H-3 Tunnel Communications Site

BENJAMIN J. CAYETANO
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
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KAZU HAYASHIDA
DIRECTOR

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JERRY M. MATSUDA
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IN REPLY REFER TO:
HWY-RM
3.73265

RECEIVED
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OFC. OF ENVIRONMENTAL QUALITY CONTROL

June 5, 1998

TO: MR. GARY GILL, DIRECTOR
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

FROM: KAZU HAYASHIDA, DIRECTOR OF TRANSPORTATION

SUBJECT: FINDING OF NO SIGNIFICANT IMPACT & FINAL ENVIRONMENTAL ASSESSMENT FOR A COMMUNICATION SITE, INTERSTATE ROUTE H-3, TRANS-KOOLAU TUNNELS, FAIP NO. I-H3-1(62)

We have reviewed the comments received during the 30-day public comment period which began on October 23, 1997. We have determined that this project will have no significant environmental impact and request that you publish this FONSI and the Final Environmental Assessment in your next OEQC Bulletin.

We enclose a completed OEQC Bulletin Publication Form, four copies of the Final Environmental Assessment and diskette.

If you have any questions, please call Michael Amuro at 587-2023.

MKA:mka

Enclosures(5)

1998-06-23-OA-FEA- H-3 Tunnel Communications Site

FINAL ENVIRONMENTAL ASSESSMENT

H-3 TUNNEL
CELLULAR PCS
TELEPHONE TRANSMITTER/RECEIVER SITE

AGENT: Donald Clegg
Analytical Plannning Consultants
84 N. King Street
Honolulu, Hawaii 96817
Ph. 536-5695 Fx. 599-1553

FINAL ENVIRONMENTAL ASSESSMENT FOR A COMMUNICATIONS SITE ON THE HALAWA SIDE OF THE H-3 TUNNEL

BACKGROUND

The applicants are PrimeCo Personal Communications L.P., Western PCS II Inc., SprintCom Inc., Hawaiian Wireless Inc., Honolulu Cellular Inc., and GTE. They are proposing to construct a transmitter/receiver installation at the Honolulu side of the H-3 Tunnel bores. They are also proposing to locate antennas on the light poles at the "dogleg" location of H-3 between the tunnels and the Halawa interchange. The installations will be used to facilitate Cellular and PCS wireless telephone communications, and paging on the Honolulu approach to the tunnels and within the tunnels themselves.

The applicants considered approaching the State Department of Transportation (DOT) individually for permission to locate their antenna sites to service the H-3 tunnel area and approaches, however it was decided, jointly with the DOT, that a single application should be made that included all the companies involved. This approach would better minimize any environmental and visual aesthetic impacts that might be caused by the installations. The companies have been meeting with the DOT for several months and are proposing the design which is the subject of this Environmental Assessment (EA).

DESCRIPTION OF THE PROPOSED PROJECT

a. Tunnel facilities

The carriers propose to construct an inverted "U" shaped structure approximately 40 feet high and 35 feet across, on which will be mounted the six pairs of antennas. Two of the carriers will use pairs of omni-directional antennas which are pipes 2 inches in diameter and between 5 to 7 feet long. The other four carriers will use pairs of panel antennas where each antenna includes two panels approximately 5 feet long, 6 inches wide and 2 inches thick mounted back to back. The carriers using omni directional antennas may, in the future, revise their antenna specification from omni-directional to panel in response to customer demand. This will not have any significant impact on the total visual impact of the facility. Antennas will be mounted above and below the horizontal cross beam of the support structure. The structure will be located at the makai apex of the emergency cross lanes on the Honolulu side of the tunnels (see diagrams).

It will not be necessary, with the proposed installation, to locate any antennas inside the tunnels. Radio signals from the antennas located near the entrances will provide signal inside the tunnels. The tunnels, themselves will function as a wave guide to propagate the signal from the Honolulu side, through the tunnels to the Kaneohe side.

The equipment cabinets for all the carriers will be located on an existing flat area below the roadway grade which is immediately below the antenna structure. The cabinets will not be visible to motorists traversing the freeway. An emergency generator may be located mauka on the administration building near the Windward bore of the tunnels. The generator will not be visible to passing motorists. The generator is for emergency use only and as such, will only be in operation when power from HECO fails. It will be tested approximately once every two weeks for approximately one hour. If installed, the generator sound will be attenuated to acceptable levels after consultation with the Department of Health and the Department of Transportation.

b. "Dogleg" site

In order to provide a continuous signal as motorists move down the Honolulu side of the tunnel four of the carriers are proposing to locate monopole antennas on four of the light standards where the freeway takes a "dogleg" turn about half way down. Two equipment areas, each servicing two carriers will be located under the freeway. Cables will be installed from the equipment cabinets to their respective antennas.

The installation is located on State land in the highway right of way.

AFFECTED ENVIRONMENT

The primary installation, which includes the 6 pairs of antennas and the equipment cabinets, is located on the Honolulu side of the tunnel between the Honolulu and Kaneohe bound lanes of the freeway. A second set of antennas is located on four light standards at the "dogleg" location on the Honolulu bound lanes. The equipment cabinets are located under the freeway. These are the areas that are potentially affected.

IMPACTS AND ALTERNATIVES CONSIDERED

a. Impacts

The primary impact of the installation will be the visual impact of the six pairs of antennas and their supporting structure located between the Halawa and Kaneohe bound lanes, and the antennas located on the four light standards at the "dogleg". The cabinets are below grade and will not be seen be the people in automobiles.

The antennas at the "dogleg" will be located on light standards on the Ewa edge of the Honolulu bound lanes and will have some visual impact. The equipment cabinets for these antennas will be located under the freeway and hence, not visible from cars on the freeway. A minor amount of grading will be required below the freeway at the equipment locations to provide a level surface for the cement pads needed to support the cabinets.

The area where the cabinets will be located near the tunnel faces is level and will not require any grading. Some preparation including construction of cement pads for the equipment cabinets and security fencing will be required.

There have been concerns expressed about the effects of the electromagnetic radiation from the antennas. There is no impact as the maximum radiation exclusion distance for the panel antennas is approximately 10 feet. This contour is well above the height of any vehicles utilizing H-3 freeway.

b. Alternatives

Other possible sites for the antenna installation along the side of the highway were reviewed. They were rejected in favor of the proposed site for the following reasons:

1. They were in the conservation district outside of the highway right of way.

2. They were in the right of way but would have been more visually intrusive.

3. Electrical power was not readily available.

4. A land line telephone connection into the

Hawaiian Telephone system was not readily available.

5. Telephone service could not be supplied inside the tunnels.

6. None of the other locations provided the opportunity for all the companies to co-locate, thereby minimizing the cumulative impact of multiple installations.

If the project is not constructed it will not be possible for the six applicant companies to supply continuous communications coverage as users transition from Windward Oahu to Honolulu and from Honolulu to Windward Oahu through the H-3 tunnel. There would also be signal degradation on the Honolulu approach to the tunnel.

The telephone systems involved serve a community function as public utilities by supplying needed portable communications for public use. In addition to assisting the general public and businesses the systems will provide essential communications in the event of disaster.

