0	14	07:30-07:45	216	0	216	01:30-01:45	117	0	117	07:30-07:45	124	0	124
01:45-02:00	26	0	26	07:45-08:00	226	0	226	01:45-02:00	132	0	132	07:45-08:00	119	0	119
02:00-02:15	28	0	28	08:00-08:15	193	0	193	02:00-02:15	138	0	138	08:00-08:15	126	0	126
02:15-02:30	15	0	15	08:15-08:30	161	0	161	02:15-02:30	157	0	157	08:15-08:30	118	0	118
02:30-02:45	28	0	28	08:30-08:45	173	0	173	02:30-02:45	169	0	169	08:30-08:45	114	0	114
02:45-03:00	29	0	29	08:45-09:00	157	0	157	02:45-03:00	179	0	179	08:45-09:00	99	0	99
03:00-03:15	19	0	19	09:00-09:15	152	0	152	03:00-03:15	130	0	130	09:00-09:15	107	0	107
03:15-03:30	21	0	21	09:15-09:30	143	0	143	03:15-03:30	138	0	138	09:15-09:30	88	0	88
03:30-03:45	21	0	21	09:30-09:45	152	0	152	03:30-03:45	136	0	136	09:30-09:45	130	0	130
03:45-04:00	36	0	36	09:45-10:00	125	0	125	03:45-04:00	146	0	146	09:45-10:00	105	0	105
04:00-04:15	35	0	35	10:00-10:15	158	0	158	04:00-04:15	133	0	133	10:00-10:15	106	0	106
04:15-04:30	44	0	44	10:15-10:30	151	0	151	04:15-04:30	142	0	142	10:15-10:30	81	0	81
04:30-04:45	58	0	58	10:30-10:45	139	0	139	04:30-04:45	171	0	171	10:30-10:45	95	0	95
04:45-05:00	49	0	49	10:45-11:00	138	0	138	04:45-05:00	130	0	130	10:45-11:00	64	0	64
05:00-05:15	72	0	72	11:00-11:15	118	0	118	05:00-05:15	118	0	118	11:00-11:15	65	0	65
05:15-05:30	96	0	96	11:15-11:30	102	0	102	05:15-05:30	149	0	149	11:15-11:30	55	0	55
05:30-05:45	123	0	123	11:30-11:45	130	0	130	05:30-05:45	164	0	164	11:30-11:45	72	0	72
05:45-06:00	149	0	149	11:45-12:00	123	0	123	05:45-06:00	172	0	172	11:45-12:00	53	0	53

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	06:15 AM to 07:15 AM		
AM - PEAK HR VOLUME	1069	0	1069
AM - K FACTOR (%)			9.39
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	06:15 AM to 07:15 AM		
AM - PEAK HR VOLUME	1069	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	06:00 PM to 07:00 PM		
PM - PEAK HR VOLUME	692	0	692
PM - K FACTOR (%)			6.08
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	06:00 PM to 07:00 PM		
PM - PEAK HR VOLUME	692	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	06:15 AM to 07:15 AM		
AM - PEAK HR VOLUME	1069	0	1069
AM - K FACTOR (%)			9.39
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	06:00 PM to 07:00 PM		
PM - PEAK HR VOLUME	692	0	692
PM - K FACTOR (%)			6.08
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	643	0	643
DIRECTIONAL PEAK			
PEAK HR TIME	02:00 PM to 03:00 PM		
PEAK HR VOLUME	643	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	4,237	0	4,237
AM 12-HR PERIOD (00:00-12:00)	5,304	0	5,304
PM 6-HR PERIOD (12:00-18:00)	3,379	0	3,379
PM 12-HR PERIOD (12:00-24:00)	6,082	0	6,082
24 HOUR PERIOD	11,386	0	11,386
D (%)	100.00	0.00	100.00

Run Date: 2010/07/20

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72000H1-20J
Town: Oahu
Final AADT: 14200
Functional Class: OTHER
Count Type: VOLUME
Route No: H-1
Location: ON RAMP, HALONA STREET TO H-1 WB (loop s
Counter Type: Tube
DIR 1: -MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/08/2009															
12:00-12:15	38	0	38	06:00-06:15	304	0	304	12:00-12:15	331	0	331	06:00-06:15	275	0	275
12:15-12:30	44	0	44	06:15-06:30	326	0	326	12:15-12:30	391	0	391	06:15-06:30	241	0	241
12:30-12:45	25	0	25	06:30-06:45	347	0	347	12:30-12:45	345	0	345	06:30-06:45	283	0	283
12:45-01:00	22	0	22	06:45-07:00	389	0	389	12:45-01:00	383	0	383	06:45-07:00	234	0	234
01:00-01:15	17	0	17	07:00-07:15	422	0	422	01:00-01:15	374	0	374	07:00-07:15	217	0	217
01:15-01:30	15	0	15	07:15-07:30	493	0	493	01:15-01:30	354	0	354	07:15-07:30	210	0	210
01:30-01:45	15	0	15	07:30-07:45	440	0	440	01:30-01:45	352	0	352	07:30-07:45	180	0	180
01:45-02:00	14	0	14	07:45-08:00	476	0	476	01:45-02:00	359	0	359	07:45-08:00	175	0	175
02:00-02:15	9	0	9	08:00-08:15	407	0	407	02:00-02:15	326	0	326	08:00-08:15	147	0	147
02:15-02:30	13	0	13	08:15-08:30	414	0	414	02:15-02:30	310	0	310	08:15-08:30	184	0	184
02:30-02:45	8	0	8	08:30-08:45	358	0	358	02:30-02:45	327	0	327	08:30-08:45	179	0	179
02:45-03:00	14	0	14	08:45-09:00	315	0	315	02:45-03:00	364	0	364	08:45-09:00	151	0	151
03:00-03:15	11	0	11	09:00-09:15	310	0	310	03:00-03:15	367	0	367	09:00-09:15	176	0	176
03:15-03:30	32	0	32	09:15-09:30	301	0	301	03:15-03:30	396	0	396	09:15-09:30	153	0	153
03:30-03:45	19	0	19	09:30-09:45	340	0	340	03:30-03:45	379	0	379	09:30-09:45	112	0	112
03:45-04:00	27	0	27	09:45-10:00	351	0	351	03:45-04:00	414	0	414	09:45-10:00	112	0	112
04:00-04:15	23	0	23	10:00-10:15	320	0	320	04:00-04:15	432	0	432	10:00-10:15	99	0	99
04:15-04:30	37	0	37	10:15-10:30	304	0	304	04:15-04:30	355	0	355	10:15-10:30	92	0	92
04:30-04:45	70	0	70	10:30-10:45	320	0	320	04:30-04:45	398	0	398	10:30-10:45	72	0	72
04:45-05:00	101	0	101	10:45-11:00	312	0	312	04:45-05:00	408	0	408	10:45-11:00	67	0	67
05:00-05:15	120	0	120	11:00-11:15	338	0	338	05:00-05:15	386	0	386	11:00-11:15	60	0	60
05:15-05:30	156	0	156	11:15-11:30	375	0	375	05:15-05:30	393	0	393	11:15-11:30	55	0	55
05:30-05:45	203	0	203	11:30-11:45	328	0	328	05:30-05:45	424	0	424	11:30-11:45	79	0	79
05:45-06:00	295	0	295	11:45-12:00	302	0	302	05:45-06:00	319	0	319	11:45-12:00	44	0	44

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM		
AM - PEAK HR VOLUME	1831	0	1831
AM - K FACTOR (%)			8.17
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM		
AM - PEAK HR VOLUME	1831	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	03:15 PM to 04:15 PM		
PM - PEAK HR VOLUME	1621	0	1621
PM - K FACTOR (%)			7.24
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	03:15 PM to 04:15 PM		
PM - PEAK HR VOLUME	1621	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM		
AM - PEAK HR VOLUME	1831	0	1831
AM - K FACTOR (%)			8.17
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	03:15 PM to 04:15 PM		
PM - PEAK HR VOLUME	1621	0	1621
PM - K FACTOR (%)			7.24
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	12:15 PM to 01:15 PM		
PEAK HR VOLUME	1493	0	1493
DIRECTIONAL PEAK			
PEAK HR TIME	12:15 PM to 01:15 PM		
PEAK HR VOLUME	1493	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	8,592	0	8,592
AM 12-HR PERIOD (00:00-12:00)	9,920	0	9,920
PM 6-HR PERIOD (12:00-18:00)	8,887	0	8,887
PM 12-HR PERIOD (12:00-24:00)	12,484	0	12,484
24 HOUR PERIOD	22,404	0	22,404
D (%)	100.00	0.00	100.00

Run Date: 2010/07/20

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72000H1-20P
Town: Oahu
Final AADT: 1700
Functional Class: URBAN:PRINCIPAL ARTERIAL - INTERSTATE
Count Type: VOLUME
Route No: H-1
Location: OFF RAMP, H-1 WB TO PALAMA STREET
Counter Type: Tube
DIR 1: -MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/08/2009															
12:00-12:15	13	0	13	06:00-06:15	21	0	21	12:00-12:15	50	0	50	06:00-06:15	41	0	41
12:15-12:30	12	0	12	06:15-06:30	22	0	22	12:15-12:30	62	0	62	06:15-06:30	41	0	41
12:30-12:45	5	0	5	06:30-06:45	32	0	32	12:30-12:45	52	0	52	06:30-06:45	48	0	48
12:45-01:00	10	0	10	06:45-07:00	36	0	36	12:45-01:00	54	0	54	06:45-07:00	42	0	42
01:00-01:15	10	0	10	07:00-07:15	29	0	29	01:00-01:15	54	0	54	07:00-07:15	29	0	29
01:15-01:30	4	0	4	07:15-07:30	36	0	36	01:15-01:30	40	0	40	07:15-07:30	48	0	48
01:30-01:45	4	0	4	07:30-07:45	28	0	28	01:30-01:45	40	0	40	07:30-07:45	35	0	35
01:45-02:00	6	0	6	07:45-08:00	43	0	43	01:45-02:00	34	0	34	07:45-08:00	39	0	39
02:00-02:15	9	0	9	08:00-08:15	31	0	31	02:00-02:15	33	0	33	08:00-08:15	27	0	27
02:15-02:30	2	0	2	08:15-08:30	27	0	27	02:15-02:30	60	0	60	08:15-08:30	28	0	28
02:30-02:45	6	0	6	08:30-08:45	45	0	45	02:30-02:45	47	0	47	08:30-08:45	30	0	30
02:45-03:00	7	0	7	08:45-09:00	36	0	36	02:45-03:00	45	0	45	08:45-09:00	35	0	35
03:00-03:15	5	0	5	09:00-09:15	21	0	21	03:00-03:15	40	0	40	09:00-09:15	22	0	22
03:15-03:30	8	0	8	09:15-09:30	24	0	24	03:15-03:30	30	0	30	09:15-09:30	32	0	32
03:30-03:45	9	0	9	09:30-09:45	40	0	40	03:30-03:45	43	0	43	09:30-09:45	31	0	31
03:45-04:00	9	0	9	09:45-10:00	51	0	51	03:45-04:00	43	0	43	09:45-10:00	21	0	21
04:00-04:15	8	0	8	10:00-10:15	48	0	48	04:00-04:15	38	0	38	10:00-10:15	41	0	41
04:15-04:30	8	0	8	10:15-10:30	42	0	42	04:15-04:30	26	0	26	10:15-10:30	35	0	35
04:30-04:45	11	0	11	10:30-10:45	48	0	48	04:30-04:45	36	0	36	10:30-10:45	33	0	33
04:45-05:00	12	0	12	10:45-11:00	50	0	50	04:45-05:00	34	0	34	10:45-11:00	24	0	24
05:00-05:15	11	0	11	11:00-11:15	44	0	44	05:00-05:15	35	0	35	11:00-11:15	26	0	26
05:15-05:30	12	0	12	11:15-11:30	51	0	51	05:15-05:30	38	0	38	11:15-11:30	17	0	17
05:30-05:45	14	0	14	11:30-11:45	59	0	59	05:30-05:45	46	0	46	11:30-11:45	20	0	20
05:45-06:00	17	0	17	11:45-12:00	51	0	51	05:45-06:00	38	0	38	11:45-12:00	16	0	16

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:45 AM to 08:45 AM		
AM - PEAK HR VOLUME	146	0	146
AM - K FACTOR (%)			5.02
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:45 AM to 08:45 AM		
AM - PEAK HR VOLUME	146	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	06:00 PM to 07:00 PM		
PM - PEAK HR VOLUME	172	0	172
PM - K FACTOR (%)			5.92
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	06:00 PM to 07:00 PM		
PM - PEAK HR VOLUME	172	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	11:00 AM to 12:00 PM		
AM - PEAK HR VOLUME	205	0	205
AM - K FACTOR (%)			7.05
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	12:15 PM to 01:15 PM		
PM - PEAK HR VOLUME	222	0	222
PM - K FACTOR (%)			7.64
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	11:30 AM to 12:30 PM		
PEAK HR VOLUME	222	0	222
DIRECTIONAL PEAK			
PEAK HR TIME	11:30 AM to 12:30 PM		
PEAK HR VOLUME	222	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	915	0	915
AM 12-HR PERIOD (00:00-12:00)	1,127	0	1,127
PM 6-HR PERIOD (12:00-18:00)	1,018	0	1,018
PM 12-HR PERIOD (12:00-24:00)	1,779	0	1,779
24 HOUR PERIOD	2,906	0	2,906
D (%)	100.00	0.00	100.00

Run Date: 2010/07/20

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72000H1-20S
Town: Oahu
Final AADT: 5300
Functional Class: OTHER
Count Type: VOLUME
Route No: H-1
Location: OFF RAMP, H-1 WB TO SCHOOL STREET
Counter Type: Tube
DIR 1: -MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/08/2009															
12:00-12:15	21	0	21	06:00-06:15	71	0	71	12:00-12:15	129	0	129	06:00-06:15	80	0	80
12:15-12:30	28	0	28	06:15-06:30	76	0	76	12:15-12:30	108	0	108	06:15-06:30	93	0	93
12:30-12:45	12	0	12	06:30-06:45	81	0	81	12:30-12:45	114	0	114	06:30-06:45	96	0	96
12:45-01:00	13	0	13	06:45-07:00	75	0	75	12:45-01:00	93	0	93	06:45-07:00	98	0	98
01:00-01:15	11	0	11	07:00-07:15	83	0	83	01:00-01:15	117	0	117	07:00-07:15	90	0	90
01:15-01:30	13	0	13	07:15-07:30	96	0	96	01:15-01:30	109	0	109	07:15-07:30	79	0	79
01:30-01:45	11	0	11	07:30-07:45	94	0	94	01:30-01:45	110	0	110	07:30-07:45	88	0	88
01:45-02:00	4	0	4	07:45-08:00	102	0	102	01:45-02:00	134	0	134	07:45-08:00	65	0	65
02:00-02:15	6	0	6	08:00-08:15	110	0	110	02:00-02:15	111	0	111	08:00-08:15	65	0	65
02:15-02:30	8	0	8	08:15-08:30	128	0	128	02:15-02:30	98	0	98	08:15-08:30	71	0	71
02:30-02:45	7	0	7	08:30-08:45	116	0	116	02:30-02:45	104	0	104	08:30-08:45	61	0	61
02:45-03:00	7	0	7	08:45-09:00	135	0	135	02:45-03:00	111	0	111	08:45-09:00	43	0	43
03:00-03:15	3	0	3	09:00-09:15	111	0	111	03:00-03:15	94	0	94	09:00-09:15	63	0	63
03:15-03:30	6	0	6	09:15-09:30	121	0	121	03:15-03:30	101	0	101	09:15-09:30	60	0	60
03:30-03:45	6	0	6	09:30-09:45	130	0	130	03:30-03:45	72	0	72	09:30-09:45	47	0	47
03:45-04:00	16	0	16	09:45-10:00	145	0	145	03:45-04:00	64	0	64	09:45-10:00	43	0	43
04:00-04:15	15	0	15	10:00-10:15	133	0	133	04:00-04:15	88	0	88	10:00-10:15	34	0	34
04:15-04:30	16	0	16	10:15-10:30	140	0	140	04:15-04:30	69	0	69	10:15-10:30	30	0	30
04:30-04:45	18	0	18	10:30-10:45	127	0	127	04:30-04:45	66	0	66	10:30-10:45	36	0	36
04:45-05:00	27	0	27	10:45-11:00	138	0	138	04:45-05:00	104	0	104	10:45-11:00	27	0	27
05:00-05:15	25	0	25	11:00-11:15	122	0	122	05:00-05:15	93	0	93	11:00-11:15	21	0	21
05:15-05:30	43	0	43	11:15-11:30	139	0	139	05:15-05:30	93	0	93	11:15-11:30	37	0	37
05:30-05:45	37	0	37	11:30-11:45	110	0	110	05:30-05:45	85	0	85	11:30-11:45	20	0	20
05:45-06:00	42	0	42	11:45-12:00	115	0	115	05:45-06:00	89	0	89	11:45-12:00	27	0	27

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	08:00 AM to 09:00 AM		
AM - PEAK HR VOLUME	489	0	489
AM - K FACTOR (%)			7.17
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	08:00 AM to 09:00 AM		
AM - PEAK HR VOLUME	489	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:45 PM to 05:45 PM		
PM - PEAK HR VOLUME	375	0	375
PM - K FACTOR (%)			5.50
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:45 PM to 05:45 PM		
PM - PEAK HR VOLUME	375	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	09:30 AM to 10:30 AM		
AM - PEAK HR VOLUME	548	0	548
AM - K FACTOR (%)			8.03
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	01:00 PM to 02:00 PM		
PM - PEAK HR VOLUME	470	0	470
PM - K FACTOR (%)			6.89
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	09:30 AM to 10:30 AM		
PEAK HR VOLUME	548	0	548
DIRECTIONAL PEAK			
PEAK HR TIME	09:30 AM to 10:30 AM		
PEAK HR VOLUME	548	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	2,698	0	2,698
AM 12-HR PERIOD (00:00-12:00)	3,093	0	3,093
PM 6-HR PERIOD (12:00-18:00)	2,356	0	2,356
PM 12-HR PERIOD (12:00-24:00)	3,730	0	3,730
24 HOUR PERIOD	6,823	0	6,823
D (%)	100.00	0.00	100.00

Run Date: 2010/07/21

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72000H1-21D
Town: Oahu
Final AADT: 11200
Functional Class: URBAN:PRINCIPAL ARTERIAL - INTERSTATE
Count Type: VOLUME
Route No: H-1
Location: ON RAMP, PUNCH BOWL STREET TO H-1 WB
Counter Type: Tube
DIR 1: -MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/08/2009															
12:00-12:15	40	0	40	06:00-06:15	269	0	269	12:00-12:15	213	0	213	06:00-06:15	271	0	271
12:15-12:30	35	0	35	06:15-06:30	291	0	291	12:15-12:30	218	0	218	06:15-06:30	307	0	307
12:30-12:45	37	0	37	06:30-06:45	327	0	327	12:30-12:45	251	0	251	06:30-06:45	192	0	192
12:45-01:00	22	0	22	06:45-07:00	349	0	349	12:45-01:00	203	0	203	06:45-07:00	237	0	237
01:00-01:15	21	0	21	07:00-07:15	360	0	360	01:00-01:15	228	0	228	07:00-07:15	217	0	217
01:15-01:30	18	0	18	07:15-07:30	375	0	375	01:15-01:30	194	0	194	07:15-07:30	208	0	208
01:30-01:45	23	0	23	07:30-07:45	324	0	324	01:30-01:45	206	0	206	07:30-07:45	183	0	183
01:45-02:00	25	0	25	07:45-08:00	372	0	372	01:45-02:00	219	0	219	07:45-08:00	161	0	161
02:00-02:15	20	0	20	08:00-08:15	366	0	366	02:00-02:15	246	0	246	08:00-08:15	199	0	199
02:15-02:30	24	0	24	08:15-08:30	389	0	389	02:15-02:30	259	0	259	08:15-08:30	142	0	142
02:30-02:45	14	0	14	08:30-08:45	383	0	383	02:30-02:45	184	0	184	08:30-08:45	155	0	155
02:45-03:00	11	0	11	08:45-09:00	333	0	333	02:45-03:00	282	0	282	08:45-09:00	150	0	150
03:00-03:15	8	0	8	09:00-09:15	305	0	305	03:00-03:15	290	0	290	09:00-09:15	160	0	160
03:15-03:30	22	0	22	09:15-09:30	297	0	297	03:15-03:30	343	0	343	09:15-09:30	156	0	156
03:30-03:45	9	0	9	09:30-09:45	248	0	248	03:30-03:45	460	0	460	09:30-09:45	148	0	148
03:45-04:00	14	0	14	09:45-10:00	221	0	221	03:45-04:00	410	0	410	09:45-10:00	134	0	134
04:00-04:15	27	0	27	10:00-10:15	197	0	197	04:00-04:15	414	0	414	10:00-10:15	123	0	123
04:15-04:30	25	0	25	10:15-10:30	202	0	202	04:15-04:30	478	0	478	10:15-10:30	74	0	74
04:30-04:45	41	0	41	10:30-10:45	204	0	204	04:30-04:45	490	0	490	10:30-10:45	88	0	88
04:45-05:00	29	0	29	10:45-11:00	193	0	193	04:45-05:00	429	0	429	10:45-11:00	74	0	74
05:00-05:15	49	0	49	11:00-11:15	197	0	197	05:00-05:15	494	0	494	11:00-11:15	100	0	100
05:15-05:30	55	0	55	11:15-11:30	202	0	202	05:15-05:30	473	0	473	11:15-11:30	67	0	67
05:30-05:45	121	0	121	11:30-11:45	206	0	206	05:30-05:45	477	0	477	11:30-11:45	96	0	96
05:45-06:00	181	0	181	11:45-12:00	197	0	197	05:45-06:00	296	0	296	11:45-12:00	62	0	62

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:45 AM to 08:45 AM		
AM - PEAK HR VOLUME	1510	0	1510
AM - K FACTOR (%)			7.89
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:45 AM to 08:45 AM		
AM - PEAK HR VOLUME	1510	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:15 PM to 05:15 PM		
PM - PEAK HR VOLUME	1891	0	1891
PM - K FACTOR (%)			9.88
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:15 PM to 05:15 PM		
PM - PEAK HR VOLUME	1891	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:45 AM to 08:45 AM		
AM - PEAK HR VOLUME	1510	0	1510
AM - K FACTOR (%)			7.89
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	04:15 PM to 05:15 PM		
PM - PEAK HR VOLUME	1891	0	1891
PM - K FACTOR (%)			9.88
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	09:00 AM to 10:00 AM		
PEAK HR VOLUME	1071	0	1071
DIRECTIONAL PEAK			
PEAK HR TIME	09:00 AM to 10:00 AM		
PEAK HR VOLUME	1071	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	6,807	0	6,807
AM 12-HR PERIOD (00:00-12:00)	7,678	0	7,678
PM 6-HR PERIOD (12:00-18:00)	7,757	0	7,757
PM 12-HR PERIOD (12:00-24:00)	11,461	0	11,461
24 HOUR PERIOD	19,139	0	19,139
D (%)	100.00	0.00	100.00

Run Date: 2010/07/21

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72000H1-21E
Town: Oahu
Final AADT: 7900
Functional Class: URBAN:PRINCIPAL ARTERIAL - INTERSTATE
Count Type: VOLUME
Route No: H-1
Location: OFF RAMP, H-1 WB TO PALI HIGHWAY NB
Counter Type: Tube
DIR 1: -MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 12/08/2009															
12:00-12:15	44	0	44	06:00-06:15	94	0	94	12:00-12:15	176	0	176	06:00-06:15	240	0	240
12:15-12:30	43	0	43	06:15-06:30	119	0	119	12:15-12:30	179	0	179	06:15-06:30	276	0	276
12:30-12:45	29	0	29	06:30-06:45	125	0	125	12:30-12:45	152	0	152	06:30-06:45	269	0	269
12:45-01:00	32	0	32	06:45-07:00	138	0	138	12:45-01:00	173	0	173	06:45-07:00	278	0	278
01:00-01:15	27	0	27	07:00-07:15	190	0	190	01:00-01:15	172	0	172	07:00-07:15	218	0	218
01:15-01:30	28	0	28	07:15-07:30	182	0	182	01:15-01:30	184	0	184	07:15-07:30	209	0	209
01:30-01:45	25	0	25	07:30-07:45	184	0	184	01:30-01:45	227	0	227	07:30-07:45	203	0	203
01:45-02:00	27	0	27	07:45-08:00	151	0	151	01:45-02:00	221	0	221	07:45-08:00	192	0	192
02:00-02:15	34	0	34	08:00-08:15	114	0	114	02:00-02:15	221	0	221	08:00-08:15	159	0	159
02:15-02:30	22	0	22	08:15-08:30	123	0	123	02:15-02:30	247	0	247	08:15-08:30	188	0	188
02:30-02:45	9	0	9	08:30-08:45	124	0	124	02:30-02:45	214	0	214	08:30-08:45	165	0	165
02:45-03:00	16	0	16	08:45-09:00	124	0	124	02:45-03:00	225	0	225	08:45-09:00	189	0	189
03:00-03:15	24	0	24	09:00-09:15	117	0	117	03:00-03:15	209	0	209	09:00-09:15	173	0	173
03:15-03:30	13	0	13	09:15-09:30	123	0	123	03:15-03:30	211	0	211	09:15-09:30	194	0	194
03:30-03:45	14	0	14	09:30-09:45	137	0	137	03:30-03:45	224	0	224	09:30-09:45	155	0	155
03:45-04:00	13	0	13	09:45-10:00	147	0	147	03:45-04:00	213	0	213	09:45-10:00	142	0	142
04:00-04:15	17	0	17	10:00-10:15	156	0	156	04:00-04:15	213	0	213	10:00-10:15	128	0	128
04:15-04:30	21	0	21	10:15-10:30	167	0	167	04:15-04:30	240	0	240	10:15-10:30	119	0	119
04:30-04:45	17	0	17	10:30-10:45	168	0	168	04:30-04:45	239	0	239	10:30-10:45	116	0	116
04:45-05:00	29	0	29	10:45-11:00	189	0	189	04:45-05:00	258	0	258	10:45-11:00	85	0	85
05:00-05:15	41	0	41	11:00-11:15	168	0	168	05:00-05:15	273	0	273	11:00-11:15	74	0	74
05:15-05:30	54	0	54	11:15-11:30	157	0	157	05:15-05:30	293	0	293	11:15-11:30	89	0	89
05:30-05:45	67	0	67	11:30-11:45	177	0	177	05:30-05:45	272	0	272	11:30-11:45	56	0	56
05:45-06:00	68	0	68	11:45-12:00	162	0	162	05:45-06:00	288	0	288	11:45-12:00	55	0	55

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM		
AM - PEAK HR VOLUME	707	0	707
AM - K FACTOR (%)			5.22
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM		
AM - PEAK HR VOLUME	707	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	05:00 PM to 06:00 PM		
PM - PEAK HR VOLUME	1126	0	1126
PM - K FACTOR (%)			8.31
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	05:00 PM to 06:00 PM		
PM - PEAK HR VOLUME	1126	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:00 AM to 08:00 AM		
AM - PEAK HR VOLUME	707	0	707
AM - K FACTOR (%)			5.22
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	05:00 PM to 06:00 PM		
PM - PEAK HR VOLUME	1126	0	1126
PM - K FACTOR (%)			8.31
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	01:30 PM to 02:30 PM		
PEAK HR VOLUME	916	0	916
DIRECTIONAL PEAK			
PEAK HR TIME	01:30 PM to 02:30 PM		
PEAK HR VOLUME	916	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	3,536	0	3,536
AM 12-HR PERIOD (00:00-12:00)	4,250	0	4,250
PM 6-HR PERIOD (12:00-18:00)	5,324	0	5,324
PM 12-HR PERIOD (12:00-24:00)	9,296	0	9,296
24 HOUR PERIOD	13,546	0	13,546
D (%)	100.00	0.00	100.00

Run Date: 2010/05/24

Hawaii Department of Transportation
Highways Division — Highways Planning Survey Section
2009 Program Count - Summary

Site ID: B72000H1-22D
Town: Oahu
Final AADT: 0
Functional Class: URBAN:PRINCIPAL ARTERIAL - INTERSTATE
Count Type: VOLUME
Route No: H-1
Location: OFF RAMP, H-1 WB TO VINEYARD BLVD WB
Counter Type: Tube
DIR 1: -MP **DIR 2:** None

TIME-AM	DIR 1	DIR 2	TOTAL	TIME-AM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL	TIME-PM	DIR 1	DIR 2	TOTAL
DATE : 03/12/2009															
12:00-12:15	25	0	25	06:00-06:15	365	0	365	12:00-12:15	228	0	228	06:00-06:15	137	0	137
12:15-12:30	29	0	29	06:15-06:30	433	0	433	12:15-12:30	235	0	235	06:15-06:30	148	0	148
12:30-12:45	17	0	17	06:30-06:45	431	0	431	12:30-12:45	237	0	237	06:30-06:45	103	0	103
12:45-01:00	22	0	22	06:45-07:00	459	0	459	12:45-01:00	230	0	230	06:45-07:00	101	0	101
01:00-01:15	9	0	9	07:00-07:15	486	0	486	01:00-01:15	184	0	184	07:00-07:15	103	0	103
01:15-01:30	27	0	27	07:15-07:30	544	0	544	01:15-01:30	227	0	227	07:15-07:30	140	0	140
01:30-01:45	22	0	22	07:30-07:45	515	0	515	01:30-01:45	225	0	225	07:30-07:45	107	0	107
01:45-02:00	12	0	12	07:45-08:00	552	0	552	01:45-02:00	231	0	231	07:45-08:00	104	0	104
02:00-02:15	8	0	8	08:00-08:15	528	0	528	02:00-02:15	206	0	206	08:00-08:15	103	0	103
02:15-02:30	11	0	11	08:15-08:30	567	0	567	02:15-02:30	224	0	224	08:15-08:30	95	0	95
02:30-02:45	15	0	15	08:30-08:45	526	0	526	02:30-02:45	221	0	221	08:30-08:45	95	0	95
02:45-03:00	18	0	18	08:45-09:00	496	0	496	02:45-03:00	189	0	189	08:45-09:00	111	0	111
03:00-03:15	14	0	14	09:00-09:15	503	0	503	03:00-03:15	184	0	184	09:00-09:15	90	0	90
03:15-03:30	21	0	21	09:15-09:30	480	0	480	03:15-03:30	141	0	141	09:15-09:30	110	0	110
03:30-03:45	14	0	14	09:30-09:45	204	0	204	03:30-03:45	160	0	160	09:30-09:45	85	0	85
03:45-04:00	11	0	11	09:45-10:00	199	0	199	03:45-04:00	152	0	152	09:45-10:00	85	0	85
04:00-04:15	27	0	27	10:00-10:15	275	0	275	04:00-04:15	138	0	138	10:00-10:15	69	0	69
04:15-04:30	24	0	24	10:15-10:30	284	0	284	04:15-04:30	153	0	153	10:15-10:30	77	0	77
04:30-04:45	32	0	32	10:30-10:45	259	0	259	04:30-04:45	147	0	147	10:30-10:45	63	0	63
04:45-05:00	58	0	58	10:45-11:00	278	0	278	04:45-05:00	158	0	158	10:45-11:00	75	0	75
05:00-05:15	66	0	66	11:00-11:15	248	0	248	05:00-05:15	188	0	188	11:00-11:15	45	0	45
05:15-05:30	84	0	84	11:15-11:30	232	0	232	05:15-05:30	164	0	164	11:15-11:30	54	0	54
05:30-05:45	101	0	101	11:30-11:45	235	0	235	05:30-05:45	186	0	186	11:30-11:45	37	0	37
05:45-06:00	186	0	186	11:45-12:00	243	0	243	05:45-06:00	197	0	197	11:45-12:00	24	0	24

AM COMMUTER PERIOD (05:00-09:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:45 AM to 08:45 AM		
AM - PEAK HR VOLUME	2173	0	2173
AM - K FACTOR (%)			12.81
AM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:45 AM to 08:45 AM		
AM - PEAK HR VOLUME	2173	0	

PM COMMUTER PERIOD (15:00-19:00)	DIR 1	DIR 2	
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	05:00 PM to 06:00 PM		
PM - PEAK HR VOLUME	735	0	735
PM - K FACTOR (%)			4.33
PM - D (%)	100.00	0.00	100.00
DIRECTIONAL PEAK			
PM - PEAK HR TIME	05:00 PM to 06:00 PM		
PM - PEAK HR VOLUME	735	0	

AM PERIOD (00:00-12:00)			
TWO DIRECTIONAL PEAK			
AM - PEAK HR TIME	07:45 AM to 08:45 AM		
AM - PEAK HR VOLUME	2173	0	2173
AM - K FACTOR (%)			12.81
AM - D (%)	100.00	0.00	100.00

PM PERIOD (12:00-24:00)			
TWO DIRECTIONAL PEAK			
PM - PEAK HR TIME	12:00 PM to 01:00 PM		
PM - PEAK HR VOLUME	930	0	930
PM - K FACTOR (%)			5.48
PM - D (%)	100.00	0.00	100.00

NON-COMMUTER PERIOD (09:00-15:00)			
TWO DIRECTIONAL PEAK			
PEAK HR TIME	09:00 AM to 10:00 AM		
PEAK HR VOLUME	1386	0	1386
DIRECTIONAL PEAK			
PEAK HR TIME	09:00 AM to 10:00 AM		
PEAK HR VOLUME	1386	0	

6-HR, 12-HR, 24-HR PERIODS	DIR 1	DIR 2	Total
AM 6-HR PERIOD (06:00-12:00)	9,342	0	9,342
AM 12-HR PERIOD (00:00-12:00)	10,195	0	10,195
PM 6-HR PERIOD (12:00-18:00)	4,605	0	4,605
PM 12-HR PERIOD (12:00-24:00)	6,766	0	6,766
24 HOUR PERIOD	16,961	0	16,961
D (%)	100.00	0.00	100.00

APPENDIX B RAMP AND WEAVING LOS CRITERIA

Step 8: Determine LOS

The LOS in a weaving segment, as in all freeway analysis, is related to the density in the segment. Exhibit 12-10 provides LOS criteria for weaving segments on freeways, collector–distributor (C-D) roadways, and multilane highways. This methodology was developed for freeway weaving segments, although an isolated C-D roadway was included in its development. The methodology may be applied to weaving segments on uninterrupted segments of multilane surface facilities, although its use in such cases is approximate.

LOS can be determined for weaving segments on freeways, multilane highways, and C-D roadways.

Exhibit 12-10
LOS for Weaving Segments

LOS	Density (pc/mi/ln) Freeway Weaving Segments	Weaving Segments on Multilane Highways or C-D Roadways
A	0–10	0–12
B	>10–20	>12–24
C	>20–28	>24–32
D	>28–35	>32–36
E	>35	>36
F	Demand exceeds capacity	

The boundary between stable and unstable flow—the boundary between levels of service E and F—occurs when the demand flow rate exceeds the capacity of the segment, as described in Step 5. The threshold densities for other levels of service were set relative to the criteria for basic freeway segments (or multilane highways). In general, density thresholds in weaving segments are somewhat higher than those for similar basic freeway segments (or multilane highways). It is believed that drivers will tolerate higher densities in an area where lane-changing turbulence is expected than on basic segments.

To apply density criteria, the average speed of all vehicles, computed in Step 7, must be converted to density by using Equation 12-22.

$$D = \frac{\left(\frac{v}{N}\right)}{S}$$

Equation 12-22

where D is density in passenger cars per mile per lane and all other variables are as previously defined.

SPECIAL CASES

Multiple Weaving Segments

When a series of closely spaced merge and diverge areas creates overlapping weaving movements (between different merge–diverge pairs) that share the same segment of a roadway, a multiple weaving segment is created. In earlier editions of the HCM, a specific application of the weaving methodology for two-segment multiple weaving segments was included. While it was a logical extension of the methodology, it did not address cases in which three or more sets of weaving movements overlapped, nor was it well-supported by field data.

- No heavy vehicles,
- 12-ft lanes,
- Adequate lateral clearances (≥6 ft), and
- Road users familiar with the facility (i.e., f_p = 1.00).

LOS CRITERIA FOR MERGE AND DIVERGE SEGMENTS

LOS A–E is defined in terms of density; LOS F exists when demand exceeds capacity.

Merge/diverge segment LOS is defined in terms of density for all cases of stable operation (LOS A–E). LOS F exists when the freeway demand exceeds the capacity of the upstream (diverges) or downstream (merges) freeway segment, or where the off-ramp demand exceeds the off-ramp capacity.

At LOS A, unrestricted operations exist, and the density is low enough to permit smooth merging or diverging with very little turbulence in the traffic stream. At LOS B, merging and diverging maneuvers become noticeable to through drivers, and minimal turbulence occurs. At LOS C, speed within the ramp influence area begins to decline as turbulence levels become much more noticeable. Both ramp and freeway vehicles begin to adjust their speeds to accomplish smooth transitions. At LOS D, turbulence levels in the influence area become intrusive, and virtually all vehicles slow to accommodate merging or diverging maneuvers. Some ramp queues may form at heavily used on-ramps, but freeway operation remains stable. LOS E represents operating conditions approaching or at capacity. Small changes in demand or disruptions within the traffic stream can cause both ramp and freeway queues to form.

LOS F defines operating conditions within queues that form on both the ramp and the freeway mainline when capacity is exceeded by demand. For on-ramps, LOS F exists when the total demand flow rate from the upstream freeway segment and the on-ramp exceeds the capacity of the downstream freeway segment. For off-ramps, LOS F exists when the total demand flow rate on the approaching upstream freeway segment exceeds the capacity of the upstream freeway segment. LOS F also occurs when the off-ramp demand exceeds the capacity of the off-ramp.

Exhibit 13-2 summarizes the LOS criteria for freeway merge and diverge segments. These criteria apply to all ramp–freeway junctions and may also be applied to major merges and diverges; high-speed, uncontrolled merge or diverge ramps on multilane highway sections; and merges and diverges on freeway C-D roadways. LOS is not defined for ramp roadways, while the LOS of a ramp–street junction is defined in Chapter 22, Interchange Ramp Terminals.

Exhibit 13-2
LOS Criteria for Freeway Merge and Diverge Segments

LOS	Density (pc/mi/ln)	Comments
A	≤10	Unrestricted operations
B	>10–20	Merging and diverging maneuvers noticeable to drivers
C	>20–28	Influence area speeds begin to decline
D	>28–35	Influence area turbulence becomes intrusive
E	>35	Turbulence felt by virtually all drivers
F	Demand exceeds capacity	Ramp and freeway queues form

APPENDIX C RAMP AND WEAVING LOS ANALYSIS WORKSHEETS

H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	11/6/2012
Analysis Time Period	AM Peak Hour

Site Information

Freeway/Dir of Travel	H 1 Eastbound
Weaving Segment Location	Middle St. to Kalihi St.
Analysis Year	2012 Existing

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	4
Weaving segment length, L_S	1029ft
Freeway free-flow speed, FFS	65 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2350
Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4263	0.88	3	0	2.5	2.0	0.957	1.00	5062
V_{RF}	1819	0.88	3	0	2.5	2.0	0.957	1.00	2160
V_{FR}	733	0.88	3	0	2.5	2.0	0.957	1.00	870
V_{RR}	242	0.88	3	0	2.5	2.0	0.957	1.00	287
V_{NW}	5349							V =	8379
V_W	3030								
VR	0.362								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	8379 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	7923 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.012	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	4688 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	11/6/2012
Analysis Time Period	AM Peak Hour

Site Information

Freeway/Dir of Travel	H1 Eastbound
Weaving Segment Location	Kalihi St to Palama St.
Analysis Year	2012 -Existing

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2260ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	5902	0.90	3	0	2.5	2.0	0.957	1.00	6853
V_{RF}	1477	0.90	3	0	2.5	2.0	0.957	1.00	1715
V_{FR}	149	0.90	3	0	2.5	2.0	0.957	1.00	173
V_{RR}	739	0.90	3	0	2.5	2.0	0.957	1.00	858
V_{NW}	7711							V =	9599
V_W	1888								
VR	0.197								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	9599 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	8528 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.077	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	4502 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	11/6/2012
Analysis Time Period	AM Peak Hour

Site Information

Freeway/Dir of Travel	H1 Eastbound
Weaving Segment Location	Liliha St to Pali St
Analysis Year	2012

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1460ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	6220	0.90	3	0	2.5	2.0	0.957	1.00	7222
V_{RF}	469	0.90	3	0	2.5	2.0	0.957	1.00	545
V_{FR}	633	0.90	3	0	2.5	2.0	0.957	1.00	735
V_{RR}	235	0.90	3	0	2.5	2.0	0.957	1.00	273
V_{NW}	7495							V =	8775
V_W	1280								
VR	0.146								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1280 lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	1722 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	2508 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	4230 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	1641

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	8775 pc/h	Weaving intensity factor, W	0.523
Weaving segment capacity, c_w	8444 veh/h	Weaving segment speed, S	50.4 mph
Weaving segment v/c ratio	0.994	Average weaving speed, S_W	51.1 mph
Weaving segment density, D	43.5 pc/mi/ln	Average non-weaving speed, S_{NW}	50.3 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	3990 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Eastbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Punchbowl Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	AM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	350	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	6853	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	618	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6853	0.90	Rolling	3	0	0.957	1.00	7957
Ramp	618	0.90	Rolling	3	0	0.957	1.00	718
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.528 using Equation (Exhibit 13-7)

V_{12} = 4541 pc/h

V_3 or V_{av34} 3416 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = 5257 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7957	Exhibit 13-8	7200	Yes
$V_{FO} = V_F - V_R$	7239	Exhibit 13-8	7200	Yes
V_R	718	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4541	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 46.3 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_S = 0.298 (Exhibit 13-12)

S_R= 61.7 mph (Exhibit 13-12)

S_0= 70.2 mph (Exhibit 13-12)

S = 64.3 mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	10/2/2012
Analysis Time Period	AM Peak Hour

Site Information

Freeway/Dir of Travel	H1 EB
Weaving Segment Location	Pali OnRamp to Kinua OffRamp
Analysis Year	2012

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1330ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3485	0.90	3	0	2.5	2.0	0.957	1.00	4046
V_{RF}	953	0.90	3	0	2.5	2.0	0.957	1.00	1107
V_{FR}	911	0.90	3	0	2.5	2.0	0.957	1.00	1058
V_{RR}	476	0.90	3	0	2.5	2.0	0.957	1.00	553
V_{NW}	4599							V =	6764
V_W	2165								
VR	0.320								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	2165 lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	2582 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	898 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	3480 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	918

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6764 pc/h	Weaving intensity factor, W	0.483
Weaving segment capacity, c_w	7175 veh/h	Weaving segment speed, S	48.0 mph
Weaving segment v/c ratio	0.902	Average weaving speed, S_W	52.1 mph
Weaving segment density, D	35.2 pc/mi/ln	Average non-weaving speed, S_{NW}	46.3 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	5800 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Eastbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Vineyard Blvd Onramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	AM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A: 900	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 4438	V_D = veh/h
	Ramp Volume, V_R: 616	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4438	0.90	Rolling	3	0	0.957	1.00	5153
Ramp	616	0.90	Rolling	3	0	0.957	1.00	715
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2860 pc/h

V_3 or V_{av34} 2293 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2944 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5868	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3659	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 14.9 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.172 (Exibit 13-11)

S_R= 65.2 mph (Exhibit 13-11)

S_0= 63.8 mph (Exhibit 13-11)

S = 64.7 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	11/6/2012
Analysis Time Period	AM Peak Hour

Site Information

Freeway/Dir of Travel	H1 Westbound
Weaving Segment Location	Lunalilo Onramp to Vineyard
Analysis Year	2012

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1710ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4003	0.90	3	0	2.5	2.0	0.957	1.00	4648
V_{RF}	1101	0.90	3	0	2.5	2.0	0.957	1.00	1278
V_{FR}	1593	0.90	3	0	2.5	2.0	0.957	1.00	1850
V_{RR}	327	0.90	3	0	2.5	2.0	0.957	1.00	380
V_{NW}	5028							V =	8156
V_W	3128								
VR	0.384								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	8156 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	5988 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.303	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	6497 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Pali Hwy Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	AM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	500	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	4657	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	635	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4657	0.90	Rolling	3	0	0.957	1.00	5407
Ramp	635	0.90	Rolling	3	0	0.957	1.00	737
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.591 using Equation (Exhibit 13-7)

V_{12} = 3497 pc/h

V_3 or V_{av34} 1910 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5407	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	4670	Exhibit 13-8	7200	No
V_R	737	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3497	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 29.8 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.299 (Exhibit 13-12)

S_R= 61.6 mph (Exhibit 13-12)

S_0= 73.2 mph (Exhibit 13-12)

S = 65.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Punchbowl Onramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	AM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A: 500	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 4657	V_D = veh/h
	Ramp Volume, V_R: 1411	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4657	0.90	Rolling	3	0	0.957	1.00	5407
Ramp	1411	0.90	Rolling	3	0	0.957	1.00	1638
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.591 using Equation (Exhibit 13-6)

V_{12} = 3198 pc/h

V_3 or V_{av34} 2209 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7045	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4836	Exhibit 13-8	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 39.3 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.767 (Exibit 13-11)

S_R= 47.4 mph (Exhibit 13-11)

S_0= 58.8 mph (Exhibit 13-11)

S = 50.4 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	N School Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	AM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	500	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	4657	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	335	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4657	0.90	Rolling	3	0	0.957	1.00	5407
Ramp	335	0.90	Rolling	3	0	0.957	1.00	389
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.607 using Equation (Exhibit 13-7)

V_{12} = 3435 pc/h

V_3 or V_{av34} 1972 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5407	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	5018	Exhibit 13-8	7050	No
V_R	389	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3435	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 29.3 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.333 (Exhibit 13-12)

S_R= 57.3 mph (Exhibit 13-12)

S_0= 67.5 mph (Exhibit 13-12)

S = 60.7 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Palama Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	AM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D: 700	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 6592	V_D = veh/h
	Ramp Volume, V_R: 133	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6592	0.90	Rolling	3	0	0.957	1.00	7654
Ramp	133	0.90	Rolling	3	0	0.957	1.00	154
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.562 using Equation (Exhibit 13-7)