The ability for real time portable communications for occupants of cars transiting over H-3 will assist greatly in providing a safe environment for the residents of Oahu. Traveling over H-3 at night can be frightening and dangerous in the event of a breakdown. The ability to call for assistance immediately without leaving the car will contribute to the safety, and the physical and mental well being of those who must travel this road at night.

MITIGATION MEASURES

There are a number of vertical structures and poles that are visible to motorists approaching the tunnel entrances from Honolulu or exiting the tunnel Honolulu bound. The antennas and the antenna support structure will not add noticeable to the existing visual experience. The antennas and the support structure will be painted to blend as much as possible with the existing background clutter.

The emergency generator, if installed, will be located in an area that is not visible to motorists going in either direction on H-3.

Equipment cabinets housing the electronics associated with the antennas will be located immediately below the antenna structure and not visible to motorists going in either direction on H-3.

The antennas on the light standards at the "dogleg" location will be located on the existing light standards hence no new poles will be required. The antennas will be painted to match the poles and will appear to be a part of the lights. Only light standards on the Honolulu bound lanes will be used which reduces the visual impact for motorists on the Kaneohe bound lanes. The equipment cabinets will be located under the freeway structure and will not be visible to motorists traveling in either direction.

Construction will be done utilizing "best management practices". This means that there will be no runoff from the small amount of grubbing and grading that will be required to prepare the sites for the equipment cabinets at the approach to the tunnels, and at the "dogleg" location.

The installation will be secured from the public and will only be accessible to maintenance personnel.

COMMENTS RECEIVED ON THE DRAFT ENVIRONMENTAL ASSESSMENT

The draft EA was published in the October 23, 1996 OEQC Bulletin. Copies of the EA were submitted for review and comment to the State Department of Transportation, OEQC, and the Office of Hawaiian Affairs. The following comments were received:

1. Office of Hawaiian Affairs (OHA).

   OHA stated, "Based on the information contained in the DEA, the Office of Hawaiian Affairs (OHA) has no objections to the proposed project at this time. The approach of joint utilization of a single transmitter/receiver serves to mitigate the visual impact of multiple installations. Furthermore, the RF safety Assessment indicates that the public's level of exposure to electromagnetic radiation will be significantly below established safety levels."

2. OEQC

   a.) "Document all contacts made with State agencies, county agencies and interested community groups regarding the proposed project, and include copies of any correspondence."

   COMMENT

   Contact was made with OHA and OEQC and the State DOT. Correspondence is enclosed. Other evaluations of the project were made by those who reviewed the DEA as a result of publication in the OEQC Bulletin.

b.) "Indicate the anticipated start and completion dates of this project."

COMMENT

Anticipated start date is January 5, 1998. Anticipated completion date is March 15, 1998.

c.) List all required permits and approvals for this project and their status.

COMMENT

Approval of the design has been obtained from the State DOT. A building permit must be approved by the City Building Department. The building permit application will be submitted after the FONSI is approved.

d.) "On a single map show the locations of all facilities being proposed, using the tunnel bores as points of reference."

COMMENT

A map is enclosed with the FEA.

DETERMINATION AND REASONS SUPPORTING THE DETERMINATION

The proposed project would not have a significant effect on the environment and therefore preparation of an environmental impact statement is not required. The "significance criteria," Section 12 of Hawaii Administrative Rules Title 11, Chapter 200, "Environmental impact Statement Rules," were reviewed and analyzed. Based on the analysis, the following were concluded:

1. No irrevocable commitment to loss or destruction of any natural or cultural resource would result.

   All construction is located in previously disturbed land and no natural of cultural resources are present.

2. The action would not curtail the range of beneficial uses of the environment.

   The project will occupy only a very small area of land non of which is currently in any significant environmental use.

3. The proposed action does not conflict with the state's long term environmental goals and guidelines.

   Conservation of natural resources and enhancement of the quality of life are the two broad policies of the "State Environmental Policy" in Chapter 344 of the Hawaii Revised Statutes. The proposed project does not consume any natural resources. It will enhance the quality of life by enabling residents to communicate by telephone while transiting the Koolau's via the H-3 Freeway. The system will provide essential communications in the event of disaster and provide for emergency communications for stranded motorists. The ability to call for assistance will contribute to the safety, and the physical and mental well being of those who must travel over H-3, especially at night.

4. The economic or social welfare of the community or state would not be substantially affected.

   The economic and social well being of the community will be enhanced by the increase in communication

services that will be provided by these systems.

5. The proposed action does not substantially affect public health.

   There is no public health impact caused by these systems. The radiated power for the antenna systems will range between 60 to 100 watts. This is equivalent to the radiation emitted by standard household electric light bulbs. The exclusion distance for the Land Use Ordinance allowable power for human contact of 0.1 milliwatts per square centimeter is 7.2 feet. No automobiles will be within 7.2 feet of a transmitting antenna. Further, the Federal standards for human radiation tolerance is 0.5 milliwatts per square centimeter which is five times that allowed by the LUO.

6. No substantial secondary impacts, such as population changes or effects on public facilities, are anticipated.

   Provision of the communication services made possible by this installation will have no impact on population changes or public facilities.

7. No substantial degradation of environmental quality is anticipated.

No degradation of the environment is anticipated. The project area has already been extensively altered during construction of the tunnels.

8. The proposed action does not involve a commitment to larger actions, nor would cumulative impacts result in considerable impacts on the environment.

   The project is self contained and independent of any other installations.

9. No rare, threatened or endangered species or their habitats would be affected.

   The area involved with this project is very small and previously has been extensively altered. There are no endangered of threatened species or their habitats on the property.

10. Air quality, water quality, or ambient noise levels would not be detrimentally affected.

    In operation this is a passive facility. It does not impact air quality, does not use water. The only noise generated is from the operation of the fans cooling the electronic equipment cabinets which will be less than the noise of the vehicles transiting the freeway. Further, the cabinets are located several miles from the nearest dwelling.

11. The project would not affect environmentally sensitive areas, such as flood plains, tsunami zones, erosion-prone areas, geologically hazardous lands, estuaries, fresh waters or coastal waters.

    The project area is not on or near any of the above areas of concern.

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PHONE (808) 594-1888

FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

November 24, 1997

Donald Clegg
Analytical Planning Consultants, Inc.
84 N. King Street
Honolulu, Hawaii 96817

Re: Draft Environmental Assessment Proposed Transmitter/Receiver Installation at the H-3 Tunnel

Dear Mr. Clegg:

Thank you very much for the opportunity to review the above-referenced Draft Environmental Assessment (DEA). The project is being jointly proposed by PrimeCo Personal communications L.P., Western Wireless Inc., Honolulu Cellular Inc., and GTE. The applicants are proposing to construct a transmitter/receiver installation at the Honolulu side of the H-3 Tunnel Bores. The purpose of the proposed project is to facilitate Cellular and PCS wireless telephone communications, and paging on the Honolulu approach to the tunnels and within the tunnels themselves.

Based on the information contained in the DEA, the Office of Hawaiian Affairs (OHA) has no objections to the proposed project at this time. The approach of joint utilization of a single transmitter/receiver serves to mitigate the visual impact of multiple installations. Furthermore, the RF safety Assessment indicates that the public's level of exposure to electromagnetic radiation will be significantly below established safety levels.

Please contact Colin Kippen, Land and Natural Resources Division Officer, or Richard Stook, EIS Planner at 594-1755, should you have any questions regarding this matter.

Sincerely yours,

Randall Ogata
Administrator

Colin Kippen, Officer
Land and Natural Resources

RS:rs
cc: Board of Trustees

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BENJAMIN J. CAYETANO
GOVERNOR

FILE COPY

GARY GILL
DIRECTOR

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
235 SOUTH BERETANIA STREET
SUITE 702
HONOLULU, HAWAII 96813
TELEPHONE (808) 586-4186
FACSIMILE (808) 586-4186

October 27, 1997

Kazu Hayashida, Director
Department of Transportation
869 Punchbowl St.
Honolulu, HI 96813

Attn: Mike Amuro

Dear Mr. Hayashida:

Subject: Draft Environmental Assessment (EA) for H-3 Tunnel Communications Sites, Halawa Valley

Please include the following in the final EA:

1. Consultations: Document all contacts made with state agencies, county agencies and interested community groups regarding the proposed project, and include copies of any correspondence.

2. Indicate the anticipated start and completion dates of this project.

3. Significance criteria: A discussion of findings and reasons, according to the significance criteria listed in HRS Title 11-200-12, that support the anticipated Finding of No Significant Impact (FONSI) determination. You may use the enclosed guideline as a sample.

4. Permits and approvals: List all required permits and approvals for this project and their status.

5. Location of facilities: On a single map show the locations of all facilities being proposed, using the tunnel bores as points of reference.

If you have any questions, call Nancy Heinrich at 586-4185.

Sincerely,

GARY GILL
Director

Enc.

c: Donald Clegg
Eric Schatz

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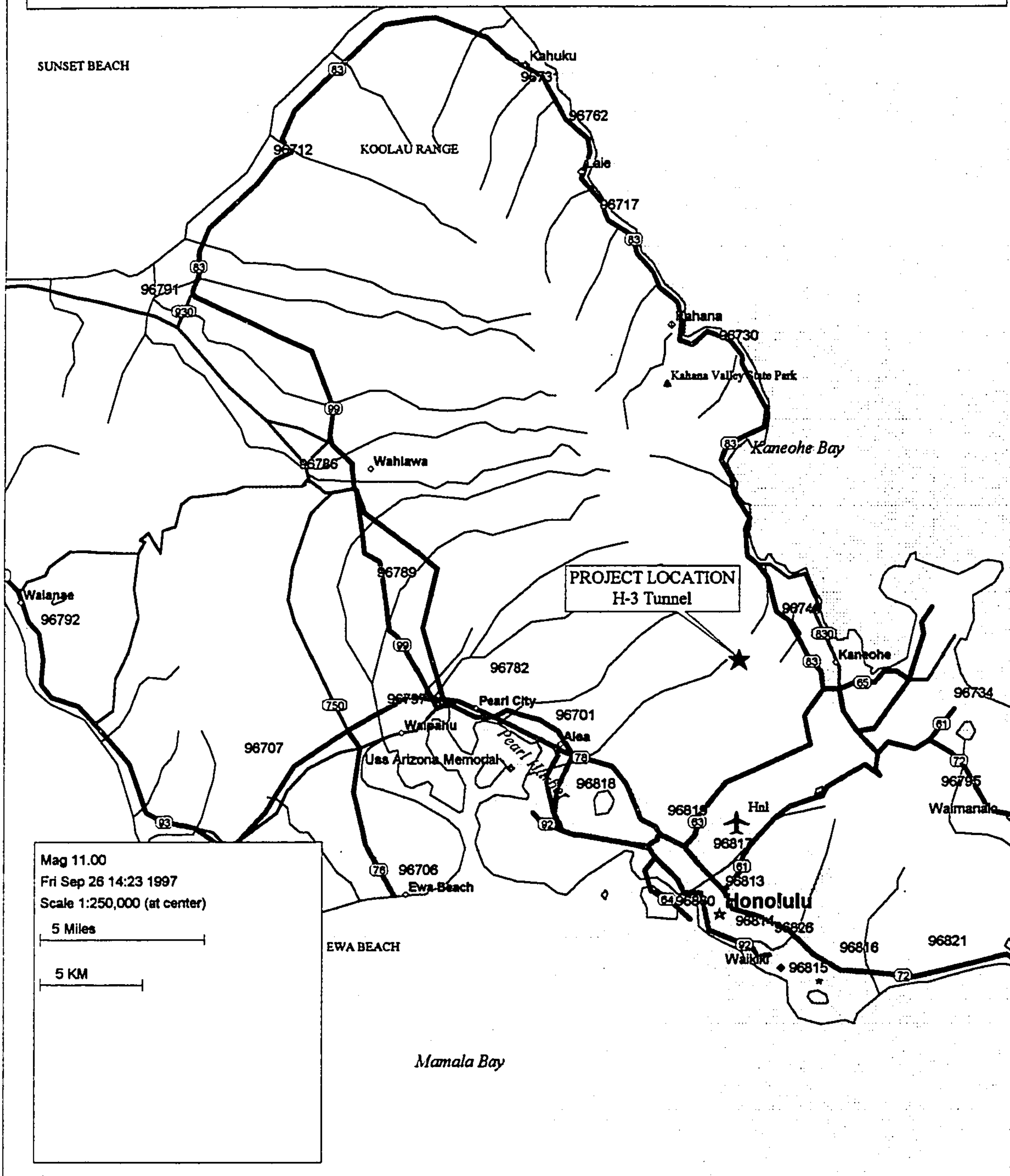
H-3 Tunnel Antenna Site Location