V_{12} = 4366 pc/h

V_3 or V_{av34} 3288 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = 4954 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7654	Exhibit 13-8	7200	Yes
$V_{FO} = V_F - V_R$	7500	Exhibit 13-8	7200	Yes
V_R	154	Exhibit 13-10	2100	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4366	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 40.6 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_S = 0.247 (Exhibit 13-12)

S_R= 63.1 mph (Exhibit 13-12)

S_0= 70.2 mph (Exhibit 13-12)

S = 65.4 mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	11/6/2012
Analysis Time Period	AM Peak Hour

Site Information

Freeway/Dir of Travel	H-1 Eastbound
Weaving Segment Location	Halona OnRamp to OffRamp
Analysis Year	2012

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1029ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	5789	0.90	3	0	2.5	2.0	0.957	1.00	6722
V_{RF}	1101	0.90	3	0	2.5	2.0	0.957	1.00	1278
V_{FR}	495	0.90	3	0	2.5	2.0	0.957	1.00	575
V_{RR}	550	0.90	3	0	2.5	2.0	0.957	1.00	639
V_{NW}	7361							V =	9214
V_W	1853								
VR	0.201								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	9214 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	8157 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.081	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	4548 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Kalihi Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	AM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	700	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	6890	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	495	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6890	0.90	Rolling	3	0	0.957	1.00	8000
Ramp	495	0.90	Rolling	3	0	0.957	1.00	575
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.534 using Equation (Exhibit 13-7)

V_{12} = 4537 pc/h

V_3 or V_{av34} 3463 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = 5300 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

	Actual	Capacity		LOS F?
V_F	8000	Exhibit 13-8	7200	Yes
$V_{FO} = V_F - V_R$	7425	Exhibit 13-8	7200	Yes
V_R	575	Exhibit 13-10	2100	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4537	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 43.5 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

D_S = 0.285 (Exhibit 13-12)

S_R= 62.0 mph (Exhibit 13-12)

S_0= 70.2 mph (Exhibit 13-12)

S = 64.6 mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	10/2/2012
Analysis Time Period	AM Peak Hour

Site Information

Freeway/Dir of Travel	H1 Westbound
Weaving Segment Location	Kalihi OnRamp to Middle St.
Analysis Year	2012 Existing

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1180ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2695	0.90	3	0	2.5	2.0	0.957	1.00	3129
V_{RF}	369	0.90	3	0	2.5	2.0	0.957	1.00	428
V_{FR}	1807	0.90	3	0	2.5	2.0	0.957	1.00	2098
V_{RR}	236	0.90	3	0	2.5	2.0	0.957	1.00	274
V_{NW}	3403							V =	5929
V_W	2526								
VR	0.426								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5929 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	5391 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.052	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	6975 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Off-Ramp To Middle St
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	AM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 2	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D: 1300	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 2043	V_D = veh/h
	Ramp Volume, V_R: 252	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 40.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2043	0.90	Rolling	3	0	0.957	1.00	2372
Ramp	252	0.90	Rolling	3	0	0.957	1.00	293
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 2372 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

	Actual	Capacity		LOS F?
V_F	2372	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	2079	Exhibit 13-8	4600	No
V_R	293	Exhibit 13-10	2100	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2372	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 13.0 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

D_s = 0.389 (Exhibit 13-12)

S_R= 53.0 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 53.0 mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	11/6/2012
Analysis Time Period	PM Peak Hour

Site Information

Freeway/Dir of Travel	H-1 Eastbound
Weaving Segment Location	Middle St. to Kalihi St.
Analysis Year	2012 Existing

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	4
Weaving segment length, L_S	2430ft
Freeway free-flow speed, FFS	65 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2350
Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	fp	v (pc/h)
V_{FF}	4546	0.97	3	0	2.5	2.0	0.957	1.00	4897
V_{RF}	1320	0.97	3	0	2.5	2.0	0.957	1.00	1422
V_{FR}	723	0.97	3	0	2.5	2.0	0.957	1.00	779
V_{RR}	238	0.97	3	0	2.5	2.0	0.957	1.00	256
V_{NW}	5153							V =	7354
V_W	2201								
VR	0.299								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	2201 lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	2800 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	2702 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	5502 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	1878

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	7354 pc/h	Weaving intensity factor, W	0.431
Weaving segment capacity, c_w	8532 veh/h	Weaving segment speed, S	42.8 mph
Weaving segment v/c ratio	0.825	Average weaving speed, S_W	49.9 mph
Weaving segment density, D	43.0 pc/mi/ln	Average non-weaving speed, S_{NW}	40.3 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	4010 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	11/6/2012
Analysis Time Period	PM Peak Hour

Site Information

Freeway/Dir of Travel	H1 Eastbound
Weaving Segment Location	Kalihi St to Palama St
Analysis Year	2012

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2260ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	5784	0.90	3	0	2.5	2.0	0.957	1.00	6716
V_{RF}	1116	0.90	3	0	2.5	2.0	0.957	1.00	1296
V_{FR}	382	0.90	3	0	2.5	2.0	0.957	1.00	444
V_{RR}	558	0.90	3	0	2.5	2.0	0.957	1.00	648
V_{NW}	7364							V =	9104
V_W	1740								
VR	0.191								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	9104 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	8547 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.019	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	4446 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	10/2/2012
Analysis Time Period	PM Peak Hour

Site Information

Freeway/Dir of Travel	H1 Eastbound
Weaving Segment Location	Liliha OnRamp to Pali OffRamp
Analysis Year	2012 -Existing

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1460ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	6442	0.90	3	0	2.5	2.0	0.957	1.00	7480
V_{RF}	469	0.90	3	0	2.5	2.0	0.957	1.00	545
V_{FR}	690	0.90	3	0	2.5	2.0	0.957	1.00	801
V_{RR}	361	0.90	3	0	2.5	2.0	0.957	1.00	419
V_{NW}	7899							V =	9245
V_W	1346								
VR	0.146								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	9245 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	8448 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.047	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	3988 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Eastbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Punchbowl Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	PM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	350	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	7132	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	504	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7132	0.90	Rolling	3	0	0.957	1.00	8281
Ramp	504	0.90	Rolling	3	0	0.957	1.00	585
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.526 using Equation (Exhibit 13-7)

V_{12} = 4634 pc/h

V_3 or V_{av34} 3647 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = 5581 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8281	Exhibit 13-8	7200	Yes
$V_{FO} = V_F - V_R$	7696	Exhibit 13-8	7200	Yes
V_R	585	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4634	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 49.1 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_S = 0.286 (Exhibit 13-12)

S_R= 62.0 mph (Exhibit 13-12)

S_0= 70.2 mph (Exhibit 13-12)

S = 64.4 mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	PB Americas Inc.
Date Performed	10/2/2012
Analysis Time Period	PM Peak Hour

Site Information

Freeway/Dir of Travel	H1 EB
Weaving Segment Location	Pali OnRamp to Kinua OffRamp
Analysis Year	2012

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	4
Weaving segment length, L_S	1330ft
Freeway free-flow speed, FFS	70 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2400
Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3527	0.90	3	0	2.5	2.0	0.957	1.00	4095
V_{RF}	741	0.90	3	0	2.5	2.0	0.957	1.00	860
V_{FR}	1169	0.90	3	0	2.5	2.0	0.957	1.00	1357
V_{RR}	370	0.90	3	0	2.5	2.0	0.957	1.00	430
V_{NW}	4525							V =	6742
V_W	2217								
VR	0.329								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	2217 lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	2634 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	883 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	3517 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	903

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6742 pc/h	Weaving intensity factor, W	0.487
Weaving segment capacity, c_w	6984 veh/h	Weaving segment speed, S	47.8 mph
Weaving segment v/c ratio	0.924	Average weaving speed, S_W	52.0 mph
Weaving segment density, D	35.3 pc/mi/ln	Average non-weaving speed, S_{NW}	45.9 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	5895 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Shenghong Li	Freeway/Dir of Travel	H-1 Eastbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Vineyard Blvd Onramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	PM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A: 900	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 4268	V_D = veh/h
	Ramp Volume, V_R: 1410	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4268	0.90	Rolling	3	0	0.957	1.00	4956
Ramp	1410	0.90	Rolling	3	0	0.957	1.00	1637
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.555 using Equation (Exhibit 13-6)

V_{12} = 2751 pc/h

V_3 or V_{av34} 2205 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2832 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6593	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4469	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 20.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.361 (Exibit 13-11)

S_R= 59.9 mph (Exhibit 13-11)

S_0= 64.2 mph (Exhibit 13-11)

S = 61.2 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	11/6/2012
Analysis Time Period	PM Peak Hour

Site Information

Freeway/Dir of Travel	H1 Westbound
Weaving Segment Location	Lunalilo Onramp to Vineyard
Analysis Year	2012

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1710ft	Freeway maximum capacity, C_{IFL}	2350
Freeway free-flow speed, FFS	65 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3714	0.90	3	0	2.5	2.0	0.957	1.00	4312
V_{RF}	865	0.90	3	0	2.5	2.0	0.957	1.00	1004
V_{FR}	170	0.90	3	0	2.5	2.0	0.957	1.00	197
V_{RR}	433	0.90	3	0	2.5	2.0	0.957	1.00	503
V_{NW}	4815							V =	6016
V_W	1201								
VR	0.200								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1004 lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	1492 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1148 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	2640 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	1235

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6016 pc/h	Weaving intensity factor, W	0.318
Weaving segment capacity, c_w	8168 veh/h	Weaving segment speed, S	51.0 mph
Weaving segment v/c ratio	0.705	Average weaving speed, S_W	52.9 mph
Weaving segment density, D	29.5 pc/mi/ln	Average non-weaving speed, S_{NW}	50.6 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	4532 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Pali Hwy Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	PM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D: 500	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 4579	V_D = veh/h
	Ramp Volume, V_R: 890	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4579	0.90	Rolling	3	0	0.957	1.00	5317
Ramp	890	0.90	Rolling	3	0	0.957	1.00	1033
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.580 using Equation (Exhibit 13-7)

V_{12} = 3516 pc/h

V_3 or V_{av34} 1801 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

	Actual	Capacity		LOS F?
V_F	5317	Exhibit 13-8	7200	No
$V_{FO} = V_F - V_R$	4284	Exhibit 13-8	7200	No
V_R	1033	Exhibit 13-10	2100	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3516	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 30.0 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

D_s = 0.326 (Exhibit 13-12)

S_R= 60.9 mph (Exhibit 13-12)

S_0= 73.7 mph (Exhibit 13-12)

S = 64.7 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Punchbowl Onramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	PM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A: 500	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 4579	V_D = veh/h
	Ramp Volume, V_R: 1762	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4579	0.90	Rolling	3	0	0.957	1.00	5317
Ramp	1762	0.90	Rolling	3	0	0.957	1.00	2046
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.591 using Equation (Exhibit 13-6)

V_{12} = 3145 pc/h

V_3 or V_{av34} 2172 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7363	Exhibit 13-8		Yes

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	5191	Exhibit 13-8	4600:All	Yes

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 41.9 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.977 (Exibit 13-11)

S_R= 42.5 mph (Exhibit 13-11)

S_0= 59.0 mph (Exhibit 13-11)

S = 46.3 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	N School Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	PM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	500	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	4579	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	293	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4579	0.90	Rolling	3	0	0.957	1.00	5317
Ramp	293	0.90	Rolling	3	0	0.957	1.00	340
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.611 using Equation (Exhibit 13-7)

V_{12} = 3383 pc/h

V_3 or V_{av34} 1934 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5317	Exhibit 13-8	7050	No
$V_{FO} = V_F - V_R$	4977	Exhibit 13-8	7050	No
V_R	340	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3383	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 28.8 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.329 (Exhibit 13-12)

S_R= 57.4 mph (Exhibit 13-12)

S_0= 67.7 mph (Exhibit 13-12)

S = 60.8 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Palama Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	PM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	700	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	6665	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	150	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6665	0.90	Rolling	3	0	0.957	1.00	7739
Ramp	150	0.90	Rolling	3	0	0.957	1.00	174
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.559 using Equation (Exhibit 13-7)

V_{12} = 4399 pc/h

V_3 or V_{av34} 3340 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = 5039 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7739	Exhibit 13-8	7200	Yes
$V_{FO} = V_F - V_R$	7565	Exhibit 13-8	7200	Yes
V_R	174	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4399	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 41.3 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

D_S = 0.249 (Exhibit 13-12)

S_R= 63.0 mph (Exhibit 13-12)

S_0= 70.2 mph (Exhibit 13-12)

S = 65.4 mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	10/2/2012
Analysis Time Period	PM Peak Hour

Site Information

Freeway/Dir of Travel	H1 WB
Weaving Segment Location	Halona OnRamp to OffRamp
Analysis Year	2012 -Existing

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1029ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	6566	0.90	3	0	2.5	2.0	0.957	1.00	7624
V_{RF}	1053	0.90	3	0	2.5	2.0	0.957	1.00	1223
V_{FR}	30	0.90	3	0	2.5	2.0	0.957	1.00	35
V_{RR}	527	0.90	3	0	2.5	2.0	0.957	1.00	612
V_{NW}	8236							V =	9494
V_W	1258								
VR	0.133								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	9494 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	8360 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.087	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	3858 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Kalihi Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	PM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	700	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	7619	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	923	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7619	0.90	Rolling	3	0	0.957	1.00	8847
Ramp	923	0.90	Rolling	3	0	0.957	1.00	1072
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.490 using Equation (Exhibit 13-7)

V_{12} = 4878 pc/h

V_3 or V_{av34} 3969 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = 6147 pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8847	Exhibit 13-8	7200	Yes
$V_{FO} = V_F - V_R$	7775	Exhibit 13-8	7200	Yes
V_R	1072	Exhibit 13-10	2100	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4878	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 50.8 (pc/mi/ln)

LOS = F (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_S = 0.329 (Exhibit 13-12)

S_R= 60.8 mph (Exhibit 13-12)

S_0= 70.2 mph (Exhibit 13-12)

S = 63.4 mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	10/2/2012
Analysis Time Period	PM Peak Hour

Site Information

Freeway/Dir of Travel	H1 WB
Weaving Segment Location	Halona OnRamp to OffRamp
Analysis Year	2012 -Existing

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1029ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	6566	0.90	3	0	2.5	2.0	0.957	1.00	7624
V_{RF}	1053	0.90	3	0	2.5	2.0	0.957	1.00	1223
V_{FR}	30	0.90	3	0	2.5	2.0	0.957	1.00	35
V_{RR}	527	0.90	3	0	2.5	2.0	0.957	1.00	612
V_{NW}	8236							V =	9494
V_W	1258								
VR	0.133								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	9494 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	8360 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.087	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	3858 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Off-Ramp To Middle St
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	PM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	2	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	1300	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	1626	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	225	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	60.0		
		Ramp Free-Flow Speed, S_{FR}	40.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1626	0.90	Rolling	3	0	0.957	1.00	1888
Ramp	225	0.90	Rolling	3	0	0.957	1.00	261
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 1.000 using Equation (Exhibit 13-7)

V_{12} = 1888 pc/h

V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

	Actual	Capacity		LOS F?
V_F	1888	Exhibit 13-8	4600	No
$V_{FO} = V_F - V_R$	1627	Exhibit 13-8	4600	No
V_R	261	Exhibit 13-10	2100	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1888	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 8.8 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

D_s = 0.386 (Exhibit 13-12)

S_R= 53.0 mph (Exhibit 13-12)

S_0= N/A mph (Exhibit 13-12)

S = 53.0 mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	11/6/2012
Analysis Time Period	AM Peak Hour

Site Information

Freeway/Dir of Travel	H-1 Eastbound
Weaving Segment Location	Middle St. to Kalihi St.
Analysis Year	2012 -Alternative #1

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	4
Weaving segment length, L_S	2430ft
Freeway free-flow speed, FFS	60 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2300
Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4263	0.88	3	0	2.5	2.0	0.957	1.00	5062
V_{RF}	1819	0.88	3	0	2.5	2.0	0.957	1.00	2160
V_{FR}	733	0.88	3	0	2.5	2.0	0.957	1.00	870
V_{RR}	242	0.88	3	0	2.5	2.0	0.957	1.00	287
V_{NW}	5349							V =	8379
V_W	3030								
VR	0.362								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	0 lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	599 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	2881 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	3480 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	1950

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	8379 pc/h	Weaving intensity factor, W	0.300
Weaving segment capacity, c_w	8142 veh/h	Weaving segment speed, S	49.8 mph
Weaving segment v/c ratio	0.985	Average weaving speed, S_W	49.6 mph
Weaving segment density, D	42.0 pc/mi/ln	Average non-weaving speed, S_{NW}	49.9 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	4688 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	11/6/2012
Analysis Time Period	AM Peak Hour

Site Information

Freeway/Dir of Travel	H1 Eastbound
Weaving Segment Location	Kalihi St to Palama St.
Analysis Year	2012 -Existing

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	5	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2260ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	5902	0.90	3	0	2.5	2.0	0.957	1.00	6853
V_{RF}	1477	0.90	3	0	2.5	2.0	0.957	1.00	1715
V_{FR}	149	0.90	3	0	2.5	2.0	0.957	1.00	173
V_{RR}	739	0.90	3	0	2.5	2.0	0.957	1.00	858
V_{NW}	7711							V =	9599
V_W	1888								
VR	0.197								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1888 lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	2786 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	3409 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	6195 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	2614

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	9599 pc/h	Weaving intensity factor, W	0.501
Weaving segment capacity, c_w	10660 veh/h	Weaving segment speed, S	48.0 mph
Weaving segment v/c ratio	0.862	Average weaving speed, S_W	51.6 mph
Weaving segment density, D	40.0 pc/mi/ln	Average non-weaving speed, S_{NW}	47.2 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	4502 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	11/6/2012
Analysis Time Period	AM Peak Hour

Site Information

Freeway/Dir of Travel	H1 Eastbound
Weaving Segment Location	Liliha St to Pali St
Analysis Year	2012

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	5	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1460ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	6220	0.90	3	0	2.5	2.0	0.957	1.00	7222
V_{RF}	469	0.90	3	0	2.5	2.0	0.957	1.00	545
V_{FR}	633	0.90	3	0	2.5	2.0	0.957	1.00	735
V_{RR}	235	0.90	3	0	2.5	2.0	0.957	1.00	273
V_{NW}	7495							V =	8775
V_W	1280								
VR	0.146								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1280 lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	1971 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	2417 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	4388 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	1641

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	8775 pc/h	Weaving intensity factor, W	0.538
Weaving segment capacity, c_w	10555 veh/h	Weaving segment speed, S	52.1 mph
Weaving segment v/c ratio	0.796	Average weaving speed, S_W	50.7 mph
Weaving segment density, D	33.7 pc/mi/ln	Average non-weaving speed, S_{NW}	52.4 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	3990 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Eastbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Punchbowl Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	AM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	350	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	6853	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	618	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6853	0.90	Rolling	3	0	0.957	1.00	7957
Ramp	618	0.90	Rolling	3	0	0.957	1.00	718
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 3874 pc/h

V_3 or V_{av34} 2041 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7957	Exhibit 13-8	9600	No
$V_{FO} = V_F - V_R$	7239	Exhibit 13-8	9600	No
V_R	718	Exhibit 13-10	2100	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3874	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 34.4 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.298 (Exhibit 13-12)

S_R= 61.7 mph (Exhibit 13-12)

S_0= 72.7 mph (Exhibit 13-12)

S = 66.9 mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	10/2/2012
Analysis Time Period	AM Peak Hour

Site Information

Freeway/Dir of Travel	H1 EB
Weaving Segment Location	Pali OnRamp to Kinua OffRamp
Analysis Year	2012

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	5
Weaving segment length, L_S	1330ft
Freeway free-flow speed, FFS	70 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2400
Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3485	0.90	3	0	2.5	2.0	0.957	1.00	4046
V_{RF}	953	0.90	3	0	2.5	2.0	0.957	1.00	1107
V_{FR}	911	0.90	3	0	2.5	2.0	0.957	1.00	1058
V_{RR}	476	0.90	3	0	2.5	2.0	0.957	1.00	553
V_{NW}	4599							V =	6764
V_W	2165								
VR	0.320								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	2165 lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	2816 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	705 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	3521 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	918

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6764 pc/h	Weaving intensity factor, W	0.487
Weaving segment capacity, c_w	7175 veh/h	Weaving segment speed, S	49.1 mph
Weaving segment v/c ratio	0.902	Average weaving speed, S_W	52.0 mph
Weaving segment density, D	27.5 pc/mi/ln	Average non-weaving speed, S_{NW}	47.9 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	5800 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Eastbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Vineyard Blvd Onramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	AM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A: 900	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 4438	V_D = veh/h
	Ramp Volume, V_R: 616	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	v = V/PHF x f_{HV} x f_p
Freeway	4438	0.90	Rolling	3	0	0.957	1.00	5153
Ramp	616	0.90	Rolling	3	0	0.957	1.00	715
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.209 using Equation (Exhibit 13-6)

V_{12} = 1077 pc/h

V_3 or V_{av34} 2038 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2061 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	5868	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	2776	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 8.0 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.084 (Exibit 13-11)

S_R= 67.7 mph (Exhibit 13-11)

S_0= 66.2 mph (Exhibit 13-11)

S = 66.9 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	11/6/2012
Analysis Time Period	AM Peak Hour

Site Information

Freeway/Dir of Travel	H1 Westbound
Weaving Segment Location	Lunalilo Onramp to Vineyard
Analysis Year	2012

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	5
Weaving segment length, L_S	1710ft
Freeway free-flow speed, FFS	65 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2350
Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4003	0.90	3	0	2.5	2.0	0.957	1.00	4648
V_{RF}	1101	0.90	3	0	2.5	2.0	0.957	1.00	1278
V_{FR}	1593	0.90	3	0	2.5	2.0	0.957	1.00	1850
V_{RR}	327	0.90	3	0	2.5	2.0	0.957	1.00	380
V_{NW}	5028							V =	8156
V_W	3128								
VR	0.384								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	8156 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	5988 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.303	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	6497 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Pali Hwy Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	AM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	500	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	4657	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	635	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4657	0.90	Rolling	3	0	0.957	1.00	5407
Ramp	635	0.90	Rolling	3	0	0.957	1.00	737
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 2773 pc/h

V_3 or V_{av34} 1317 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5407	Exhibit 13-8	9600	No
$V_{FO} = V_F - V_R$	4670	Exhibit 13-8	9600	No
V_R	737	Exhibit 13-10	2100	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2773	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 23.6 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.299 (Exhibit 13-12)

S_R= 61.6 mph (Exhibit 13-12)

S_0= 75.6 mph (Exhibit 13-12)

S = 67.7 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Punchbowl Onramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	AM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A: 500	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 4657	V_D = veh/h
	Ramp Volume, V_R: 1411	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4657	0.90	Rolling	3	0	0.957	1.00	5407
Ramp	1411	0.90	Rolling	3	0	0.957	1.00	1638
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.013 using Equation (Exhibit 13-6)

V_{12} = 71 pc/h

V_3 or V_{av34} 2668 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2162 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7045	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3800	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 31.2 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.450 (Exibit 13-11)