STATE OF HAWAII

DEPARTMENT OF TRANSPORTATION

HIGHWAYS DIVISION

HONOLULU, HAWAII

PLANS FOR

CONSTRUCTION OF A PORTION OF

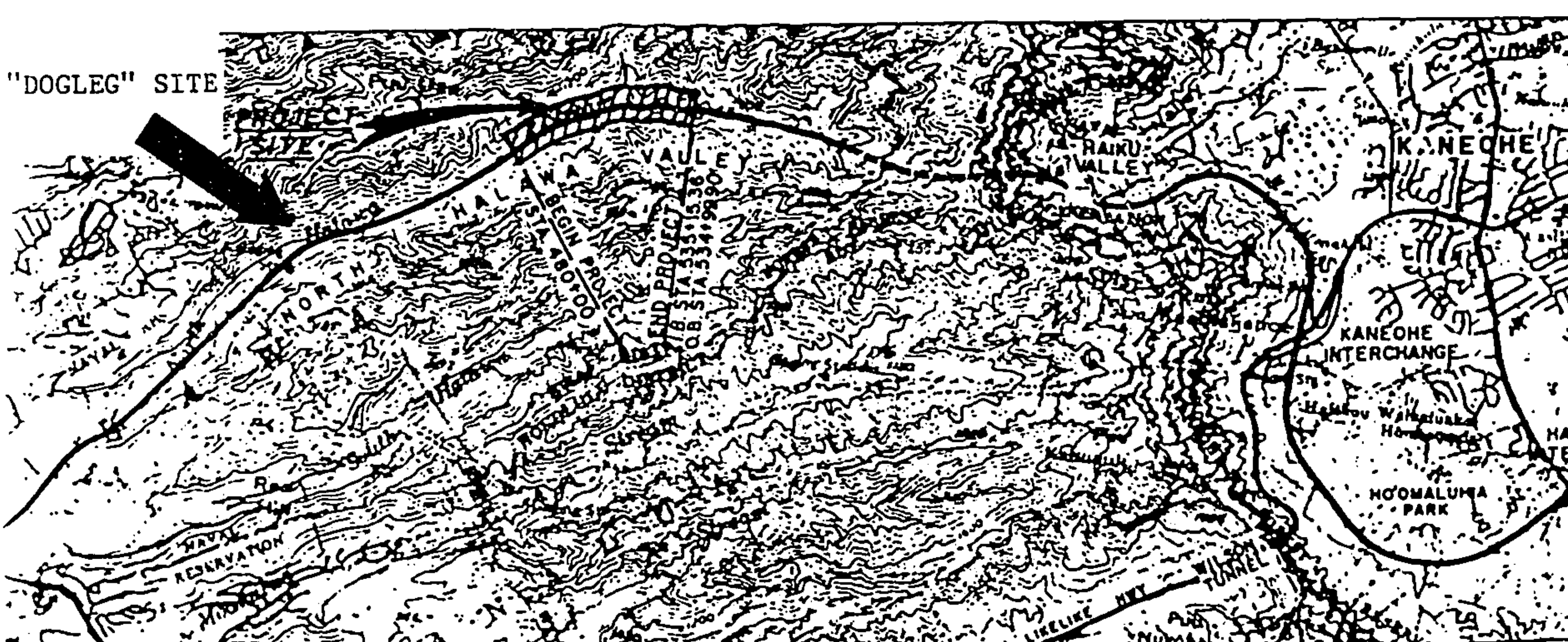
INTERSTATE ROUTE H-3

NORTH HALAWA VALLEY HIGHWAY, UNIT II

FEDERAL AID INTERSTATE PROJECT NO. I-H3-1(69)8

DISTRICT OF EWA

ISLAND OF HAWAII



LAYOUT PLAN

1/2 0 1/...

SCALE IN M...

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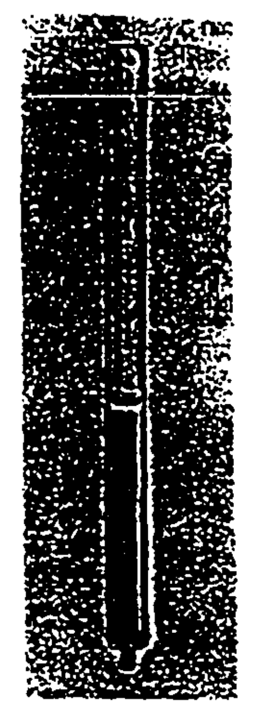
ALLEN GROUP

ASPP2933, ..SPP2936 DB910C-M PCN/PCS OMNI ANTENNAS 3, 6 or 10 dBd, 1850-1990 MHz

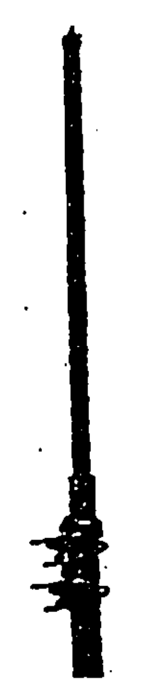
Drawing on their experience and leadership with 800/900 MHz antennas, Decibel Products and Antenna Specialists, divisions of ATG, have created a complete line of PCN/PCS antennas for 1850-1990 MHz. With aesthetically pleasing designs and very low profiles, the field-tested antennas are now available for domestic and International applications.

Three omnidirectional transmit and/or receive models are offered with 3, 6 or 10 dBd gain.

- **Sturdy Construction** - All three have radomes of tough fiberglass, two ASP models are white in color, the DB model has Horizon Blue™ Mirage™ fiberglass. Radiators are made of passivated aluminum or brass, hardware of galvanized or V2A steel.
- **Power Rating** - 400 watts maximum input.
- **Trouble Free** - Each antenna is tested for power rating compliance and the absence of intermodulation generators.
- **Lightning Protection** - Direct ground.
- *Mounting - The two ASP models are shipped with two ASPA320 mounting clamps.* The DB model has an integral dual purpose mount that can be top or side mounted to a pipe with V-bolts, included.



DB910C-M



Ordering Information

N-Female	7/16 DIN Connector		Gain – dBd/dBi
ASPP2933	ASPP2933G		3/5.1
ASPP2936	ASPP2936G		6/8.1
DB910CN-M	DB910CE-M		10/12.1

Electrical Data

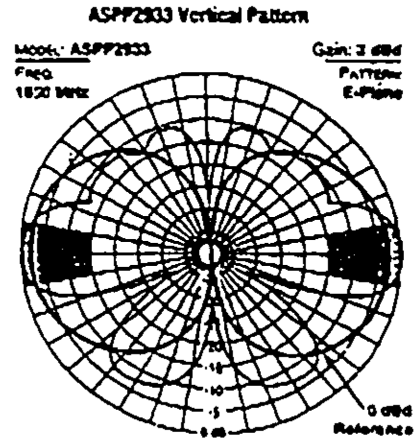
	ASPP2933	ASPP2936	DB910C-M
Frequency ranges – MHz	1850-1990	1850-1990	1850-1990
Gain – dBd/dBi	3/5.1	6/8.1	10/12.1
VSWR	< 1.5:1	< 1.5:1	< 1.5:1
Beamwidth (3 dB from maximum)	32°	12°	5°
Polarization	Vertical	Vertical	Vertical
Maximum power input – watts	400	400	400
Input impedance – ohms	50	50	50
Lightning protection	Direct ground	Direct ground	Direct ground
Termination – standard	N-Female	N-Female	N-Female
Jumper cable	Order separately	Order separately	Order separately

Mechanical Data

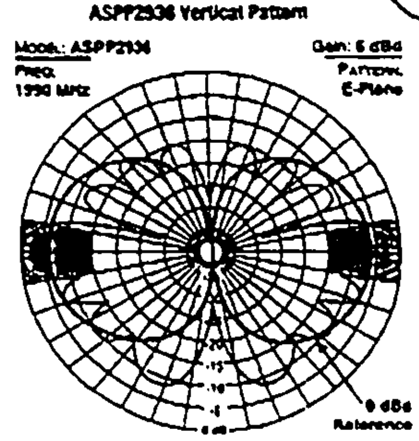
	ASPP2933	ASPP2936	DB910C-M
Overall length – in. (mm)	24 (610)	36 (915)	77 (1955)
Radome OD – in. (mm)	1.0 (25.4)	1.0 (25.4)	1.5 (38)
Wind area – ft² (m²)	.17 (.0155)	.25 (.0233)	.54 (.05)
Wind load at 125 mph (201 kph) – lbf (N)	4 (17)	6 (26)	14 (61)
Maximum wind speed – mph (kph)	140 (225)	140 (225)	125 (201)
Weight – lbs. (kg)	4 (1.8)	6 (2.7)	5.2 (2.4)
Shipping weight – lbs. (kg)	11 (4.9)	13 (5.9)	9 (4.1)
Clamps (steel)	ASPA320	ASPA320	Integral Dual Purpose

CAN BE SHIPPED BY UPS

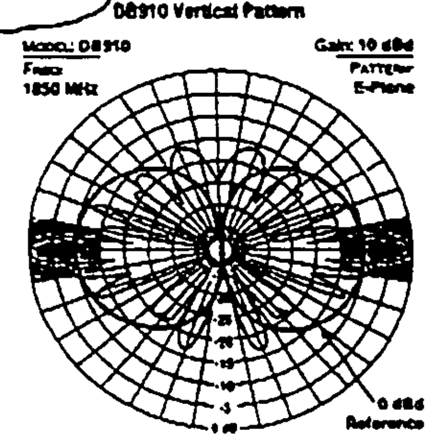
ASPP2933 Vertical Pattern



ASPP2936 Vertical Pattern



DB910 Vertical Pattern



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125, 140 & 170 Series Features

The features it takes to start something big

Engine Block

- Komatsu, liquid cooled, inline, overhead valve, industrial diesel engines.
- Four cycle operation for fuel efficiency.
- Replaceable wet cylinder liners for long life and low rebuild costs. Tuftride treated to reduce oil consumption and scuffing.
- One four valve head per cylinder. Superior head to block seal. Simplifies maintenance. Rebuild a cylinder without disturbing others.
- Swing-arm, roller-cam followers for smooth valve action and reduced wear.
- Single piece forged steel crankshaft with eight balancers and seven bearings.
- Ductile iron pistons for strength and fuel economy on 6125, 6140 and 12V140A. 6170 model has AC8A aluminum alloy pistons with Ni-resist iron ring insert.
- Keystone piston rings cut carbon build-up.

Cooling System

- Liquid cooled with radiator. Pusher fan
- Thermostatic temperature control for quick warm-ups and even cooling.
- Gear driven centrifugal water pumps.
- Coolant filter with spin-on element removes contaminants and controls acidity. Protects cylinder liners and coolant pump impeller.

Fuel System

- Direct injection for fuel economy.
- Bosch-type inline, gear-driven injection pump for accurate fuel metering and extreme reliability. International service organization.
- All speed RSV or RSUV governors for accurate speed and frequency control.
- Bosch-type injectors with replaceable nozzles
- Fuel lift pump. Spin-on fuel filter.
- Fuel lines routed to fuel manifold on base

Intake and Exhaust

- Turbo-compressors and jacketwater aftercoolers used to increase output, lower specific fuel consumption and reduce thermal loading.
- Dry air filter with dual replaceable elements and service indicator.
- Three section exhaust manifolds.

Lubricating System

- Gear-type oil pump.
- Spin-on oil filter with bypass.
- Thermostatically controlled, stainless oil cooler keeps engine oil at optimum temperature for better lubrication and long life.
- Dual circuit, oil spray piston cooling lowers temperature.
- Lube oil included.

DC Electrical System

- 24 volt with starter motor, alternator and regulator.
- Unit mounted S-3 panel with oil pressure gauge, coolant temperature gauge, DC volt meter, hour meter and start-stop switch.

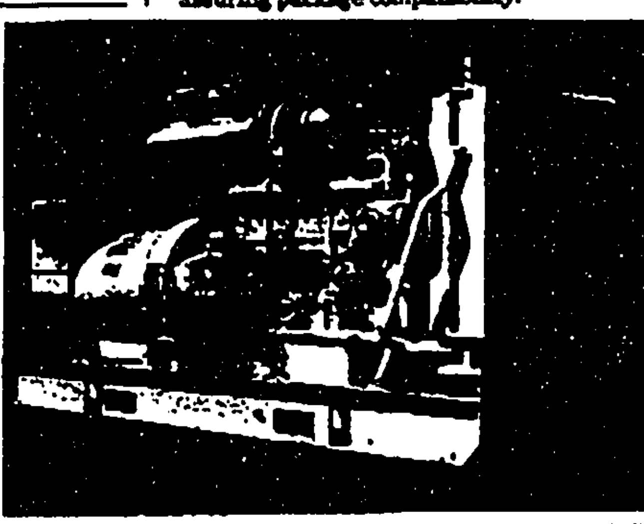
- Safety system stops engine in the event of low oil pressure or high water temperature.

AC Generator

- Northern Lights, direct coupled, brushless, single bearing, 12 lead, reconnectable generator ends.
- Generators meet or exceed NEMA and BS standards with class F/H insulation, accessible diodes, oversized ball bearings and low 105° C temperature rise at prime rating.
- Automatic voltage regulators give quick response, excitation support and stable paralleling. Voltage is regulated to ±1% RMS over no load to full load range.