S_R= 54.6 mph (Exhibit 13-11)

S_0= 61.0 mph (Exhibit 13-11)

S = 57.4 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	N School Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	AM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	500	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	4657	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	335	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4657	0.90	Rolling	3	0	0.957	1.00	5407
Ramp	335	0.90	Rolling	3	0	0.957	1.00	389
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 2577 pc/h

V_3 or V_{av34} 1415 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5407	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	5018	Exhibit 13-8	9400	No
V_R	389	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2577	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 21.9 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.333 (Exhibit 13-12)

S_R= 57.3 mph (Exhibit 13-12)

S_0= 69.7 mph (Exhibit 13-12)

S = 63.2 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Palama Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	AM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	700	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	6592	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	133	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6592	0.90	Rolling	3	0	0.957	1.00	7654
Ramp	133	0.90	Rolling	3	0	0.957	1.00	154
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 3424 pc/h

V_3 or V_{av34} 2115 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7654	Exhibit 13-8	9600	No
$V_{FO} = V_F - V_R$	7500	Exhibit 13-8	9600	No
V_R	154	Exhibit 13-10	2100	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3424	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 27.4 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.247 (Exhibit 13-12)

S_R= 63.1 mph (Exhibit 13-12)

S_0= 72.4 mph (Exhibit 13-12)

S = 67.9 mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	11/6/2012
Analysis Time Period	AM Peak Hour

Site Information

Freeway/Dir of Travel	H-1 Eastbound
Weaving Segment Location	Halona OnRamp to OffRamp
Analysis Year	2012

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	5	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1029ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	5789	0.90	3	0	2.5	2.0	0.957	1.00	6722
V_{RF}	1101	0.90	3	0	2.5	2.0	0.957	1.00	1278
V_{FR}	495	0.90	3	0	2.5	2.0	0.957	1.00	575
V_{RR}	550	0.90	3	0	2.5	2.0	0.957	1.00	639
V_{NW}	7361							V =	9214
V_W	1853								
VR	0.201								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1853 lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	2401 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1111 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	3512 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	1136

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	9214 pc/h	Weaving intensity factor, W	0.595
Weaving segment capacity, c_w	10196 veh/h	Weaving segment speed, S	48.1 mph
Weaving segment v/c ratio	0.865	Average weaving speed, S_W	49.5 mph
Weaving segment density, D	38.3 pc/mi/ln	Average non-weaving speed, S_{NW}	47.8 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	4548 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Kalihi Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	AM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	700	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	6890	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	495	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6890	0.90	Rolling	3	0	0.957	1.00	8000
Ramp	495	0.90	Rolling	3	0	0.957	1.00	575
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 3812 pc/h

V_3 or V_{av34} 2094 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8000	Exhibit 13-8	9600	No
$V_{FO} = V_F - V_R$	7425	Exhibit 13-8	9600	No
V_R	575	Exhibit 13-10	2100	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3812	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 30.7 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.285 (Exhibit 13-12)

S_R= 62.0 mph (Exhibit 13-12)

S_0= 72.5 mph (Exhibit 13-12)

S = 67.1 mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	10/2/2012
Analysis Time Period	AM Peak Hour

Site Information

Freeway/Dir of Travel	H1 Westbound
Weaving Segment Location	Kalihi OnRamp to Middle St.
Analysis Year	2012 Existing

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	5	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1180ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2695	0.90	3	0	2.5	2.0	0.957	1.00	3129
V_{RF}	369	0.90	3	0	2.5	2.0	0.957	1.00	428
V_{FR}	1807	0.90	3	0	2.5	2.0	0.957	1.00	2098
V_{RR}	236	0.90	3	0	2.5	2.0	0.957	1.00	274
V_{NW}	3403							V =	5929
V_W	2526								
VR	0.426								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	5929 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	5391 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.052	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	6975 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Off-Ramp To Middle St
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	AM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 3	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D: 1300	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 2043	V_D = veh/h
	Ramp Volume, V_R: 252	
	Freeway Free-Flow Speed, S_{FF}: 60.0	
	Ramp Free-Flow Speed, S_{FR}: 40.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	2043	0.90	Rolling	3	0	0.957	1.00	2372
Ramp	252	0.90	Rolling	3	0	0.957	1.00	293
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.687 using Equation (Exhibit 13-7)

V_{12} = 1722 pc/h

V_3 or V_{av34} 650 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

	Actual	Capacity		LOS F?
V_F	2372	Exhibit 13-8	6900	No
$V_{FO} = V_F - V_R$	2079	Exhibit 13-8	6900	No
V_R	293	Exhibit 13-10	2100	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1722	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 7.4 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

D_s = 0.389 (Exhibit 13-12)

S_R= 53.0 mph (Exhibit 13-12)

S_0= 65.8 mph (Exhibit 13-12)

S = 56.0 mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	11/6/2012
Analysis Time Period	PM Peak Hour

Site Information

Freeway/Dir of Travel	H1 Eastbound
Weaving Segment Location	Middle St. to Kalihi St.
Analysis Year	2012

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	4	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2430ft	Freeway maximum capacity, C_{IFL}	2300
Freeway free-flow speed, FFS	60 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	4546	0.97	3	0	2.5	2.0	0.957	1.00	4897
V_{RF}	1320	0.97	3	0	2.5	2.0	0.957	1.00	1422
V_{FR}	723	0.97	3	0	2.5	2.0	0.957	1.00	779
V_{RR}	238	0.97	3	0	2.5	2.0	0.957	1.00	256
V_{NW}	5153							V =	7354
V_W	2201								
VR	0.299								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	3 lc	Minimum weaving lane changes, LC_{MIN}	779 lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	1378 lc/h
Minimum RF lane changes, LC_{RF}	0 lc/pc	Non-weaving lane changes, LC_{NW}	2702 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	4080 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	1878

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	7354 pc/h	Weaving intensity factor, W	0.340
Weaving segment capacity, c_w	8341 veh/h	Weaving segment speed, S	46.4 mph
Weaving segment v/c ratio	0.844	Average weaving speed, S_W	48.6 mph
Weaving segment density, D	39.6 pc/mi/ln	Average non-weaving speed, S_{NW}	45.6 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	4010 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	11/6/2012
Analysis Time Period	PM Peak Hour

Site Information

Freeway/Dir of Travel	H1 Eastbound
Weaving Segment Location	Kalihi St to Palama St
Analysis Year	2012

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	5	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	2260ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	5784	0.90	3	0	2.5	2.0	0.957	1.00	6716
V_{RF}	1116	0.90	3	0	2.5	2.0	0.957	1.00	1296
V_{FR}	382	0.90	3	0	2.5	2.0	0.957	1.00	444
V_{RR}	558	0.90	3	0	2.5	2.0	0.957	1.00	648
V_{NW}	7364							V =	9104
V_W	1740								
VR	0.191								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1296 lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	2194 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	3331 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	5525 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	2496

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	9104 pc/h	Weaving intensity factor, W	0.458
Weaving segment capacity, c_w	10684 veh/h	Weaving segment speed, S	52.1 mph
Weaving segment v/c ratio	0.815	Average weaving speed, S_W	52.7 mph
Weaving segment density, D	35.0 pc/mi/ln	Average non-weaving speed, S_{NW}	51.9 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	4446 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	10/2/2012
Analysis Time Period	PM Peak Hour

Site Information

Freeway/Dir of Travel	H1 Eastbound
Weaving Segment Location	Liliha OnRamp to Pali OffRamp
Analysis Year	2012 -Existing

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	5	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1460ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	6442	0.90	3	0	2.5	2.0	0.957	1.00	7480
V_{RF}	469	0.90	3	0	2.5	2.0	0.957	1.00	545
V_{FR}	690	0.90	3	0	2.5	2.0	0.957	1.00	801
V_{RR}	361	0.90	3	0	2.5	2.0	0.957	1.00	419
V_{NW}	7899							V =	9245
V_W	1346								
VR	0.146								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1346 lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	2037 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	2775 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	4812 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	1730

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	9245 pc/h	Weaving intensity factor, W	0.579
Weaving segment capacity, c_w	10560 veh/h	Weaving segment speed, S	51.2 mph
Weaving segment v/c ratio	0.838	Average weaving speed, S_W	49.8 mph
Weaving segment density, D	36.1 pc/mi/ln	Average non-weaving speed, S_{NW}	51.4 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	3988 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Eastbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Punchbowl Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	PM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	350	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	7132	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	504	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7132	0.90	Rolling	3	0	0.957	1.00	8281
Ramp	504	0.90	Rolling	3	0	0.957	1.00	585
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 3940 pc/h

V_3 or V_{av34} 2170 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8281	Exhibit 13-8	9600	No
$V_{FO} = V_F - V_R$	7696	Exhibit 13-8	9600	No
V_R	585	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3940	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 35.0 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Speed Determination

D_s = 0.286 (Exhibit 13-12)

S_R= 62.0 mph (Exhibit 13-12)

S_0= 72.2 mph (Exhibit 13-12)

S = 67.0 mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	PB Americas Inc.
Date Performed	10/2/2012
Analysis Time Period	PM Peak Hour

Site Information

Freeway/Dir of Travel	H1 EB
Weaving Segment Location	Pali OnRamp to Kinua OffRamp
Analysis Year	2012

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	5	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1330ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3527	0.90	3	0	2.5	2.0	0.957	1.00	4095
V_{RF}	741	0.90	3	0	2.5	2.0	0.957	1.00	860
V_{FR}	1169	0.90	3	0	2.5	2.0	0.957	1.00	1357
V_{RR}	370	0.90	3	0	2.5	2.0	0.957	1.00	430
V_{NW}	4525							V =	6742
V_W	2217								
VR	0.329								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	2217 lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	2868 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	690 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	3558 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	903

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6742 pc/h	Weaving intensity factor, W	0.491
Weaving segment capacity, c_w	6984 veh/h	Weaving segment speed, S	48.9 mph
Weaving segment v/c ratio	0.924	Average weaving speed, S_W	51.9 mph
Weaving segment density, D	27.6 pc/mi/ln	Average non-weaving speed, S_{NW}	47.6 mph
Level of Service, LOS	C	Maximum weaving length, L_{MAX}	5895 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	Shenghong Li	Freeway/Dir of Travel	H-1 Eastbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Vineyard Blvd Onramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	PM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A: 900	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 4268	V_D = veh/h
	Ramp Volume, V_R: 1410	
	Freeway Free-Flow Speed, S_{FF}: 70.0	
	Ramp Free-Flow Speed, S_{FR}: 50.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4268	0.90	Rolling	3	0	0.957	1.00	4956
Ramp	1410	0.90	Rolling	3	0	0.957	1.00	1637
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = 0.209 using Equation (Exhibit 13-6)

V_{12} = 1036 pc/h

V_3 or V_{av34} 1960 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 1982 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	6593	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	3619	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 14.1 (pc/mi/ln)

LOS = B (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.166 (Exibit 13-11)

S_R= 65.3 mph (Exhibit 13-11)

S_0= 66.4 mph (Exhibit 13-11)

S = 65.8 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	11/6/2012
Analysis Time Period	PM Peak Hour

Site Information

Freeway/Dir of Travel	H1 Westbound
Weaving Segment Location	Lunalilo Onramp to Vineyard
Analysis Year	2012

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	4
Weaving segment length, L_S	1710ft
Freeway free-flow speed, FFS	65 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2350
Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	3714	0.90	3	0	2.5	2.0	0.957	1.00	4312
V_{RF}	865	0.90	3	0	2.5	2.0	0.957	1.00	1004
V_{FR}	170	0.90	3	0	2.5	2.0	0.957	1.00	197
V_{RR}	433	0.90	3	0	2.5	2.0	0.957	1.00	503
V_{NW}	4815							V =	6016
V_W	1201								
VR	0.200								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1004 lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	1492 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1148 lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	2640 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	1235

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6016 pc/h	Weaving intensity factor, W	0.318
Weaving segment capacity, c_w	8168 veh/h	Weaving segment speed, S	51.0 mph
Weaving segment v/c ratio	0.705	Average weaving speed, S_W	52.9 mph
Weaving segment density, D	29.5 pc/mi/ln	Average non-weaving speed, S_{NW}	50.6 mph
Level of Service, LOS	D	Maximum weaving length, L_{MAX}	4532 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Pali Hwy Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	PM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	500	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	4579	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	890	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4579	0.90	Rolling	3	0	0.957	1.00	5317
Ramp	890	0.90	Rolling	3	0	0.957	1.00	1033
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 2901 pc/h

V_3 or V_{av34} 1208 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5317	Exhibit 13-8	9600	No
$V_{FO} = V_F - V_R$	4284	Exhibit 13-8	9600	No
V_R	1033	Exhibit 13-10	2100	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2901	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 24.7 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.326 (Exhibit 13-12)

S_R= 60.9 mph (Exhibit 13-12)

S_0= 76.0 mph (Exhibit 13-12)

S = 66.9 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Punchbowl Onramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	PM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Downstream Adj Ramp
☐ Yes ☐ On	Number of Lanes, N: 4	☐ Yes ☐ On
☑ No ☐ Off	Acceleration Lane Length, L_A: 500	☑ No ☐ Off
L_{up} = ft	Deceleration Lane Length L_D:	L_{down} = ft
V_u = veh/h	Freeway Volume, V_F: 4579	V_D = veh/h
	Ramp Volume, V_R: 1762	
	Freeway Free-Flow Speed, S_{FF}: 65.0	
	Ramp Free-Flow Speed, S_{FR}: 45.0	

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4579	0.90	Rolling	3	0	0.957	1.00	5317
Ramp	1762	0.90	Rolling	3	0	0.957	1.00	2046
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = -0.038 using Equation (Exhibit 13-6)

V_{12} = -201 pc/h

V_3 or V_{av34} 2759 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☑ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☑ Yes ☐ No

If Yes, V_{12a} = 2126 pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = using Equation (Exhibit 13-7)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}	7363	Exhibit 13-8		No

Capacity Checks

	Actual	Capacity		LOS F?
V_F		Exhibit 13-8		
$V_{FO} = V_F - V_R$		Exhibit 13-8		
V_R		Exhibit 13-10		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}	4172	Exhibit 13-8	4600:All	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = 33.9 (pc/mi/ln)

LOS = D (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = 0.529 (Exibit 13-11)

S_R= 52.8 mph (Exhibit 13-11)

S_0= 61.1 mph (Exhibit 13-11)

S = 56.1 mph (Exhibit 13-13)

Speed Determination

D_s = (Exhibit 13-12)

S_R= mph (Exhibit 13-12)

S_0= mph (Exhibit 13-12)

S = mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	N School Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	PM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	500	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	4579	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	293	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	65.0		
		Ramp Free-Flow Speed, S_{FR}	45.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	4579	0.90	Rolling	3	0	0.957	1.00	5317
Ramp	293	0.90	Rolling	3	0	0.957	1.00	340
UpStream								
DownStream								

Estimation of v_{12} — Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Estimation of v_{12} — Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 2510 pc/h

V_3 or V_{av34} 1403 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Capacity Checks

	Actual	Capacity		LOS F?
V_F	5317	Exhibit 13-8	9400	No
$V_{FO} = V_F - V_R$	4977	Exhibit 13-8	9400	No
V_R	340	Exhibit 13-10	2100	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	2510	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 21.3 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Speed Determination

D_s = 0.329 (Exhibit 13-12)

S_R= 57.4 mph (Exhibit 13-12)

S_0= 69.7 mph (Exhibit 13-12)

S = 63.3 mph (Exhibit 13-13)

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Palama Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	PM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{up} = ft

V_u = veh/h

Number of Lanes, N	4
Acceleration Lane Length, L_A	
Deceleration Lane Length L_D	700
Freeway Volume, V_F	6665
Ramp Volume, V_R	150
Freeway Free-Flow Speed, S_{FF}	70.0
Ramp Free-Flow Speed, S_{FR}	50.0

Downstream Adj Ramp

☐ Yes ☐ On

☑ No ☐ Off

L_{down} = ft

V_D = veh/h

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	6665	0.90	Rolling	3	0	0.957	1.00	7739
Ramp	150	0.90	Rolling	3	0	0.957	1.00	174
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 3472 pc/h

V_3 or V_{av34} 2133 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	7739	Exhibit 13-8	9600	No
$V_{FO} = V_F - V_R$	7565	Exhibit 13-8	9600	No
V_R	174	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	3472	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 27.8 (pc/mi/ln)

LOS = C (Exhibit 13-2)

Speed Determination

D_s = 0.249 (Exhibit 13-12)

S_R= 63.0 mph (Exhibit 13-12)

S_0= 72.4 mph (Exhibit 13-12)

S = 67.9 mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	10/2/2012
Analysis Time Period	PM Peak Hour

Site Information

Freeway/Dir of Travel	H1 WB
Weaving Segment Location	Halona OnRamp to OffRamp
Analysis Year	2012 -Existing

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided
Weaving number of lanes, N	5
Weaving segment length, L_S	1029ft
Freeway free-flow speed, FFS	70 mph
Segment type	Freeway
Freeway minimum speed, S_{MIN}	15
Freeway maximum capacity, C_{IFL}	2400
Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	6566	0.90	3	0	2.5	2.0	0.957	1.00	7624
V_{RF}	1053	0.90	3	0	2.5	2.0	0.957	1.00	1223
V_{FR}	30	0.90	3	0	2.5	2.0	0.957	1.00	35
V_{RR}	527	0.90	3	0	2.5	2.0	0.957	1.00	612
V_{NW}	8236							V =	9494
V_W	1258								
VR	0.133								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	1258 lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	1806 lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	1291 lc/h
Minimum FR lane changes, LC_{FR}	1 lc/pc	Total lane changes, LC_{ALL}	3097 lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	1271

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	9494 pc/h	Weaving intensity factor, W	0.539
Weaving segment capacity, c_w	10450 veh/h	Weaving segment speed, S	51.7 mph
Weaving segment v/c ratio	0.869	Average weaving speed, S_W	50.7 mph
Weaving segment density, D	36.7 pc/mi/ln	Average non-weaving speed, S_{NW}	51.8 mph
Level of Service, LOS	E	Maximum weaving length, L_{MAX}	3858 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Kalihi Off-Ramp
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	PM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	4	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	700	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	7619	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	923	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	70.0		
		Ramp Free-Flow Speed, S_{FR}	50.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	7619	0.90	Rolling	3	0	0.957	1.00	8847
Ramp	923	0.90	Rolling	3	0	0.957	1.00	1072
UpStream								
DownStream								

Merge Areas

Estimation of v_{12}

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

Diverge Areas

Estimation of v_{12}

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.436 using Equation (Exhibit 13-7)

V_{12} = 4462 pc/h

V_3 or V_{av34} 2192 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_F	8847	Exhibit 13-8	9600	No
$V_{FO} = V_F - V_R$	7775	Exhibit 13-8	9600	No
V_R	1072	Exhibit 13-10	2100	No

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	4462	Exhibit 13-8	4400:All	Yes

Level of Service Determination (if not F)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 36.3 (pc/mi/ln)

LOS = E (Exhibit 13-2)

Speed Determination

D_s = 0.329 (Exhibit 13-12)

S_R= 60.8 mph (Exhibit 13-12)

S_0= 72.1 mph (Exhibit 13-12)

S = 65.9 mph (Exhibit 13-13)

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H-1 Freeway Improvement

FREEWAY WEAVING WORKSHEET

General Information

Analyst	LSH
Agency/Company	Parsons Brinckerhoff, Inc.
Date Performed	11/6/2012
Analysis Time Period	PM Peak Hour

Site Information

Freeway/Dir of Travel	H1 Westbound
Weaving Segment Location	Kalihi OnRamp to Middle St.
Analysis Year	2012

Project Description *H-1 Freeway Improvement*

Inputs

Weaving configuration	One-Sided	Segment type	Freeway
Weaving number of lanes, N	5	Freeway minimum speed, S_{MIN}	15
Weaving segment length, L_S	1180ft	Freeway maximum capacity, C_{IFL}	2400
Freeway free-flow speed, FFS	70 mph	Terrain type	Rolling

Conversions to pc/h Under Base Conditions

	V (veh/h)	PHF	Truck (%)	RV (%)	E_T	E_R	f_{HV}	f_p	v (pc/h)
V_{FF}	2695	0.90	3	0	2.5	2.0	0.957	1.00	3129
V_{RF}	472	0.90	0	0	2.5	2.0	1.000	1.00	524
V_{FR}	1807	0.90	3	0	2.5	2.0	0.957	1.00	2098
V_{RR}	236	0.90	3	0	2.5	2.0	0.957	1.00	274
V_{NW}	3403							V =	6025
V_W	2622								
VR	0.435								

Configuration Characteristics

Minimum maneuver lanes, N_{WL}	2 lc	Minimum weaving lane changes, LC_{MIN}	lc/h
Interchange density, ID	1.5 int/mi	Weaving lane changes, LC_W	lc/h
Minimum RF lane changes, LC_{RF}	1 lc/pc	Non-weaving lane changes, LC_{NW}	lc/h
Minimum FR lane changes, LC_{FR}	0 lc/pc	Total lane changes, LC_{ALL}	lc/h
Minimum RR lane changes, LC_{RR}	lc/pc	Non-weaving vehicle index, I_{NW}	

Weaving Segment Speed, Density, Level of Service, and Capacity

Weaving segment flow rate, v	6025 pc/h	Weaving intensity factor, W	
Weaving segment capacity, c_w	5277 veh/h	Weaving segment speed, S	mph
Weaving segment v/c ratio	1.093	Average weaving speed, S_W	mph
Weaving segment density, D	pc/mi/ln	Average non-weaving speed, S_{NW}	mph
Level of Service, LOS	F	Maximum weaving length, L_{MAX}	7079 ft

Notes

a. Weaving segments longer than the calculated maximum length should be treated as isolated merge and diverge areas using the procedures of Chapter 13, "Freeway Merge and Diverge Segments".
b. For volumes that exceed the weaving segment capacity, the level of service is "F".

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RAMPS AND RAMP JUNCTIONS WORKSHEET

General Information / Site Information

Analyst	LSH	Freeway/Dir of Travel	H-1 Westbound
Agency or Company	Parsons Brinckerhoff, Inc.	Junction	Off-Ramp To Middle St
Date Performed	11/6/2012	Jurisdiction	Honolulu
Analysis Time Period	PM Peak Hour	Analysis Year	2012

Project Description H-1 Improvements

Inputs

Upstream Adj Ramp		Number of Lanes, N	3	Downstream Adj Ramp	
☐ Yes	☐ On	Acceleration Lane Length, L_A		☐ Yes	☐ On
☑ No	☐ Off	Deceleration Lane Length L_D	1300	☑ No	☐ Off
L_{up} =	ft	Freeway Volume, V_F	1626	L_{down} =	ft
V_u =	veh/h	Ramp Volume, V_R	225	V_D =	veh/h
		Freeway Free-Flow Speed, S_{FF}	60.0		
		Ramp Free-Flow Speed, S_{FR}	40.0		

Conversion to pc/h Under Base Conditions

(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$
Freeway	1626	0.90	Rolling	3	0	0.957	1.00	1888
Ramp	225	0.90	Rolling	3	0	0.957	1.00	261
UpStream								
DownStream								

Estimation of v_{12}

Merge Areas

$V_{12} = V_F (P_{FM})$

L_{EQ} = (Equation 13-6 or 13-7)

P_{FM} = using Equation (Exhibit 13-6)

V_{12} = pc/h

V_3 or V_{av34} pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☐ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☐ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Diverge Areas

$V_{12} = V_R + (V_F - V_R)P_{FD}$

L_{EQ} = (Equation 13-12 or 13-13)

P_{FD} = 0.701 using Equation (Exhibit 13-7)

V_{12} = 1401 pc/h

V_3 or V_{av34} 487 pc/h (Equation 13-14 or 13-17)

Is V_3 or V_{av34} > 2,700 pc/h? ☐ Yes ☑ No

Is V_3 or V_{av34} > 1.5 * V_{12}/2 ☐ Yes ☑ No

If Yes, V_{12a} = pc/h (Equation 13-16, 13-18, or 13-19)

Capacity Checks

	Actual	Capacity		LOS F?
V_{FO}		Exhibit 13-8		

	Actual	Capacity		LOS F?
V_F	1888	Exhibit 13-8	6900	No
$V_{FO} = V_F - V_R$	1627	Exhibit 13-8	6900	No
V_R	261	Exhibit 13-10	2100	No

Flow Entering Merge Influence Area

	Actual	Max Desirable		Violation?
V_{R12}		Exhibit 13-8		

Flow Entering Diverge Influence Area

	Actual	Max Desirable		Violation?
V_{12}	1401	Exhibit 13-8	4400:All	No

Level of Service Determination (if not F)

$D_R = 5.475 + 0.00734\, v_R + 0.0078\, V_{12} - 0.00627\, L_A$

D_R = (pc/mi/ln)

LOS = (Exhibit 13-2)

$D_R = 4.252 + 0.0086\, V_{12} - 0.009\, L_D$

D_R = 4.6 (pc/mi/ln)

LOS = A (Exhibit 13-2)

Speed Determination

M_S = (Exibit 13-11)

S_R= mph (Exhibit 13-11)

S_0= mph (Exhibit 13-11)

S = mph (Exhibit 13-13)

D_s = 0.386 (Exhibit 13-12)

S_R= 53.0 mph (Exhibit 13-12)

S_0= 65.8 mph (Exhibit 13-12)

S = 55.8 mph (Exhibit 13-13)

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APPENDIX D QUEUING OBSERVATION WORKSHEETS

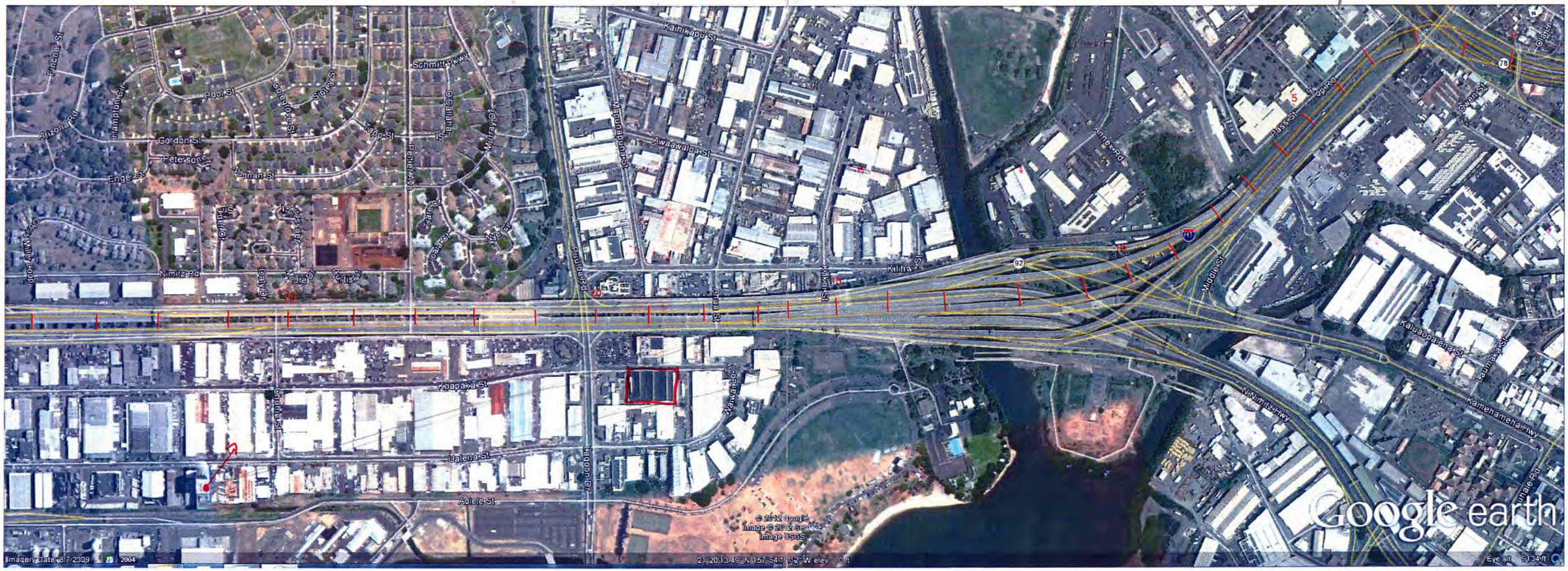
Eastbound Queuing Summary at Middle Street Merge

	Avg. BOQ (ft.)	Avg. BOQ Landmark	Max. BOQ (ft.)	Max. BOQ Landmark	Observations
H-1 Viaduct					
AM(6:30AM-8:30AM)	7,050	100 ft West of Lagoon Dr. , and close to Infiniti and Audi dealer	10,650	100 ft East of Camp Catlin Rd, and close to Advantage Rent A-Car	1. Cannot see any spot before #12 2. Traffic accident in Middle Lane at 8:20 AM
MD(1:30PM-2:30PM)	No congestion and queuing in MD				
PM(4:30PM-6:00PM)	2,500	Just Pass offramp to Nimitz Highway and Kamehame highway (near Manukai Wholesale Mart)	4,650	At Exit to Nimitz Highway	
Moanalua Freeway					
AM(6:30AM-8:30AM)	3,800	Middle of Kikowaena St Overpass and Funston Rd overpass, and at Exit of N King St to Funston Rd.	5,000	OffRamp to N King St, and near Moanalua Gardens Foundations	
MD(1:30PM-2:30PM)	No congestion and queuing in MD				
PM(4:30PM-6:00PM)	No congestion and queuing in PM				

*Queuing starting from Middle Street merge eastbound gore point.

H1 Freeway
EB Queuing

10/23/12
DM



X = Queue Cycle

AM Peak Hour: 6:00 a.m. - 7:00 a.m.

6:00 a.m.:							6:45 a.m.:	X	X	X			7:30 a.m.:	22			815	22
6:05 a.m.:							6:50 a.m.:	X	X	X	X	X	7:35 a.m.:	23			820	21
6:10 a.m.:	X	X	X	X	X	X	6:55 a.m.:	X	X	X	X	X	7:40 a.m.:	23			825	20
6:15 a.m.:	X	X	X	X	X	X	7:00 a.m.:	X	X	X	X	X	7:45 a.m.:	23			8[illegible]	19
6:20 a.m.:	X	X	X	X	X	X	7:05 a.m.:	12	X	X	X	X	7:50 a.m.:	22			[illegible]	X
6:25 a.m.:	X	X	X	X	X	X	7:10 a.m.:	12+					7:55 a.m.:	23			845	
6:30 a.m.:	X	X	X	X	X	X	7:15 a.m.:	18					8:00 a.m.:	23			84[illegible]	
6:35 a.m.:	X	X	X	X	X	X	7:20 a.m.:	19					8:05 a.m.:	24			[illegible]	
6:40 a.m.:	X	X	X	X	X	X	7:25 a.m.:	22					8:10 a.m.:	22			[illegible]	

Cannot see any spot before #12 17

10/23/2012 - On the Airport Center Parking lot

6:10 AM - Picture taken of my view of the H-1 freeway

- Took picture showing building obstructing line of sight
- Took picture showing Queue every 5 mins starting from 730 AM

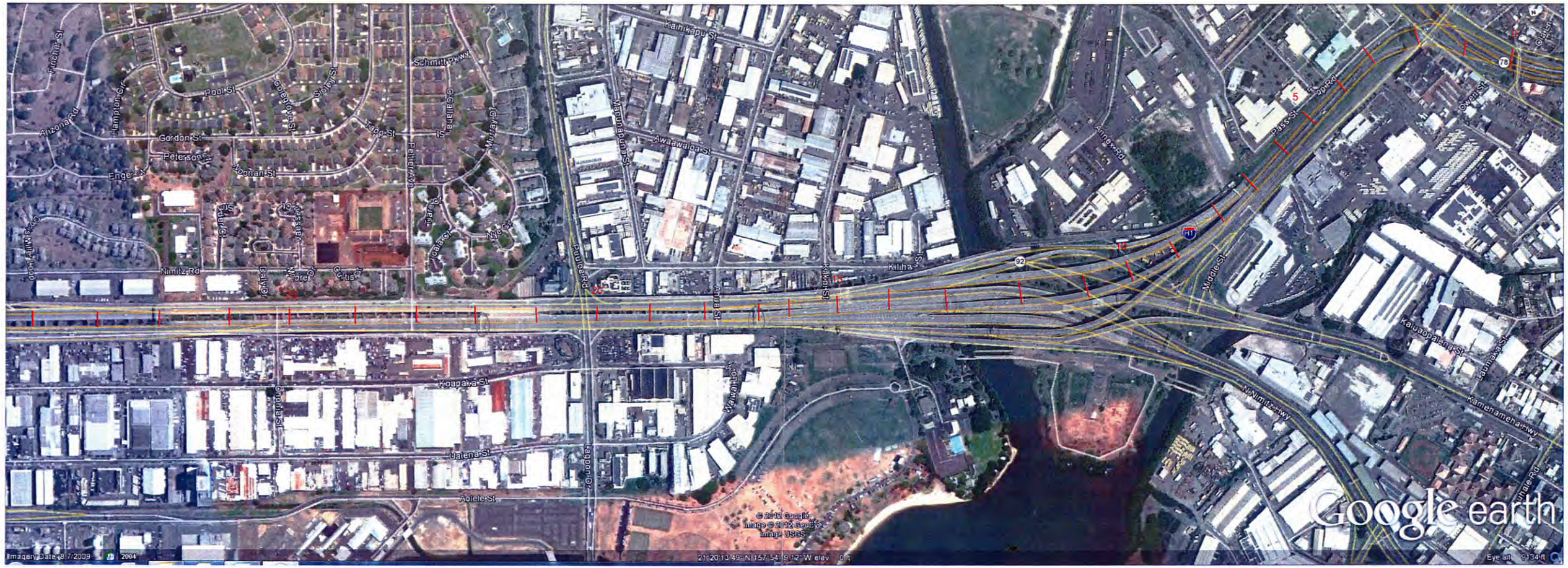
~~730~~

835

BY: DAVID MIYASAKI

H1 Freeway
EB Queuing

10/25/12
PA



AM Peak Hour: 6:30 a.m. - 8:30 a.m.

6:30 a.m.: 8	7:15 a.m.: 23	8:00 a.m.: 29+	8:45 a.m.:
6:35 a.m.: 10	7:20 a.m.: 23.5	8:05 a.m.: 29+	8:50 a.m.:
6:40 a.m.: 12	7:25 a.m.: 27	8:10 a.m.: 29+	8:55 a.m.:
6:45 a.m.: 12	7:30 a.m.: 29+	8:15 a.m.: 29+	9:05 a.m.:
6:50 a.m.: 13	7:35 a.m.: 23	8:20 a.m.: X traffic accident in middle lane	9:10 a.m.:
6:55 a.m.: 18	7:40 a.m.: 24.5	8:25 a.m.: X " " closed	9:15 a.m.:
7:00 a.m.: 18	7:45 a.m.: 27	8:30 a.m.: X	9:20 a.m.:
7:05 a.m.: 18.5	7:50 a.m.: 29+	8:35 a.m.:	9:25 a.m.:
7:10 a.m.: 23	7:55 a.m.: 29+	8:40 a.m.:	9:30 a.m.:

H1 Freeway
EB Queuing

10/23/12
DM

MD Peak Hour: 1:30 p.m. - 2:30 p.m.

1:30 p.m.:	X	X				2:15 p.m.:	X	X				3:00 p.m.:	X	X
1:35 p.m.:	X	X				2:20 p.m.:	X	X				3:05 p.m.:		
1:40 p.m.:	X	X				2:25 p.m.:	X	X				3:10 p.m.:		
1:45 p.m.:	X	X				2:30 p.m.:	X	X				3:15 p.m.:		
1:50 p.m.:	X	X				2:35 p.m.:	X	X				3:20 p.m.:		
1:55 p.m.:	X	X				2:40 p.m:	X	X				3:25 p.m.:		
2:00 p.m.:	X	X				2:45 p.m.:	X	X				3:30 p .m.:		
2:05 p.m.:	X	X				2:50 p.m.:	X	X				3:35 p.m.:		
2:10 p.m.:	X	X				2:55 p.m.:	X	X				3:40 p.m.:		

MD

MS: Middle Street, Data recorded for lanes 1+2

1) 125 pm. Taken from MS overpass. Looking EB
H1 EB after merge showing no congestion

2) 130 pm. Taken from above the tunnel Before the merge
H1 from airport showing no congestion at start
of data collection. Looking WB

3) 205 pm. Taken from MS overpass Looking EB
H1 EB after merge showing no congestion

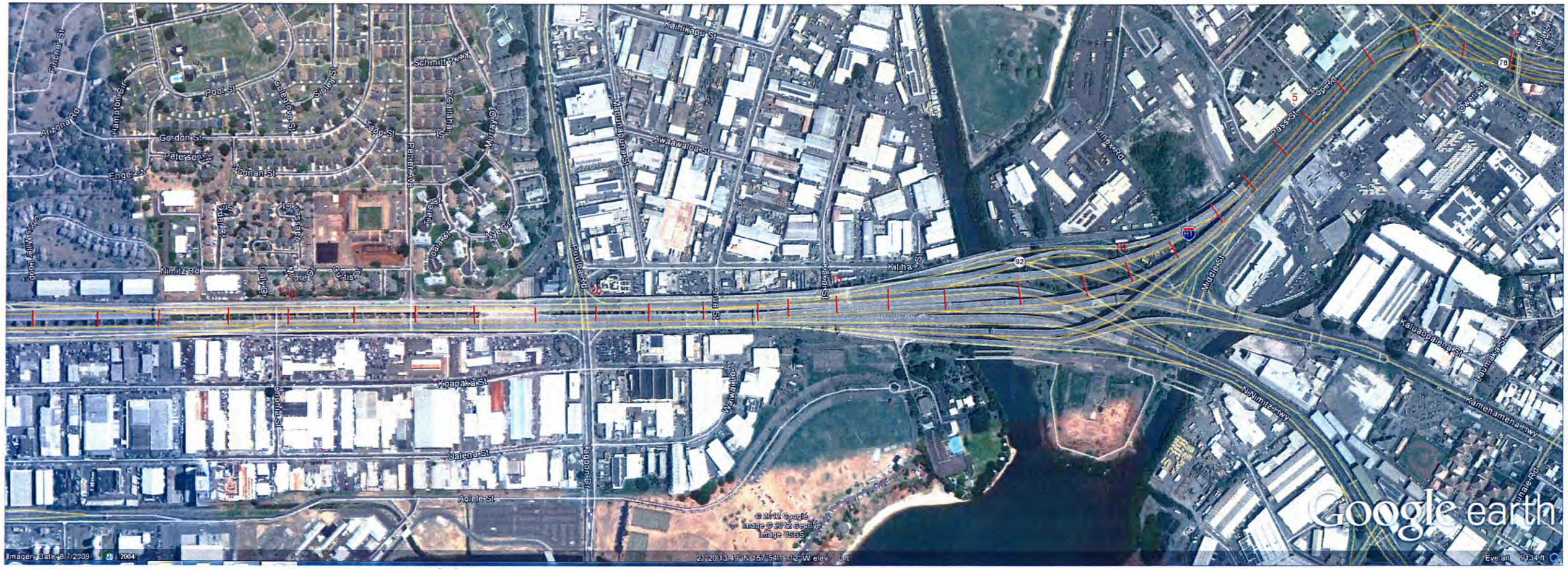
4) 210 PM. Taken from above ~~the~~ the tunnel before merge
H1 from airport showing no congestion. Looking WB

5) 215 PM. Taken from MS merge looking WB
H201 ~~[illegible]~~ EB before MS merge showing no congestion.

I stopped at 300 PM. There was no
congestion or queuing between 130PM-300PM

H1 Freeway
EB Queuing

10/25/12
PA



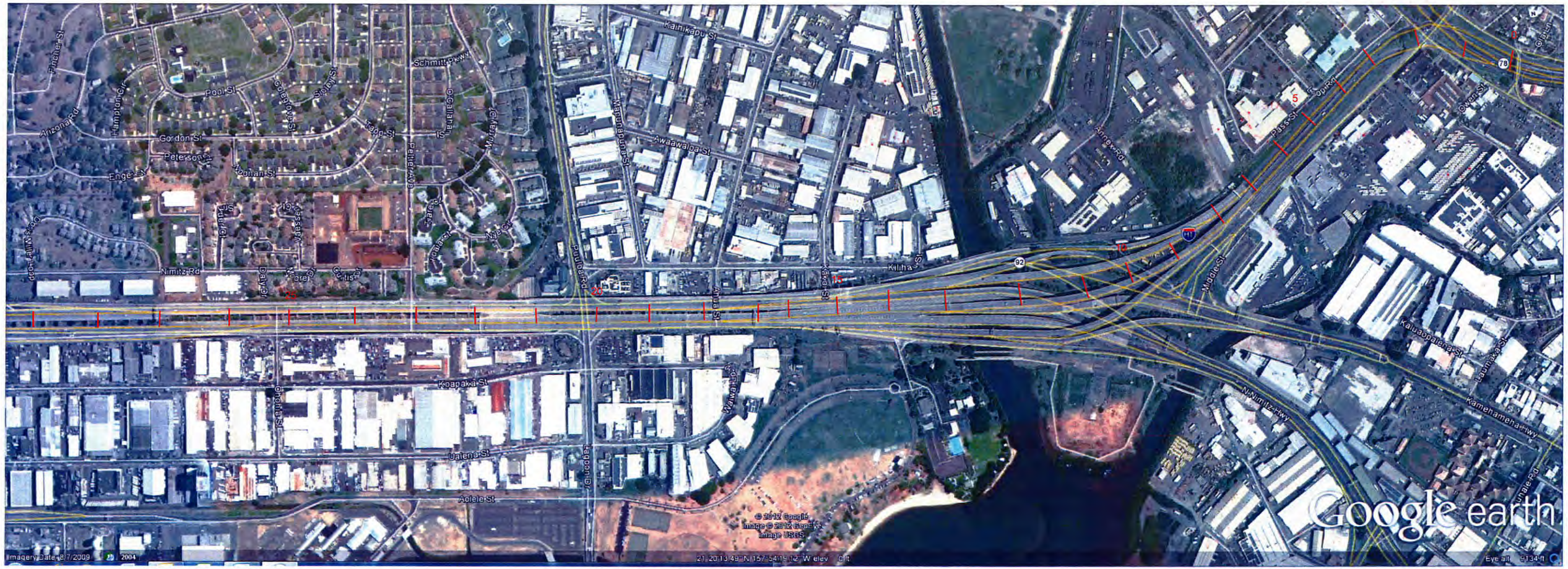
location: Ala Lana Overpass —> TheBus Middle St facility
1:30 - 2:05pm 2:10 - 2:30pm

MD Peak Hour: 1:30 p.m. - 2:30 p.m.

1:30 p.m.: X	2:15 p.m.: X	3:00 p.m.:	3:45 p.m.:
1:35 p.m.: X	2:20 p.m.: X	3:05 p.m.:	3:50 p.m.:
1:40 p.m.: X	2:25 p.m.: X	3:10 p.m.:	3:55 p.m.:
1:45 p.m.: X	2:30 p.m.: X	3:15 p.m.:	4:00 p.m.:
1:50 p.m.: X	2:35 p.m.:	3:20 p.m.:	4:05 p.m.:
1:55 p.m.: X	2:40 p.m.:	3:25 p.m.:	4:10 p.m.:
2:00 p.m.: X	2:45 p.m.:	3:30 p .m.:	4:15 p.m.:
2:05 p.m.: X	2:50 p.m.:	3:35 p.m.:	4:20 p.m.:
2:10 p.m.: X	2:55 p.m.:	3:40 p.m.:	4:25 p.m.:

H1 Freeway
EB Queuing

10/23/12
DM



PM Peak Hour: 6:00 p.m. - 7:00 p.m.

5:30 p.m.:	X	X				6:15 p.m.:	X	X				7:00 p.m.:				
5:35 p.m.:	X	X				6:20 p.m.:	X	X				7:05 p.m.:				
5:40 p.m.:	X	X				6:25 p.m.:	X	X				7:10 p.m.:				
5:45 p.m.:	X	X				6:30 p.m.:	X	X				7:15 p.m.:				
5:50 p.m.:	X	X				6:35 p.m.:	✓	✓				7:20 p.m.:				
5:55 p.m.:	X	X				6:40 p.m:	✓	✓				7:25 p.m.:				
6:00 p.m.:	X	X				6:45 p.m.:	✓	✓				7:30 p .m.:				
6:05 p.m.:	X	X				6:50 p.m.:						7:35 p.m.:				
6:10 p.m.:	X	X				6:55 p.m.:						7:40 p.m.:				

MS: Middle Street

PM

~~Taken from MS overpass~~

~~1 - 125 pm H1 EB after merge showing no congestion~~

~~2 - 130 pm H1 from airport before MS merge~~

~~showing no congestion at start of data collection~~

~~Taken from above the tunnel before the merge.~~

I took a photo of PM before the first 530 PM Photo.

1) 530 PM, no congestion (townbound)

H1 EB after merge, looking EB

2) 535 PM, no townbound congestion

H1 from airport before merge, looking WB

3) 540 PM, no townbound congestion

H201 before merge, looking WB

4) 615 PM H1 EB after merge

5) 620 PM H1 from airport before merge

6) 625 PM H201 before merge

Left early. No Queue.