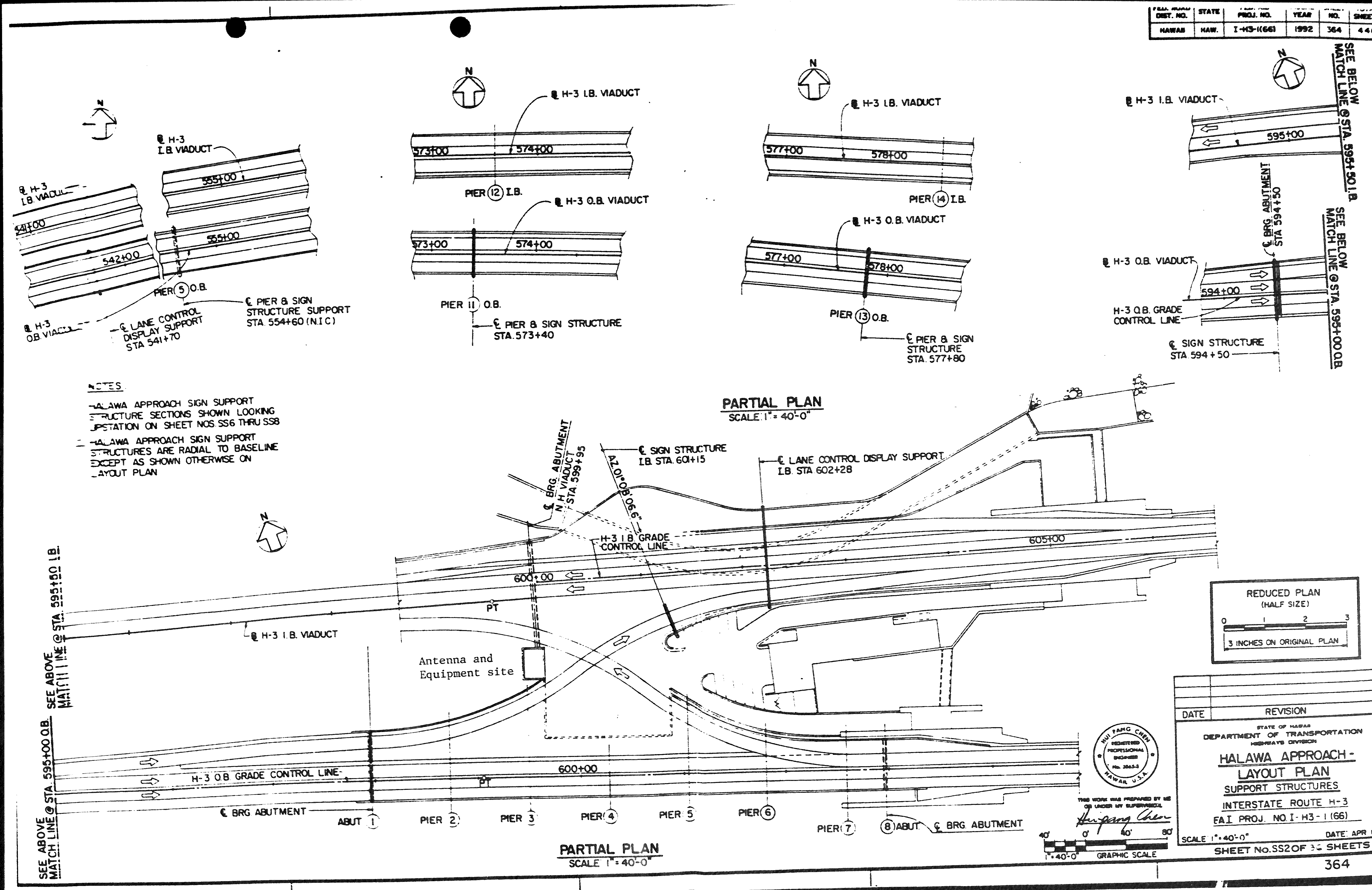
Special Equipment & Features

- Heavy duty, welded steel skid frames.
- Enamel paint for long-life finish.
- Sets are load tested with control panels assuring package compatability.



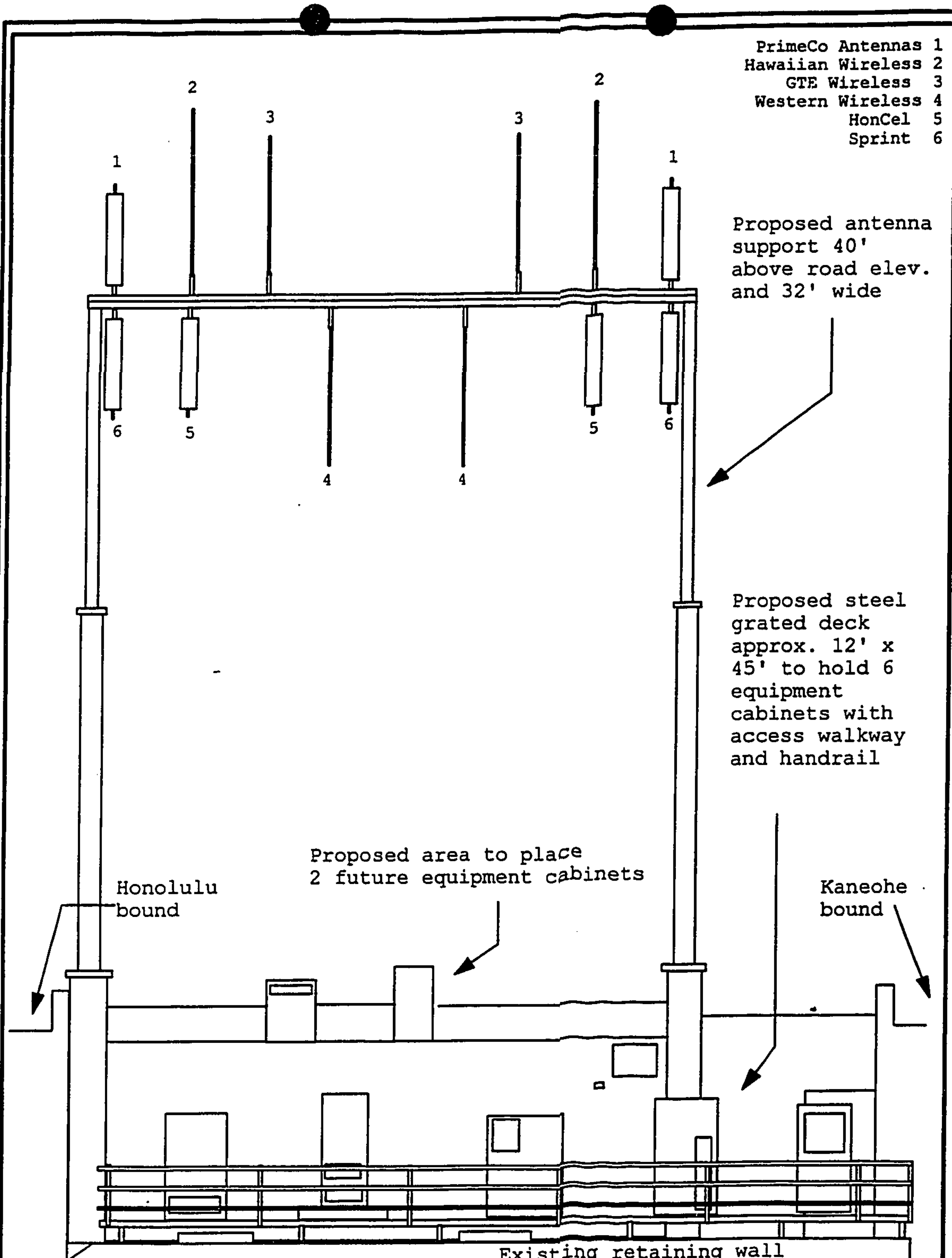
	Model Number	NL6125T	NL6125A	NL6140A	NL6170A	NL12V140
AC Output[1]						
Standby	1800 RPM 60 Hz	205 kW/206 KVA	258 kW/322 KVA	360 kW/450 KVA	570 kW/712 KVA	763 kW/954 KVA
Prime	1800 RPM 60 Hz	188 kW/235 KVA	235 KW/294 KVA	330 KW/412 KVA	520 kW/650 KVA	690 KW/862 KVA
Standby	1500 RPM 50 Hz	173 KW/216 KVA	204 kW/255 KVA	304 KW/380 KVA	482 kW/602 KVA	635 kW/794 KVA
Prime	1500 RPM 50 Hz	159 KW/199 KVA	165 kW/231 KVA	280 kW/350 KVA	439 kW/548 KVA	576 kW/720 KVA
Phase		Three phase standard on all units. Single phase optional.				
Voltages 60 Hz		60 Hz- 120/208, 120/240, 127/220, 139/240, 220/380, 240/416, 254/440 and 277/480				
Voltages 50 Hz		50 Hz- 110/190, 110/220, 115/230, 120/208, 127/220, 220/380, 240/416				
Engine						
Cylinders /Aspiration		6/Turbo	6/Turbo-AC	6/Turbo-AC	6/Turbo-AC	V12 /Turbo-AC
Displacement	cu. in. (l)	674 (11)	674 (11)	930 (15)	1413 (23)	1860 (30)
Bore	in (mm)	4.9 (125)	4.9 (125)	5.5 (140)	6.7 (170)	5.5 (140)
Stroke	in (mm)	5.9 (150)	5.9 (150)	6.5 (165)	6.7 (170)	6.5 (165)
HP at 1800 RPM[2]	prime (standby)	273 (301)	340 (375)	472 (520)	732 (807)	986 (1,086)
Specific Fuel Rate[3]	lb/bhp/hr	.357	.361	.331	.372	.337
Approx. Fuel Rate[4]	gal/hr(l/h)	13.77 (52)	16.9 (64)	22.1 (83.6)	38.6 (146)	52.6 (199)
Installation & Dimensional Data						
Intake Air Flow	cfm (l/s)	515 (243)	699 (330)	963 (454)	1,695 (800)	1,925 (908)
Exhaust Temperature	degrees F (C)	878 (470)	986 (530)	1,035 (557)	986 (530)	1,035 (557)
Max. Back Pressure	in H_2O (cm H_2O)	30 (76)	30 (76)	30 (76)	30 (76)	30 (76)
Fan Air Flow	cfm (l/s)	11,013 (5,200)	12,708 (6,000)	18,010 (8,500)	20,296 (9,580)	36,020 (17,000)
Heat Rejection[5]	btu/min (Kcal/h)	6,340 (96,000)	9,060 (137,000)	10,700 (162,000)	18,400 (278,000)	21,400 (324,000)
Length	in (cm)	110 (280)	110 (280)	124 (315)	143 (364)	140 (355)
Width	in (cm)	37.5 (95)	37.5 (95)	42.5 (108)	50 (127)	52 (132)
Height	in (cm)	62 (158)	62 (158)	69 (175)	76 (194)	74 (189)
Approximate Weight	lbs (kgs)	4500 (2040)	4,740 (2155)	6,240 (2835)	10,500 (4770)	12,400 (5636)

1. kW rating with fan and radiator at 0.8 power factor and average generator efficiency. 1 kW equals 1000 watts. 2. Net flywheel hp rating for fully equipped engine at 1800 RPM under SAE J816b. Derations: Consult factory for derations if your application requirements are above 77° F (25°C) ambient temperature and/or 650 feet (200 meters) altitude above sea level. 3. Based on prime HP rating at 1800 RPM. 4. Based on full prime kW rating at 1800 RPM. Actual rate may vary depending on operating conditions. 5. Based on stand-by rating at 1800 RPM. 6. Based on stand-by 1800 RPM sets. Consult factory in applications where dimensions are critical.

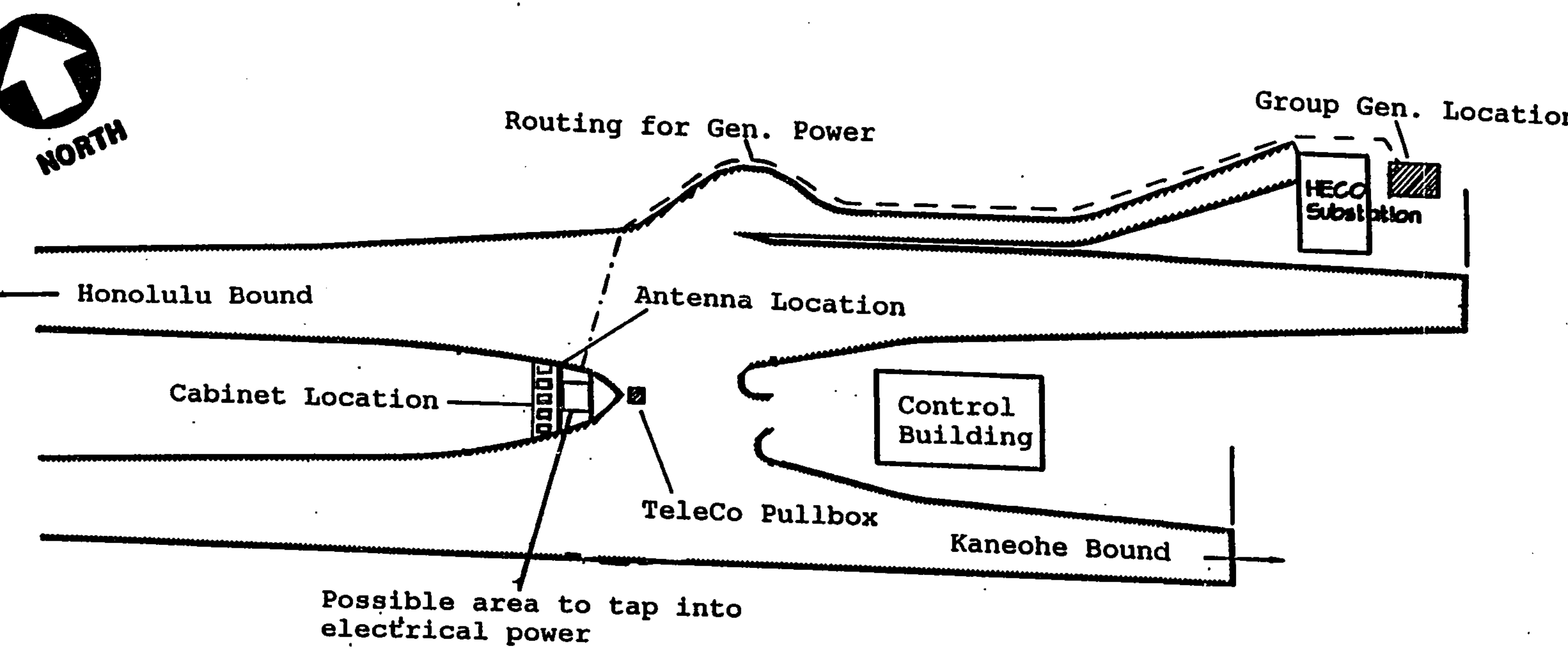


FED. ROAD DIST. NO. HAWAII | STATE HAW. | FED. AID PROJ. NO. I-H3-1(66) | FISCAL YEAR 1992 | SHEET NO. 364 | TOTAL SHEETS 440
℄ H-3 I.B. VIADUCT
555+00
℄ H-3 I.B. VIADUCT
541+00
542+00
PIER 5 O.B.
℄ H-3 O.B. VIADUCT
℄ LANE CONTROL DISPLAY SUPPORT STA 541+70
℄ PIER & SIGN STRUCTURE SUPPORT STA. 554+60 (N.I.C)
℄ H-3 I.B. VIADUCT
573+00
574+00
PIER 12 I.B.
℄ H-3 O.B. VIADUCT
PIER 11 O.B.
℄ PIER & SIGN STRUCTURE STA. 573+40
℄ H-3 I.B. VIADUCT
577+00
578+00
PIER 14 I.B.
℄ H-3 O.B. VIADUCT
PIER 13 O.B.
℄ PIER & SIGN STRUCTURE STA. 577+80
℄ H-3 I.B. VIADUCT
595+00
SEE BELOW MATCH LINE @ STA. 595+50 I.B.
℄ BRG. ABUTMENT STA 594+50
℄ H-3 O.B. VIADUCT
594+00
H-3 O.B. GRADE CONTROL LINE
℄ SIGN STRUCTURE STA 594+50
SEE BELOW MATCH LINE @ STA. 595+00 O.B.
NOTES
HALAWA APPROACH SIGN SUPPORT STRUCTURE SECTIONS SHOWN LOOKING UPSTATION ON SHEET NOS. SS6 THRU SS8