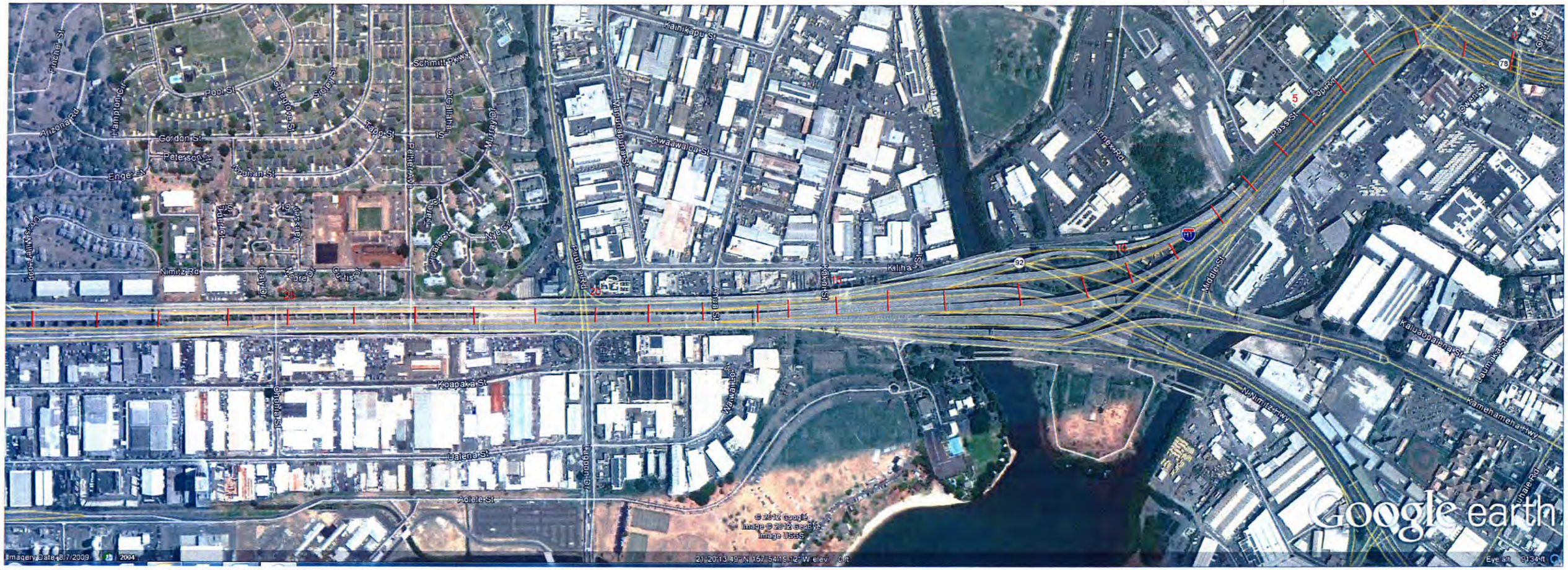
Lost my phone. Couldnt check it

Slowdown was based assumed based

H1 Freeway
EB Queuing

10/25/12 HL.
Thursday, clear,

3049 Valena St.



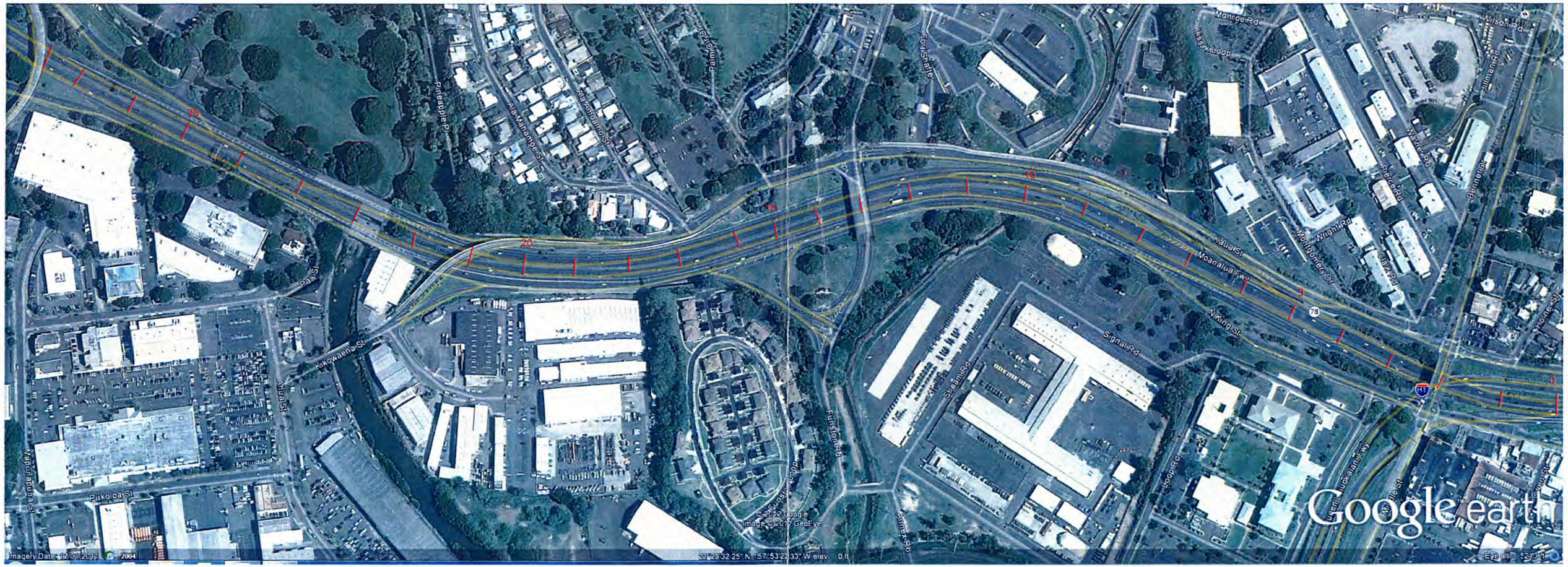
Noanalua freeway EB queue to Middle St

PM Peak Hour: 4:30 p.m. - 5:30 p.m.

4:30 p.m.:	9	9	9	9	9	5:15 p.m.:	9					6:00 p.m.:						6:45 p.m.:					
4:35 p.m.:	9					5:20 p.m.:	9					6:05 p.m.:						6:50 p.m.:					
4:40 p.m.:	<13					5:25 p.m.:						6:10 p.m.:						6:55 p.m.:					
4:45 p.m.:						5:30 p.m.:	9					6:15 p.m.:						7:00 p.m.:					
4:50 p.m.:	<13					5:35 p.m.:						6:20 p.m.:						7:05 p.m.:					
4:55 p.m.:						5:40 p.m.:	6					6:25 p.m.:						7:10 p.m.:					
5:00 p.m.:						5:45 p.m.:	1					6:30 p .m.:						7:15 p.m.:					
5:05 p.m.:	8					5:50 p.m.:	1					6:35 p.m.:						7:20 p.m.:					
5:10 p.m.:	8					5:55 p.m.:	2					6:40 p.m.:						7:25 p.m.:					

Moanalua Freeway
EB Queuing

10/23/12
SL

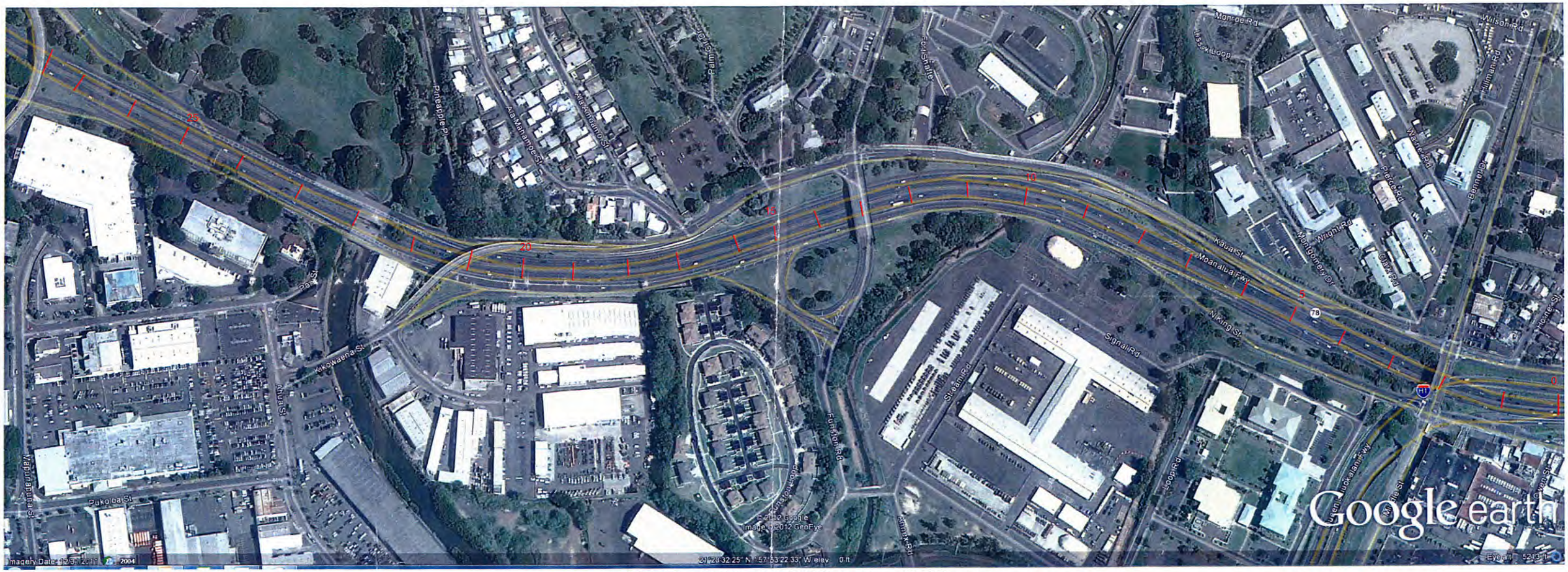


AM Peak Hour: 6:00 a.m. - 7:00 a.m.

6:00 a.m.:						6:45 a.m.:	23	20				7:30 a.m.:	12	10		18	18
6:05 a.m.:						6:50 a.m.:	21	21				7:35 a.m.:	15	12		22	22
6:10 a.m.:						6:55 a.m.:	21	16	15	15		7:40 a.m.:	16	16		28	
6:15 a.m.:						7:00 a.m.:	18	15	15	12		7:45 a.m.:	20	20		28	20
6:20 a.m.:						7:05 a.m.:	13	10	10			7:50 a.m.:	22	20		25	26
6:25 a.m.:						7:10 a.m.:	17	11	11			7:55 a.m.:	25	20		30	25
6:30 a.m.:	15					7:15 a.m.:	17	16	10			8:00 a.m.:	20	20	15	20	22
6:35 a.m.:	19	15				7:20 a.m.:	15	10		25		8:05 a.m.:	21	20		20	23
6:40 a.m.:	21	20	15			7:25 a.m.:	12	10		26	23	8:10 a.m.:	17	16		20	25

Moanalua Freeway
EB Queuing

10/25/12
SL

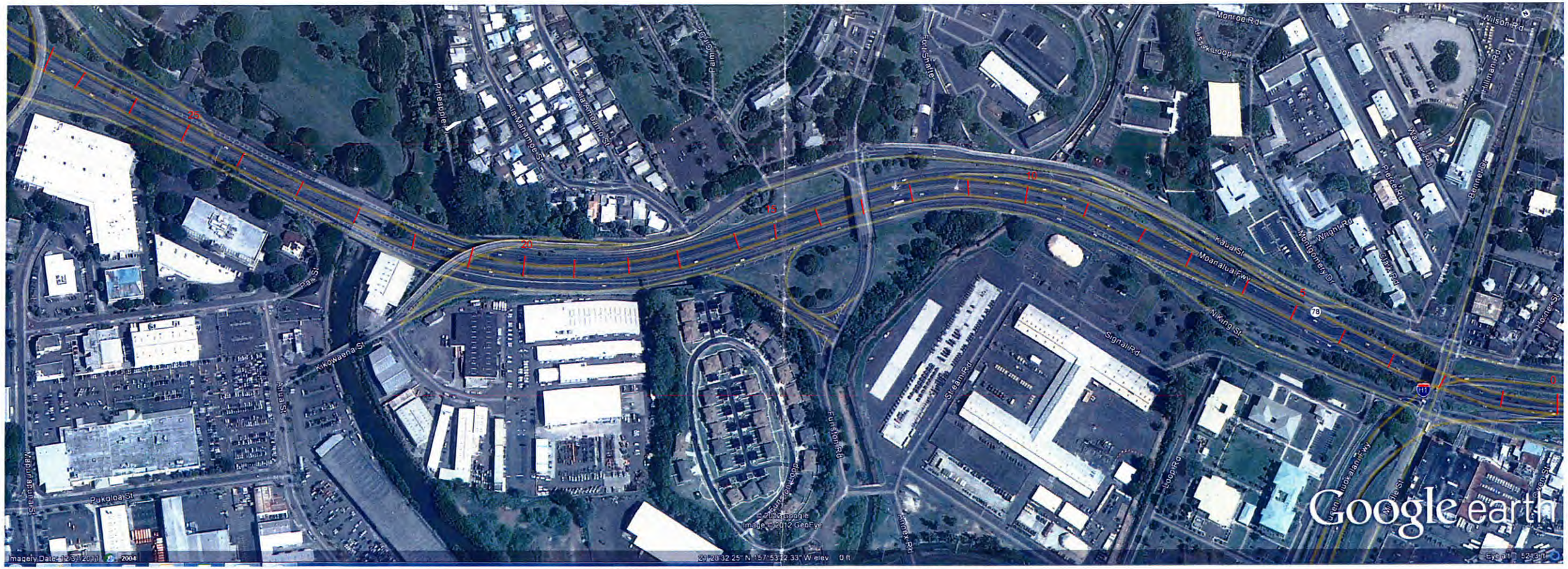


AM Peak Hour: 6:30 a.m. - 8:30 a.m.

6:30 a.m.:						7:15 a.m.:	/	/	/	/	/	8:00 a.m.:	/	/	/	/	/
6:35 a.m.:						7:20 a.m.:	/	/	/	/	/	8:05 a.m.:	/	/	/	/	/
6:40 a.m.:						7:25 a.m.:	/	/	/	/	/	8:10 a.m.:	/	/	/	/	/
6:45 a.m.:						7:30 a.m.:	/	/	/	/	/	8:15 a.m.:	/	/	/	/	/
6:50 a.m.:						7:35 a.m.:	/	/	/	/	/	8:20 a.m.:	/	/	/	/	/
6:55 a.m.:						7:40 a.m.:	/	/	/	/	/	8:25 a.m.:	/	/	/	/	/
7:00 a.m.:						7:45 a.m.:	/	/	/	/	/	8:30 a.m.:	/	/	/	/	/
7:05 a.m.:			/		/	7:50 a.m.:	/	/	/	/	/	8:35 a.m.:	/	/	/	/	/
7:10 a.m.:		/	/	/	/	7:55 a.m.:	/	/	/	/	/	8:40 a.m.:	/	/	/	/	/

Moanalua Freeway
EB Queuing

10/23/12
SL

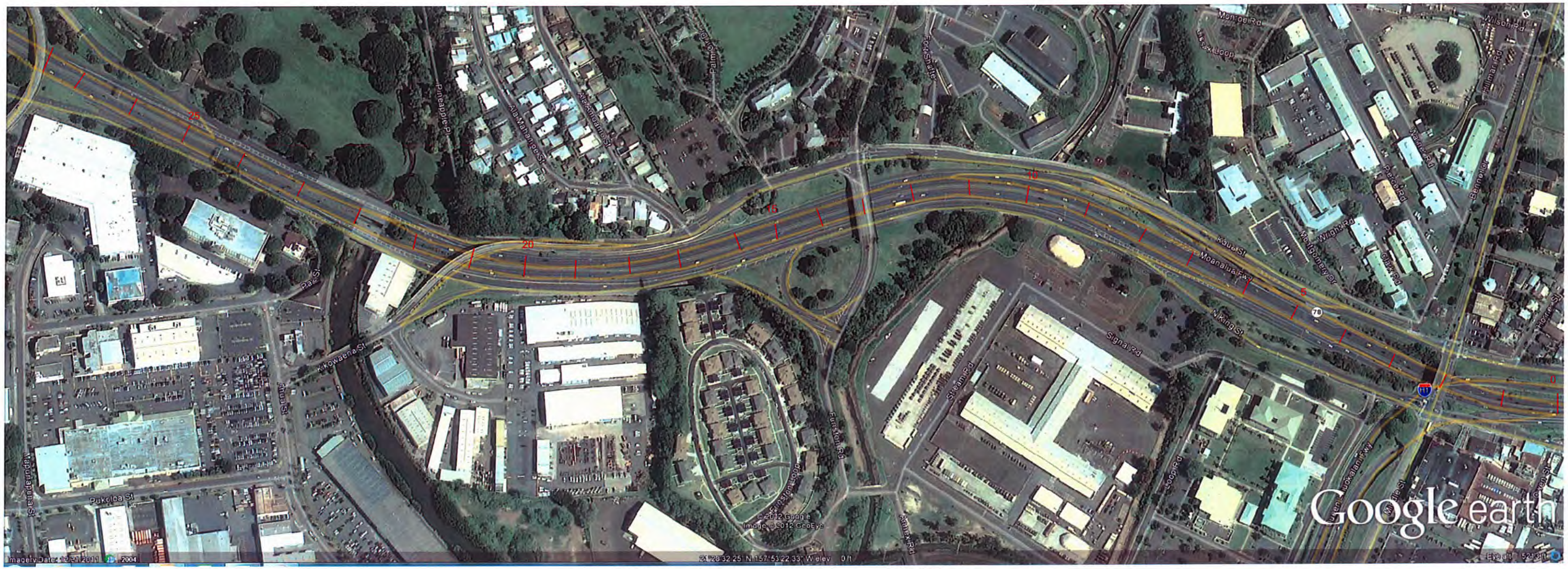


MD Peak Hour: 1:30 p.m. - 2:30 p.m.

1:30 p.m.:	/					2:15 p.m.:	/					3:00 p.m.:				
1:35 p.m.:	/					2:20 p.m.:	/					3:05 p.m.:				
1:40 p.m.:	/					2:25 p.m.:	/					3:10 p.m.:				
1:45 p.m.:	/					2:30 p.m.:	/					3:15 p.m.:				
1:50 p.m.:	/					2:35 p.m.:						3:20 p.m.:				
1:55 p.m.:	/					2:40 p.m.:						3:25 p.m.:				
2:00 p.m.:	/					2:45 p.m.:						3:30 p .m.:				
2:05 p.m.:	/					2:50 p.m.:						3:35 p.m.:				
2:10 p.m.:	/					2:55 p.m.:						3:40 p.m.:				

Moanalua Freeway
EB Queuing

10/25/12
SL

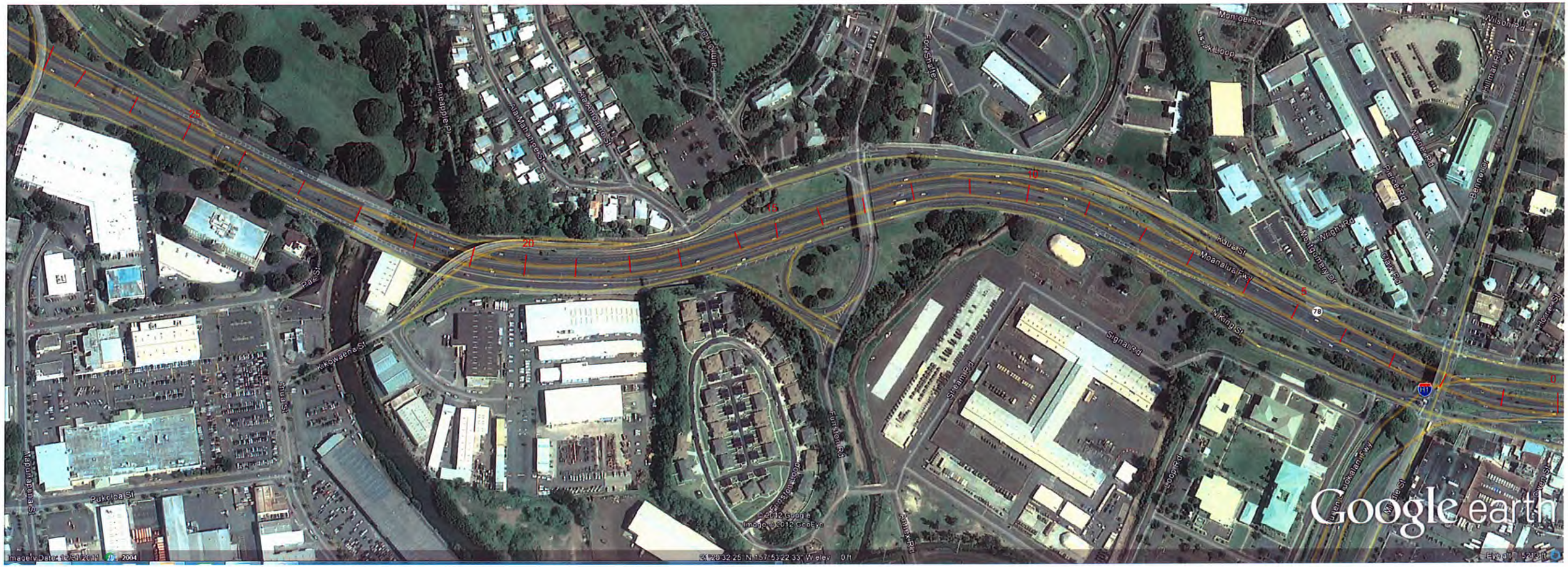


MD Peak Hour: 1:30 p.m. - 2:30 p.m.

1:30 p.m.:	/	/	/	/	/	2:15 p.m.:	/	/	/	/	/	3:00 p.m.:					
1:35 p.m.:	/	/	/	/	/	2:20 p.m.:	/	/	/	/	/	3:05 p.m.:					
1:40 p.m.:	/	/	/	/	/	2:25 p.m.:	/	/	/	/	/	3:10 p.m.:					
1:45 p.m.:	/	/	/	/	/	2:30 p.m.:	/	/	/	/	/	3:15 p.m.:					
1:50 p.m.:	/	/	/	/	/	2:35 p.m.:						3:20 p.m.:					
1:55 p.m.:	/	/	/	/	/	2:40 p.m:						3:25 p.m.:					
2:00 p.m.:	/	/	/	/	/	2:45 p.m.:						3:30 p .m.:					
2:05 p.m.:	/	/	/	/	/	2:50 p.m.:						3:35 p.m.:					
2:10 p.m.:	/	/	/	/	/	2:55 p.m.:						3:40 p.m.:					

Moanalua Freeway
EB Queuing

10/23/12
SL

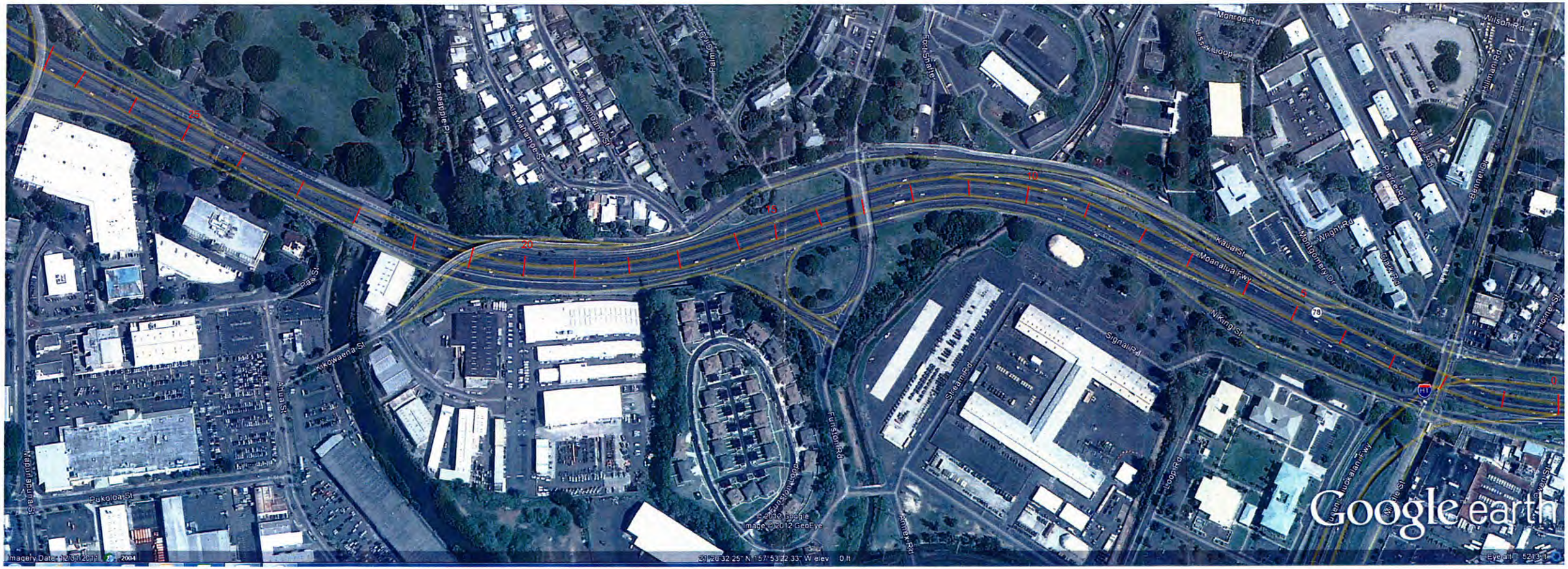


PM Peak Hour: 6:00 p.m. - 7:00 p.m.

5:30 p.m.:	/	/	/	/	/	6:15 p.m.:	/	/	/	/	/	7:00 p.m.:	/	/	/	/	/
5:35 p.m.:	/	/	/	/	/	6:20 p.m.:	/	/	/	/	/	7:05 p.m.:	/	/	/	/	/
5:40 p.m.:	/	/	/	/	/	6:25 p.m.:	/	/	/	/	/	7:10 p.m.:	/	/	/	/	/
5:45 p.m.:	/	/	/	/	/	6:30 p.m.:	/	/	/	/	/	7:15 p.m.:	/	/	/	/	/
5:50 p.m.:	/	/	/	/	/	6:35 p.m.:	/	/	/	/	/	7:20 p.m.:	/	/	/	/	/
5:55 p.m.:	/	/	/	/	/	6:40 p.m:	/	/	/	/	/	7:25 p.m.:	/	/	/	/	/
6:00 p.m.:	/	/	/	/	/	6:45 p.m.:	/	/	/	/	/	7:30 p .m.:	/	/	/	/	/
6:05 p.m.:	/	/	/	/	/	6:50 p.m.:	/	/	/	/	/	7:35 p.m.:					
6:10 p.m.:	/	/	/	/	/	6:55 p.m.:	/	/	/	/	/	7:40 p.m.:					

Moanalua Freeway
EB Queuing

10/25/12
SL



PM Peak Hour: 6:00 p.m. - 7:00 p.m.

4:30 ~~5:30~~ p.m.:	5 6:15 p.m.:	7:00 p.m.:
4:35 ~~5:35~~ p.m.:	6:20 p.m.:	7:05 p.m.:
4:40 ~~5:40~~ p.m.:	6:25 p.m.:	7:10 p.m.:
4:45 ~~5:45~~ p.m.:	6:30 p.m.:	7:15 p.m.:
4:50 ~~5:50~~ p.m.:	6:35 p.m.:	7:20 p.m.:
4:55 ~~5:55~~ p.m.:	6:40 p.m.:	7:25 p.m.:
5:00 ~~6:00~~ p.m.:	6:45 p.m.:	7:30 p .m.:
5:05 ~~6:05~~ p.m.:	6:50 p.m.:	7:35 p.m.:
5:10 ~~6:10~~ p.m.:	6:55 p.m.:	7:40 p.m.:

APPENDIX E VISSIM ANALYSIS WORKSHEETS

H1 Weaving Analysis (Baseline)

Link	Segment Name	H1 Weaving Analysis			
		AM Peak Hour			
Sum of Density (pc/mi-lane)		Lane			
Link	Section	1	2	3	4
1	EB H1 after Likelike Offramp	118.4	113.4	96.8	
2	EB Likelike Offramp	16.7			
4	H1 Airport before Middle Street Merge	111.2	116.1		
5	EB H201 at Middle Street Merge	113.4	105.1	141.2	
7	EB H201 before Middle Street Merge	55.3	54.6	65.9	
10	EB H1 before Likelike Offramp	**115.3**	**106.5**	**134.1**	**95.2**
18	H1 Airport along Likelike Offramp	166.3			
LOS		Lane			
Link	Section	1	2	3	4
1	EB H1 after Likelike Offramp	**F**	**F**	**F**	
2	EB Likelike Offramp	**B**			
4	H1 Airport before Middle Street Merge	**F**	**F**		
5	EB H201 at Middle Street Merge	**F**	F	F	
7	EB H201 before Middle Street Merge	**F**	**F**	**F**	
10	EB H1 before Likelike Offramp	**F**	F	F	F
18	H1 Airport along Likelike Offramp	**F**			
Average of Speed (mph)		Lane			
Link	Section	1	2	3	4
1	EB H1 after Likelike Offramp	12.82	14.06	19.84	
2	EB Likelike Offramp	41.19			
4	H1 Airport before Middle Street Merge	9.12	7.94		
5	EB H201 at Middle Street Merge	14.17	16.76	8	
7	EB H201 before Middle Street Merge	30	28.72	14.8	
10	EB H1 before Likelike Offramp	**13.8**	**16.44**	**8.54**	**12.95**
18	H1 Airport along Likelike Offramp	7.42			
Sum of Volume(pc/hr-lane)		Lane			
Link	Section	1	2	3	4
1	EB H1 after Likelike Offramp	1517.74	1594.1	1919.8	
2	EB Likelike Offramp	689.27			
4	H1 Airport before Middle Street Merge	1014.39	922.12		
5	EB H201 at Middle Street Merge	1606.55	1761	1129.39	
7	EB H201 before Middle Street Merge	**1659.5**	**1567.62**	**975.12**	
10	EB H1 before Likelike Offramp	**1591.37**	**1750.13**	**1145.5**	**1233.15**
18	H1 Airport along Likelike Offramp	1233.99			

Travel Times (s)		
Link	Section	Time
1	H1 airport viaduct to Likelike Offramp	**952**
2	H1 airport viaduct to H1 EB after Likelike Offramp	**977**
3	H201 to Likelike Offramp	**746**
4	H201 to H1 EB after Likelike Offramp	**375**

Queue Length=	
H201 before merge Average	**3494**
H201 before merge Max	**5150**
H1 airport before merge Average	**6751**
H1 airport before merge Max	**9936**

H1 Weaving Analysis (Alternative 1)

Link	Segment Name	H1 Weaving Analysis			
		AM Peak Hour			
Sum of Density (pc/mi-lane)		Lane			
Link	Section	1	2	3	4
1	EB H1 after Likelike Offramp	38.8	30.9	25.7	16.5
2	EB Likelike Offramp	23.5			
4	H1 Airport before Middle Street Merge	168.0	146.6		
5	EB H201 at Middle Street Merge	54.5	84.6	93.1	
7	EB H201 before Middle Street Merge	84.7	100.2	55.8	
10	EB H1 before Likelike Offramp	**67.1**	**99.1**	**97.4**	**71.7**
18	H1 Airport along Likelike Offramp	106.5			
LOS		**Lane**			
Link	Section	**1**	**2**	**3**	**4**
1	EB H1 after Likelike Offramp	**E**	**D**	**C**	B
2	EB Likelike Offramp	**C**			
4	H1 Airport before Middle Street Merge	**F**	**F**		
5	EB H201 at Middle Street Merge	**F**	F	F	
7	EB H201 before Middle Street Merge	**F**	**F**	**F**	
10	EB H1 before Likelike Offramp	**F**	F	F	F
18	H1 Airport along Likelike Offramp	**F**			
Average of Speed (mph)		**Lane**			
Link	Section	**1**	**2**	**3**	**4**
1	EB H1 after Likelike Offramp	50.91	51.38	51.33	52.15
2	EB Likelike Offramp	41.96			
4	H1 Airport before Middle Street Merge	3.96	6.17		
5	EB H201 at Middle Street Merge	35.91	21.99	15.69	
7	EB H201 before Middle Street Merge	23.09	17.23	30.21	
10	EB H1 before Likelike Offramp	**29.6**	**16.53**	**16.28**	**21.96**
18	H1 Airport along Likelike Offramp	14.59			
Sum of Volume(pc/hr-lane)		**Lane**			
Link	Section	**1**	**2**	**3**	**4**
1	EB H1 after Likelike Offramp	1975.05	1585.58	1319.16	859.53
2	EB Likelike Offramp	986.19			
4	H1 Airport before Middle Street Merge	665.13	904.73		
5	EB H201 at Middle Street Merge	1955.67	1859.7	1461.21	
7	EB H201 before Middle Street Merge	**1955.56**	**1725.94**	**1684.64**	
10	EB H1 before Likelike Offramp	**1987.36**	**1637.55**	**1586.23**	**1573.9**
18	H1 Airport along Likelike Offramp	1553.39			

Travel Times (s)		
Link	Section	Time
1	H1 airport viaduct to Likelike Offramp	**1098**
2	H1 airport viaduct to H1 EB after Likelike Offramp	**1058**
3	H201 to Likelike Offramp	**248**
4	H201 to H1 EB after Likelike Offramp	**300**

Queue Length=	
H201 before merge Average	**1919**
H201 before merge max	**3699**
H1 airport before merge Average	**8370**
H1 airport before merge Max	**11032**

H1 Weaving Analysis (Alternative 2)

Link	Segment Name	H1 Weaving Analysis			
		AM Peak Hour			
		Volume Demand	Volume Served	% served	GEH
1	**EB H1 after Likelike Offramp**	6409	5667	88%	9.55
2	**EB Likelike Offramp**	1124	1085	97%	1.18
4	**H1 Airport before Middle Street Merge**	2370	2316	98%	1.12
5	**EB H201 at Middle Street Merge**	5853	5742	98%	1.45
7	**EB H201 before Middle Street Merge**	5163	4484	87%	9.78
10	**EB H1 before Likelike Offramp**	7533	6744	90%	9.34
18	**H1 Airport along Likelike Offramp**	1680	942	56%	20.39

Sum of Density (pc/mi-lane)		Lane			
Link	Section	1	2	3	4
1	EB H1 after Likelike Offramp	11.4	35.2	35.5	35.4
2	EB Likelike Offramp	28.5			
4	H1 Airport before Middle Street Merge	50.1	21.8		
5	EB H201 at Middle Street Merge	44.9	37.4	43.2	
7	EB H201 before Middle Street Merge	47.5	40.2	42.8	
10	EB H1 before Likelike Offramp	**50.7**	**50.1**	**57.6**	**72.3**
18	H1 Airport along Likelike Offramp	23.2			

LOS		**Lane**			
Link	Section	**1**	**2**	**3**	**4**
1	EB H1 after Likelike Offramp	**B**	**E**	**E**	E
2	EB Likelike Offramp	**D**			
4	H1 Airport before Middle Street Merge	**F**	**C**		
5	EB H201 at Middle Street Merge	**E**	E	E	
7	EB H201 before Middle Street Merge	**F**	**E**	**E**	
10	EB H1 before Likelike Offramp	**F**	F	F	F
18	H1 Airport along Likelike Offramp	**C**			

Average of Speed (mph)		**Lane**			
Link	Section	**1**	**2**	**3**	**4**
1	EB H1 after Likelike Offramp	53.65	51.53	50.78	48.08
2	EB Likelike Offramp	40.31			
4	H1 Airport before Middle Street Merge	27.53	50.54		
5	EB H201 at Middle Street Merge	50.73	50.66	42.87	
7	EB H201 before Middle Street Merge	46.51	47.11	13.67	
10	EB H1 before Likelike Offramp	**42.18**	**36.49**	**30.4**	**18.58**
18	H1 Airport along Likelike Offramp	43.06			

Sum of Volume(pc/hr-lane)		**Lane**			
Link	Section	**1**	**2**	**3**	**4**
1	EB H1 after Likelike Offramp	613.1	1813.54	1801.14	1702.24
2	EB Likelike Offramp	1147.44			
4	H1 Airport before Middle Street Merge	1380.59	1101.3		
5	EB H201 at Middle Street Merge	2275.43	1896.73	1852.72	
7	EB H201 before Middle Street Merge	**2208.52**	**1896.14**	**585.59**	
10	EB H1 before Likelike Offramp	**2138.14**	**1829.6**	**1751.84**	**1343.04**
18	H1 Airport along Likelike Offramp	999.91			

Travel Times (s)		
Link	Section	Time
1	H1 airport viaduct to Likelike Offramp	**247**
2	H1 airport viaduct to H1 EB after Likelike Offramp	**356**
3	H201 to Likelike Offramp	**359**
4	H201 to H1 EB after Likelike Offramp	**212**

Average Queue Length (feet)	
H201 before merge Middle Street Merge	**1741**
H201 before merge Middle Street Max	**5951**
H1 airport before merge Middle Street Merge	**3372**
H1 airport before merge Middle Street Max	**6128**

APPENDIX G NOTICE OF INTENT AND NOTICE OF GENERAL PERMIT COVERAGE; NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PROGRAM

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NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

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

IN REPLY REFER TO:
HWY-DD 2.2828

September 12, 2012

TO: THE HONORABLE LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

ATTN: ALEC WONG, P.E., CHIEF
CLEAN WATER BRANCH

FROM: GLENN M. OKIMOTO, Ph.D.
DIRECTOR OF TRANSPORTATION

SUBJECT: INTERSTATE ROUTE H-1 REHABILITATION
MIDDLE STREET TO VICINITY OF WARD AVENUE
PROJECT NO: IM-H1-1(269)

Submitted for your review and approval is the Notice of Intent for the Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue project. Enclosed is the $500.00 application fee.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions regarding the project, please call Mr.Ross Hironaka, Hawaii Department of Transportation (HIDOT) Project Manager at 692-7575. If responding to this letter in writing, please reply to the attention of Mr.Ross Hironaka, Project Manager, Design Section, Design Branch, Highways Division and reference HWY-DD 2.2828 as noted above.

Enclosures

c: Parsons Brinkerhoff (Jim Hayes)

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Reset Form | Print Form

CWB NOI General Form for Appendix C

Previously assigned NGPC File No (for renewal NOI only): HI _____

Automatic Coverage (for New NOI only)
- ☐ I elect to **claim** automatic coverage per HAR, Section 11-55-34.09(f).
- ☒ I elect to **waive** automatic coverage per HAR, Section 11-55-34.09(g).

1. Owner Information

Owner Legal Name: State of Hawaii

Owner Department: Department of Transportation

Owner Division: Highways Division

Owner Mailing Address: 869 Punchbowl Street

Owner Mailing City: Honolulu | Owner Mailing State: HI | Owner Mailing Zip+4: 96813-5097

Owner Street Address: 869 Punchbowl Street

Owner City: Honolulu | Owner State: HI | Owner Zip+4: 96813-5097

Owner Contact Person First Name: Ross | Owner Contact Person Last Name: Hironaka

Owner Contact Person Position Title: HDOT Project Manager

Owner Phone No: 808-692-7575 | Owner Fax No: 808-692-7590

Owner Contact Person Email: Ross.Hironaka@hawaii.gov

2. Owner Type: Municipal

Options for Owner Type:
- Industrial - Private Facility or Project
- Municipal - City, County, or State Government Facility or Project
- Federal - Federal Government Facility or Project
- MS4 - Municipal Separate Storm Sewer System

3. Operator or General Contractor Information

☒ For CWB-NOI Forms C, F, G, and I only
The general contractor information will be submitted at least 30 calendar days before the start of construction activities.

Operator Legal Name: _____

Operator Department: _____

Operator Division: _____

Operator Mailing Address: _____

Operator Mailing City: _____ | Oper. Mailing State: HI | Operator Mailing Zip+4: _____

Operator Street Address: _____

Operator City: _____ | Operator State: HI | Operator Zip+4: _____

Operator Contact Person First Name: _____ | Oper. Contact Person Last Name: _____

Operator Contact Person Position Title: _____

Operator Phone No: _____ | Operator Fax No: _____

Operator Contact Person Email: _____

4. Facility or Project Information

Facility Legal Name: Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue

Facility Mailing Address: 601 Kamokila Boulevard, Room 688

Facility Mailing City: Kapolei | Facility Mailing State: HI | Facility Mailing Zip+4: 96707-0000

Facility Street Address: Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue

Facility City: Honolulu | Facility State: HI | Facility Zip+4: 00009-6817

Facility Contact Person First Name: Pamela | Facility Contact Person Last Name: Uyeda

Facility Contact Person Position Title: Project Manager

Facility Phone No: 808-566-2265 | Facility Fax No: 808-528-2368

Facility Contact Person Email: uyeda@pbworld.com

Island of Facility: Oahu

If there are multiple Plat and/or Parcel Numbers, please separate them with semi-colons.
If there are more Tax Map Keys (TMKs), please attach a separate sheet.

TMK Division	Zone	Section	Plat	Parcel or Lot
(1)	1	2	16	DOT right-of-way
(1)	1	3	1 through 9	DOT right-of-way
(1)	1	6	1-4, 6-8, 21, 23, 24	DOT right-of-way
(1)	1	7	8,9,18-20,23,33,34,44,45	DOT right-of-way

5. Receiving State Water(s) Information

5.a. Number of Receiving State Waters: 4 or more - Please attach additional pages with the required information

5.a.i. Receiving Waters Name: Moanalua Stream

Receiving Waters Classification: 2

Latitude Degrees (N): 021 | Latitude Minutes: 20 | Latitude Seconds: 26

Longitude Degrees (W): 157 | Longitude Minutes: 53 | Longitude Seconds: 08

5.a.ii. Additional Receiving Waters Name: Moanalua Stream

Receiving Waters Classification: 2

Latitude Degrees (N): 021 | Latitude Minutes: 20 | Latitude Seconds: 26

Longitude Degrees (W): 157 | Longitude Minutes: 53 | Longitude Seconds: 09

5.a.iii. Additional Receiving Waters Name: Moanalua Stream

Receiving Waters Classification: 2

Latitude Degrees (N): 021 | Latitude Minutes: 20 | Latitude Seconds: 22

Longitude Degrees (W): 157 | Longitude Minutes: 53 | Longitude Seconds: 08

5.b. Receiving Separate Drainage System - Complete the following if the discharge from your facility or project first enters a separate storm drainage system (e.g., City and County of Honolulu Municipal Separate Storm Sewer System [MS4] , etc.)

Separate Drainage System Owner Name: Hawaii Department of Transportation (See attached for locations)(Applicant is Owner)

Latitude Degrees (N): 021 | Latitude Minutes: 20 | Latitude Seconds: 16

Longitude Degrees (W): 157 | Longitude Minutes: 52 | Longitude Seconds: 59

☒ Drainage System Owner Approval to Discharge is attached.

☐ The request to the Drainage System Owner for Approval to Discharge is attached. The Approval to Discharge will be submitted at least 30 calendar days before the start of construction activities or discharge, whichever is sooner.

6. Authorized Representative Information - Select authorization under A or B or C or A & C. Do not select A & B or B & C - this will cause a delay in the issuance of the NGPC. The owner certifies that the duly authorized representative is an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, superintendent, or position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the company, (A duly authorized representative may thus be either a named individual or any individual occupying a named position.), as in accordance with HAR, Section 11-55-07(b).

☒ A. This statement authorizes the named individual or any individual occupying the named position of the company/organization listed below to act as our representative to submit information/documents necessary to complete the CWB NOI Form for coverage under the NPDES general permit to discharge to State waters from the subject facility. The Owner hereby agrees to comply with and be responsible for all NGPC conditions.

☐ B. This statement authorizes the named individual or any individual occupying the named position of the company/organization listed below to act as our representative to submit information/documents necessary to complete the CWB NOI Form for coverage under the NPDES general permit to discharge to State waters from the subject facility. Our representative is further authorized to submit information/documents for compliance with the NGPC conditions, except submittal of the CWB NOC Form. The Owner hereby agrees to comply with and be responsible for all NGPC conditions.

Representative Company/Organization Name: State of Hawaii
Representative Department: Department of Transportation
Representative Division: Highways Division
Representative Mailing Address: 869 Punchbowl Street
Rep. Mailing City: Honolulu | Rep. Mailing State: HI | Rep. Mailing Zip+4: 96813-5097
Representative Street Address: 869 Punchbowl Street
Representative City: Honolulu | Rep. State: HI | Representative Zip+4: 96813-5097

Representative First Name: Alvin A. | Representative Last Name: Takeshita
Representative Position Title: Administrator
Representative Phone No: 808-587-2220 | Representative Fax No: 808-587-2340
Representative Contact Person Email: alvin.takeshita@hawaii.gov

☒ C. This statement authorizes the named individual or any individual occupying the named position of the company/organization listed below to act as our representative to submit information/documents for compliance with the NGPC conditions, except submittal of the CWB NOC Form. The Owner hereby agrees to comply with and be responsible for all NGPC Conditions.

Representative Company/Organization Name: State of Hawaii
Representative Department: Department of Transportation
Representative Division: Highways Division
Representative Mailing Address:
Rep. Mailing City: Honolulu | Rep. Mailing State: HI | Rep. Mailing Zip+4: 96819-2017
Representative Street Address: 727 Kakoi Street
Representative City: Honolulu | Rep. State: HI | Representative Zip+4: 96819-2017

Representative First Name: Pratt M. | Representative Last Name: Kinimaka
Representative Position Title: Oahu District Engineer
Representative Phone No: 808-831-6700 | Representative Fax No: 808-831-6725
Representative Contact Person Email: Pratt.Kinimaka@hawaii.gov

7. Certification - Alteration of this item will result in the invalidation of this CWB-NOI Form submittal. **The person certifying this CWB-NOI Form must meet one of the following descriptions and be employed by the owner or be an administrator of the sole proprietorship, trust, or LLC listed in Item 1.**

◉	I certify that for a state agency, I am a principal executive officer or ranking elected official.
○	I certify that for a municipal agency, I am a principal executive officer or ranking elected official.
○	I certify that for a non-federal public agency, I am a principal executive officer or ranking elected official.
○	I certify that for a federal agency, I am the chief executive officer of the agency, or I am the senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.
○	I certify that I am a general partner for a partnership.
○	I certify that for a corporation, I am the President, Vice President, Secretary, or Treasurer of the corporation and in charge of a principal business function, or I perform similar policy or decision-making functions for the corporation.
○	I certify that I am the proprietor for a sole proprietorship.
○	I certify that for a corporation, I am the Manager of one or more manufacturing, production, or operating facilities and am authorized to make management decisions which govern the operation of the regulated facility or facilities including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations. I can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements and authority to sign documents has been assigned or delegated to me in accordance with corporate procedures.
○	I certify that for a trust, I am a trustee.
○	I certify that for a limited liability company (LLC), I am the Manager or a Member authorized to make management decisions for the LLC and am in charge of a principal business function, or I perform similar policy or decision-making functions for the LLC.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature Glenn M. Okimoto Date Signed SEP 12 2012

Certifying Person First Name Glenn M. Certifying Person Last Name Okimoto

Certifying Person Position Title Director of Transportation

Certifying Person's Company or Agency State of Hawaii

Certifying Department Department of Transportation

Certifying Division Highways Division

Certifying Phone No 808-587-2150 Certifying Fax No 808-587-2167

Certifying Person Email glenn.okimoto@hawaii.gov

For facilities/projects on all islands, submit one (1) set of the following to the CWB:

1. Transmittal or cover letter (hard copy).
2. Original Certification signature (hard copy of CWB NOI General Form page 4 only).
3. CD or DVD containing:
   a. Certified and complete CWB NOI General Form (in pdf format);
   b. Applicable discharge CWB NOI Form (e.g., Certified and complete CWB SSCBMP Plan Template) in pdf format; and,
   c. Supporting documents (in pdf format).
4. $500 Filing Fee

Print Form

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

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

In reply, please refer to:
EMD/CWB

R10E233.FNL.12

September 18, 2012

The Honorable Glenn M. Okimoto, Ph.D.
Director
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Attention: Mr. Ross Hironaka
Project Manager

Dear Dr. Okimoto:

Subject: NOTICE OF GENERAL PERMIT COVERAGE (NGPC)
National Pollutant Discharge Elimination System (NPDES)
Interstate Route H-1 Rehabilitation,
Middle Street to Vicinity of Ward Avenue
Honolulu, Island of Oahu, Hawaii
File No. HI R10E233

In compliance with the provisions of the Clean Water Act, as amended, (33 U.S.C. §1251 et seq.; the "Act"); Hawaii Revised Statutes, Chapter 342D; and Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55, Department of Health (DOH), State of Hawaii,

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION (DOT)
HIGHWAYS DIVISION (HWYS)

(hereinafter PERMITTEE)

is authorized to discharge storm water associated with construction activity from the subject project located at Interstate Route H-1, Middle Street to Vicinity of Ward Avenue, Honolulu, Island of Oahu, Hawaii, to the receiving State Waters, at the following discharge points:

Discharge Point	Receiving State Waters	Classification	Latitude (N)	Longitude (W)
1	Moanalua Stream	Class 2, Inland Water	21°20'26"	157°53'06"
2	Moanalua Stream	Class 2, Inland Water	21°20'27"	157°53'08"
3	Moanalua Stream	Class 2, Inland Water	21°20'26"	157°53'09"
4	Moanalua Stream	Class 2, Inland Water	21°20'22"	157°53'08"
5	Kalihi Stream	Class 2, Inland Water	21°20'02"	157°52'47"
6	Kalihi Stream	Class 2, Inland Water	21°20'09"	157°52'39"
7	Kalihi Stream	Class 2, Inland Water	21°20'08"	157°52'40"
8	Kalihi Stream	Class 2, Inland Water	21°20'08"	157°52'39"
9	Kapalama Canal Stream	Class 2, Inland Water	21°19'26"	157°52'14"
10	Kapalama Canal Stream	Class 2, Inland Water	21°19'34"	157°52'04"
11	Kapalama Canal Stream	Class 2, Inland Water	21°19'34"	157°52'04"
12	Kapalama Canal Stream	Class 2, Inland Water	21°19'35"	157°52'04"
13	Kapalama Canal Stream	Class 2, Inland Water	21°19'37"	157°52'03"
14	Kapalama Canal Stream	Class 2, Inland Water	21°19'34"	157°52'03"
15	Kapalama Canal Stream	Class 2, Inland Water	21°19'33"	157°52'03"
16	Nuuanu Stream	Class 2, Inland Water	21°19'06"	157°51'28"
17	Nuuanu Stream	Class 2, Inland Water	21°19'06"	157°51'27"
19	Kewalo Basin	Class A, Marine Water and Embayment	21°19'40"	157°51'26"
20	Open Channel Ala Moana Beach Park at Piikoi Street	Class 2, Inland Water	21°17'26"	157°50'52"

This NGPC will take effect on the date of this notice. This NGPC will expire at midnight, October 21, 2012, or when amendments to HAR, Chapter 11-55, Appendix C, are adopted, whichever occurs first. Any non-compliance with the conditions of this NGPC may be subject to penalties of up to $25,000 per violation per day.

The Permittee shall:

1. Submit the following information in accordance with the CWB NOI General Form and the CWB Site-Specific Construction Best Management Practice (SSCBMP) Plan to the Clean Water Branch (CWB) on a CD or DVD in pdf format for review and comment **at least 30 calendar days prior to the start of construction activities.**

   All questions/concerns that the DOH may have must be answered to the satisfaction of the CWB.

   a. The General Contractor information (CWB NOI General Form: Item No. 3.).

   b. BMP location map (Section 3.1. of SSCBMP Plan).

2. Notify the Director of Health of the construction start date by e-mail at cleanwaterbranch@doh.hawaii.gov or fax at (808) 586-4352 within seven (7) calendar days before the start of construction activities. All communication, including but not limited to the e-mail and fax, with the CWB shall include the **File No. HI R10E233** and the certification statement below. The notification will only be accepted from the person qualified in accordance with HAR, Chapter 11-55, Section 11-55-34.08(f).

3. Complete and submit the Solid Waste Disclosure Form for Construction Sites to the DOH, Solid and Hazardous Waste Branch, Solid Waste Section, as specified on the form at least 30 calendar days before the start of the construction activities. The form can be downloaded at: http://www.hawaii.gov/health/environmental/waste/sw/pdf/swdiscformnov2008.pdf.

4. Implement, operate, and maintain the project site-specific Best Management Practices (BMPs) Plan to ensure that storm water discharges associated with construction activities will not cause or contribute to a violation of applicable State water quality standards.

5. Review the effectiveness and adequacy of the implemented site-specific BMPs Plan(s) and Erosion and Sediment Control (ESC) Plan(s) at a minimum of once per week, and update the plan as often as necessary. Any change(s) to the site-specific BMPs Plans and/or ESC Plans or corrections to the information already on file with the CWB shall be maintained onsite and be available upon request. Any change(s) to the information on the CWB NOI General Form shall be submitted to the CWB within seven (7) calendar days of the change(s).

6. Retain a copy of this NGPC and all other related materials at the job site or nearby field office.

7. Comply with HAR, Sections 11-55-34.04(a), 11-55-34.07, 11-55-34.11, and 11-55-34.12 (enclosed) and any other applicable Sections of HAR, Chapter 11-55; HAR, Chapter 11-55, Appendix A, DOH, Standard General Permit Conditions (enclosed); HAR, Chapter 11-55, Appendix C, NPDES General Permit Authorizing Discharges of Storm Water Associated with Construction Activities (enclosed); and all materials submitted in and with the Notice of Intent (NOI), dated September 12, 2012.

8. Complete and submit the Notice of Cessation (NOC) Form (CWB-NOC Form) to the CWB within two (2) weeks of completion of the subject project. The CWB-NOC Form can be downloaded from our website at: http://www.hawaii.gov/health/environmental/water/cleanwater/forms/pdf/cwb-noc.pdf.

9. Know that as of the date of this NGPC, Mr. Alvin Takeshita or the Administrator, DOT-HWYS is no longer recognized as the duly authorized representative. Mr. Pratt Kinimaka, or the Oahu District Engineer, DOT-HWYS is recognized as the duly authorized representative to submit all information/documents for compliance with the NGPC conditions, except submittal of the CWB-NOC Form. A new authorized representative may be appointed by updating the CWB NOI General Form (Item No. 6.c. – Authorized Representative Information); submitting a hard copy of CWB NOI General Form (Item No. 7. – Certification) with an original signature and date; and submitting the CWB NOI General Form (with the revisions to Item Nos. 6.c. and 7.) on a CD/DVD in pdf format.

10. For future submittals include the **File No. HI R10E233** and the following certification statement in your cover letter:

    "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

The Permittee is responsible for obtaining other Federal, State, or local authorizations as required by law.

If you have any questions, please contact Ms. Jamie Tanimoto of the Enforcement Section or Ms. Jiaping Fouse of the Engineering Section, CWB, at 586-4309.

Sincerely,

FOR LORETTA J. FUDDY, A.C.S.W., M.P.H
Director of Health

Enclosures:
1. HAR, Sections 11-55-01 and 11-55-34 to 11-55-34.12
2. HAR, Chapter 11-55, Appendices A and C
3. Title 40, Code of Federal Regulations Citations as referenced in HAR, Chapter 11-55, Water Pollution Control, Appendix A
4. Receipt No. 41403 for $500 Filing Fee
5. Hawaii DOH Customer Satisfaction Survey

c: The Honorable Glenn M. Okimoto, Ph.D., DOT-HWYS
(w/o encls.) [via e-mail Glenn.Okimoto@hawaii.gov]
Mr. Ross Hironaka, DOT-HWYS
(w/o encls.) [via e-mail Ross.Hironaka@hawaii.gov only]
Mr. Alvin Takeshita, DOT-HWYS
(w/o encls.) [via e-mail alvin.takeshita@hawaii.gov only]
Mr. Pratt Kinimaka, DOT-HWYS
(w/o encl.) [via e-mail Pratt.Kinimaka@hawaii.gov only]
Ms. Pamela Uyeda, Project Manager
(w/o encl.) [via e-mail uyeda@pbworld.com only]
Mr. Kevin Kasamoto, DOT-HWYS
(w/o encl.) [via e-mail Kevin.Kasamoto@hawaii.gov only]
Mr.Kelly Sato, DOT-HWYS (w/o encls.) [via e-mail Kelly.sato@hawaii.gov only]
Mr. Robert Shin, DOT-HWYS (w/o encls.) [via e-mail robert.shin@hawaii.gov only]
Ms. Larissa Sato, PB Americas (w/o encls.) [via e-mail sato@pbworld.com only]

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NEIL ABERCROMBIE
GOVERNOR

GLENN M. OKIMOTO
DIRECTOR

Deputy Directors
JADE T. BUTAY
FORD N. FUCHIGAMI
RANDY GRUNE
JADINE URASAKI

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

IN REPLY REFER TO:
HWY-DD 2.2241

TO: THE HONORABLE LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

ATTN: ALEC WONG, P.E., CHIEF
CLEAN WATER BRANCH

FROM: GLENN M. OKIMOTO, Ph.D.
DIRECTOR OF TRANSPORTATION

SUBJECT: INTERSTATE ROUTE H-1 REHABILITATION, MIDDLE STREET TO VICNITY OF WARD AVENUE
HONOLULU, ISLAND OF OAHU, HAWAII
RENEWAL NOI, NGPC FILE NUMBER HI R10E233

The State of Hawaii Department of Transportation, Highways Division (HDOT) has completed the on-line renewal of the subject NGPC. The e-Permitting submission number is 1ET-VHTS-MH5D. Attached are the items necessary to complete the renewal process.

Please feel free to contact Ross Hironaka by telephone at (808) 692-7575, if you have any questions. We look forward to working with you on this needed project.

Attachments:

- Certification Statement & Transmittal Letter for 2012 Renewal NOI e-Permitting Submissions
- Check for $500 payable to State of Hawaii

c: Parsons Brinkerhoff (Jim Hayes)

CERTIFICATION STATEMENT & TRANSMITTAL LETTER FOR 2012 RENEWAL NOI E-PERMITTING SUBMISSIONS

1. Submission and File Numbers

   e-Permitting Submission #: 1ET-VHTS-MH5D

   Renewal NOI, NGPC File Number: HI R10E233

2. Certification Statement

   I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

   Signature _____ Date Signed SEP 20 2012

   Certifying Person Printed First and Last Name Glenn M. Okimoto

3. Transmittal Requirements (Check all.)
   - [x] I have read the instructions below.
   - [x] If I do not follow all of the instructions below, I acknowledge that:
     a. This submittal will not be accepted by the Clean Water Branch (CWB);
     b. Processing of my renewal NOI submission will not begin;
     c. I am delaying the processing of my renewal NOI submission; and
     d. The CWB may deny my renewal NOI request for continued coverage under the General Permit with or without prejudice.
   - [x] The signature provided in Item No. 2 is an original signature.
   - [x] Attached is a hard copy of my printed e-Permitting submission identified in Item No. 1 above.

4. Filing Fee (Check only one.)
   - [x] A $500 check made payable to the State of Hawaii is attached.
   - [ ] The filing fee was paid online through the e-Permitting Portal.
   - [ ] I am a State agency, and I am requesting a Bill for Collection.

IMPORTANT INSTRUCTIONS:

You are required to follow these instructions to complete your e-Permitting renewal NOI submittal. Failure to follow all of these instructions will delay the processing of your submittal and may result in the denial of your request for continued coverage under the applicable General Permit. **Processing of your submission will not begin until the Clean Water Branch (CWB) receives all of the items below.**

Item No. 1 – Submission and File Numbers

a. Enter your e-Permitting Submission #. You may find your unique e-Permitting Submission # (e.g. 15H-ZGVV-421H) in your History Link of the e-Permitting Portal.

b. Enter your Notice of General Permit Coverage (NGPC) file number. This file number is located on your current NGPC (e.g. HI R10C200).

Item No. 2 – Certification Statement

a. This is the certification statement for the e-Permitting submission # identified in Item No. 1.

b. Enter the Printed First and Last Name of the Certifying Person identified in the e-Permitting NOI form.

c. Enter the Date Signed.

d. Provide an original Certification signature (hard copy of this form).
Someone else may sign "for" the individual listed in the Certifying Person Printed First and Last Name.

Item No. 3 – Transmittal Requirements

a. You are required to fulfill all requirements and check all boxes.

b. Print your e-Permitting renewal NOI submission. To print the submission, click on the History Link in the e-Permitting Portal (after you submitted the NOI). Locate your submission and press the view button under the Action column. Press the Print Submission button. Attach your printed renewal NOI submission with this Certification Statement & Transmittal Letter for 2012 Renewal NOI e-Permitting Submissions form.

Item No. 4 – Filing Fee

a. You are required to check only one (1) of the boxes.

b. A $500 filing fee is required for all renewal NOIs.

Additional

Mail or deliver this form and all attachments to the Department of Health, Clean Water Branch, 919 Ala Moana Boulevard, Room 301, Honolulu, Hawaii 96814.

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Department of Health
Healthy People • Healthy Communities • Healthy Islands

2012 Renewal Notice of Intent Form

(Submission Id: 1ET-VHTS-MH5D, v2)

DRAFT PRINTED ON 9/19/2012 11:43:27 AM

Renewal Information

Provide your current NGPC file number.

HIR10E233

Provide the project or facility name on your current NGPC.

Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue

I read the applicable General Permit (HAR, Chapter 11-55, Appendices B - L) and Standard General Permit Conditions (HAR, Chapter 11-55, Appendix A). I am submitting this renewal NOI since my facility, project, or activity complies with the applicable general permit conditions. I certify that I will comply with all conditions of this general permit.

Yes.

If you selected "No" above, DO NOT submit this renewal NOI. (If you submit the renewal NOI, your filing fee will be processed and your request for continued coverage under the general permit may be denied with or without prejudice.)

Did you submit to the CWB all of the required NGPC compliance information prior to starting your discharge or activity?

2. My discharge or activity did not begin yet.

If you selected "3. No. My discharge or activity started, and I did not comply with the requirements in my NGPC." you will be contacted by the CWB Enforcement Section regarding your NGPC non-compliance. An administrative extension of your NGPC will be granted. However, resolution of your non-compliance(s) is required before a renewal NGPC will be considered. Failure to resolve the non-compliance(s) in a timely manner may result in the termination of your administrative extension and renewal NOI.

Owner Information

Provide the Owner Legal Name. The Owner Legal Name is the Permittee identified on your current NGPC. (For example: State of Hawaii, City and County of Honolulu, XYZ Corporation, etc.) If you do not have a copy of your NGPC you are in violation of the General Permit conditions.

Owner Legal Name

State of Hawaii

Owner Department

Department of Transportation

Owner Division

Highways Division

The Owner Legal Name you provided above is supposed to match the Permittee identified on your current NGPC. Please indicate if the Owner Legal Name you are providing above matches the Permittee on your current NGPC.

Yes. The Owner Legal Name matches the Permittee on my current NGPC.

If you answered "No. The Owner Legal Name has changed since the current NGPC was issued," please explain why this information was not provided to the CWB. As a reminder, your current NGPC requires this information to be submitted to the CWB within 7 calendar days of the change. Any non-compliance with the NGPC conditions is grounds for denying your renewal NOI. Transfer of ownerships must be submitted separately from your renewal NOI.

NONE PROVIDED

Owner Mailing Address

869 Punchbowl Street
Honolulu, Hawaii 96813

Owner Street Address

869 Punchbowl Street
Honolulu, Hawaii 96813

Owner Type

Municipal - City, County, or State Government Project

Signatory Type:

The person certifying this NOI must meet one of the following descriptions and be employed by the owner or be an administrator of the sole proprietorship, trust, or LLC listed in the Owner Contact Information section. Please identify your appropriate signatory type based on the items listed below.

State Agency: I certify that for a state agency, I am a principal executive officer or ranking elected official.

Municipal Agency: I certify that for a municipal agency, I am a principal executive officer or ranking elected official.

Non-Federal Public Agency: I certify that for a non-federal public agency, I am a principal executive officer or ranking elected official.

Federal Agency: I certify that for a federal agency, I am the chief executive officer of the agency, or I am the senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency.

Partnership: I certify that I am a general partner for a partnership.

Proprietorship: I certify that I am the proprietor for a sole proprietorship.

Corporation Officer: I certify that for a corporation, I am the President, Vice President, Secretary, or Treasurer of the corporation and in charge of a principal business function, or I perform similar policy or decision-making functions for the corporation.

Corporation Manager: I certify that for a corporation, I am the Manager of one or more manufacturing, production, or operating facilities and am authorized to make management decisions which govern the operation of the regulated facility or facilities including having the explicit or implicit duty of making major capital investment recommendations, and initiating and directing other comprehensive measures to assure long term environmental compliance with environmental laws and regulations. I can ensure that the necessary systems are established or actions taken to gather complete and accurate information for permit application requirements and authority to sign documents has been assigned or delegated to me in accordance with corporate procedures.

Trust: I certify that for a trust, I am a trustee.

LLC: I certify that for a limited liability company (LLC), I am the Manager or a Member authorized to make management decisions for the LLC and am in charge of a principal business function, or I perform similar policy or decisionmaking functions for the LLC.

Please Select the Signatory Type based on the above descriptions.

State Agency

Certifying Person Salutation

Mr.

Certifying Person First Name

Glenn M.

Certifying Person Last Name

Okimoto

Certifying Person Title

Director of Transportation

Certifying Person Email Address

glenn.okimoto@hawaii.gov

Certifying Person Phone Number (e.g., 555-555-5555)

808-587-2150

Certifying Person Alternate Phone Number (cell) (e.g., 555-555-5555)

NONE PROVIDED

Certifying Person Fax Number (e.g., 555-555-5555)

808-587-2167

The Owner's contact person may be the staff person with direct responsibility for the facility or project, not necessarily the certifying or “responsible” person.

Owner Contact Person's Salutation

Mr.

Owner Contact Person's First Name

Ross

Owner Contact Person's Last Name

Hironaka

Owner Contact Person's Position Title

Project Manager

Owner Contact Person's Email

ross.hironaka@hawaii.gov

Owner Contact Person's Phone number (e.g., 555-555-5555)

808-692-7575

Owner Contact Person's Alternate Phone Number (cell) (e.g., 555-555-5555)

NONE PROVIDED

Owner Contact Person's Fax number (e.g., 555-555-5555)

808-692-7590

Multi-Phase Construction Projects (1)

Phase Name

NONE PROVIDED

Date Construction Started

NONE PROVIDED

Date the Site Specific Best Management Plan was submitted to DOH-CWB.

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-DD-

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

LORETTA J. FUDDY, A.C.S.W., M.P.H.
DIRECTOR OF HEALTH

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

In reply, please refer to:
DOH/CWB

R10E233.EXT.12

October 19, 2012

The Honorable Glenn M. Okimoto, Ph.D.
Director
Department of Transportation
869 Punchbowl Street
Honolulu, Hawaii 96813-5097

Attention: Mr. Ross Hironaka
Project Manager

Dear Dr. Okimoto:

Subject: Administrative Extension of Notice of General Permit Coverage (NGPC) Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Avenue Honolulu, Island of Oahu, Hawaii File No. HI R10E233

DIRECTOR'S OFFICE
DEPT. OF
TRANSPORTATION
2012 OCT 31 A 9:53

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of your renewal Notice of Intent (NOI) and $500 filing fee for coverage under the National Pollutant Discharge Elimination System general permit provisions, in accordance with the Hawaii Administrative Rules (HAR), Section 11-55-34.08.

The DOH is unable to complete the processing of your NOI prior to the current NGPC expiration date. Therefore, in accordance with HAR, Section 11-55-34.09(d), the DOH hereby administratively extends the subject NGPC until a notice of renewed coverage under the applicable general permit is issued or until notified by the DOH, whichever occurs first. Please note that the DOH may request you submit additional information in order to complete the processing of your NOI for renewed coverage.

The Permittee shall not be held in violation of Hawaii Revised Statutes, Chapter 342D-6(h), and HAR, Chapter 11-55, during the pendency of its renewal NOI, so long as it acts consistently with the NGPC presently granted. **Note: The Permittee shall continue any sampling required by the current NGPC.** Any non-compliance with the conditions of the administratively extended NGPC may be subject to penalties of up to $25,000 per violation per day.

It is the Permittee's responsibility to ensure that anyone working under this administrative extension of your NGPC understands and complies with the terms and conditions therein.
Enclosed is a receipt for the $500 filing fee. If you have any questions, please contact Ms. Jiaping Fouse of the Engineering Section, CWB, at 586-4309.

Sincerely,

for LORETTA J. FUDDY, A.C.S.W., M.P.H
Director of Health

Enclosure: Receipt No. 41416 for $500 Filing Fee

c: Mr. Ross Hironaka, DOT-HWYS
(w/o encls.) [via e-mail Ross.Hironaka@hawaii.gov only]
Mr. Kelly Sato, DOT-HWYS (w/o encls.) [via e-mail Kelly.sato@hawaii.gov only]
Ms. Sharon Nekoba, DOT-HWYS
(w/o encls.) [via e-mail Sharon.h.nekoba@hawaii.gov only]
Ms. Larissa Sato, PB Americas (w/o encls.) [via e-mail sato@pbworld.com only]

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STATE OF HAWAII
OFFICIAL RECEIPT

No. 41416

Clean Water Branch
Department or Agency

DATE: Oct. 17 20 12

RECEIVED from Parsons Brinckerhoff Group Administration, Inc.
Five hundred and 00/100 DOLLARS
Renewal filing fee for NPDES/NGPC File No. HIR10E233 - Interstate Route H-1 Rehabilitation, Middle Street to Vicinity of Ward Ave.

$ 500.00 (0231)

(CM# 1312440 dtd 9/18/12)

Authorized Signature

STATE ACCOUNTING FORM B-24
July 1, 1999 (Revised)