HALAWA APPROACH SIGN SUPPORT STRUCTURES ARE RADIAL TO BASELINE EXCEPT AS SHOWN OTHERWISE ON LAYOUT PLAN
PARTIAL PLAN
SCALE 1" = 40'-0"
℄ BRG. ABUTMENT N.H. VIADUCT STA. 599+95
AZ. 01°08'06.9"
℄ SIGN STRUCTURE I.B. STA. 601+15
℄ LANE CONTROL DISPLAY SUPPORT I.B. STA 602+28
H-3 I.B. GRADE CONTROL LINE
605+00
600+00
PT
℄ H-3 I.B. VIADUCT
SEE ABOVE MATCH LINE @ STA. 595+50 I.B.
Antenna and Equipment site
REDUCED PLAN (HALF SIZE)
0 1 2 3
3 INCHES ON ORIGINAL PLAN
SEE ABOVE MATCH LINE @ STA. 595+00 O.B.
H-3 O.B. GRADE CONTROL LINE
600+00
PT
℄ BRG. ABUTMENT
ABUT 1
PIER 2
PIER 3
PIER 4
PIER 5
PIER 6
PIER 7
8 ABUT
℄ BRG. ABUTMENT
PARTIAL PLAN
SCALE 1" = 40'-0"
HUI FANG CHEN REGISTERED PROFESSIONAL ENGINEER No. 3863-S HAWAII, U.S.A.
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION
40' 0' 40' 80'
1" = 40'-0" GRAPHIC SCALE
DATE | REVISION
STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION
HALAWA APPROACH - LAYOUT PLAN
SUPPORT STRUCTURES
INTERSTATE ROUTE H-3
FAI PROJ. NO. I-H3-1 (66)
SCALE 1" = 40'-0"
DATE: APR 19
SHEET No. SS2 OF 3_ SHEETS
364

0000 0015 1663



ELEVATION A (scale 1" = 7' approx.)


Routing for Gen. Power
Group Gen. Location
HECO Substation
NORTH
Honolulu Bound
Antenna Location
Cabinet Location
Control Building
TeleCo Pullbox
Kaneohe Bound
Possible area to tap into electrical power

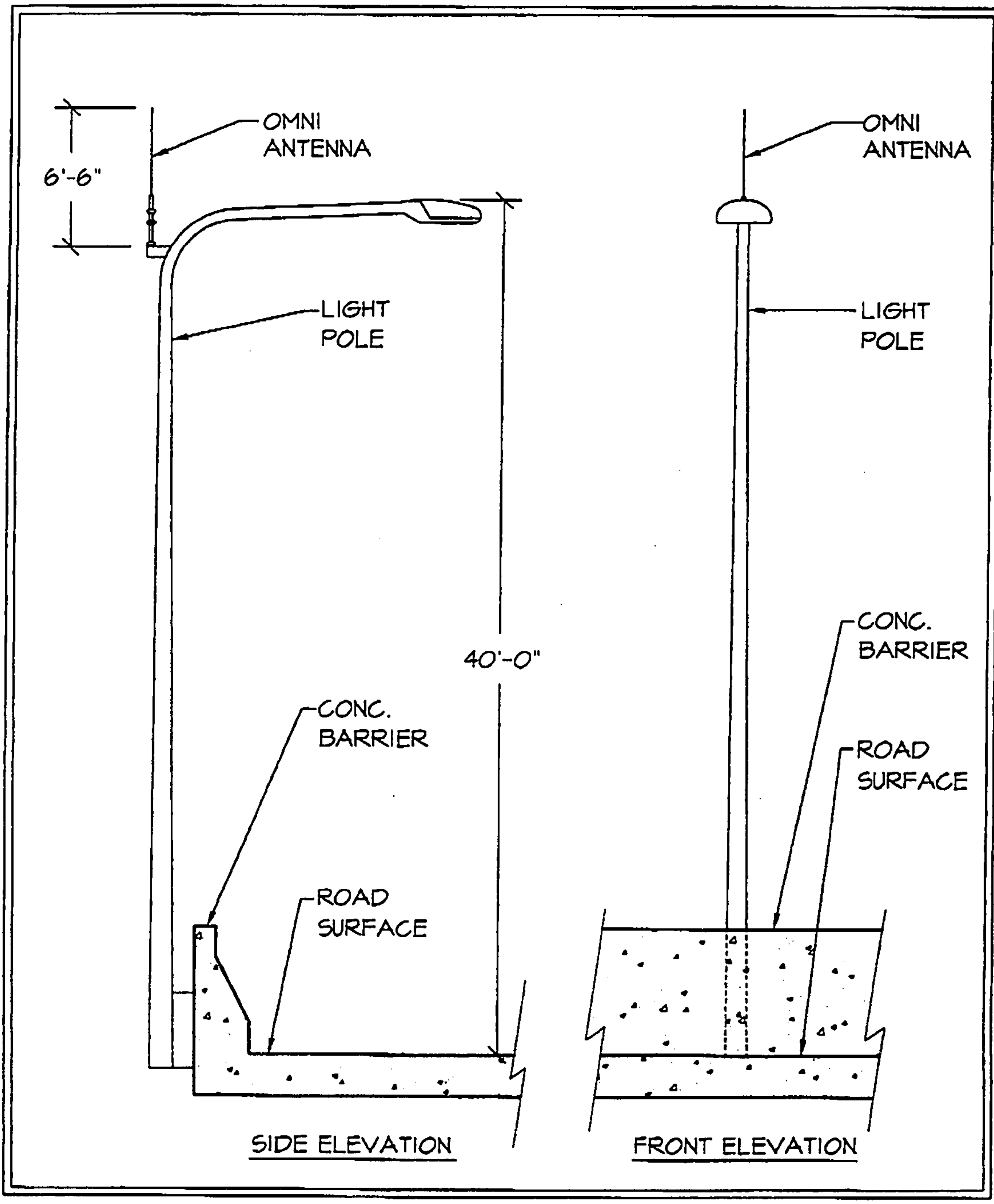
0000 0015 1665

9-04-1997 11:59AM FROM WESTERN WIRELESS 808 487 0561

SITE DESCRIPTION

SITE NAME : H-3 DOGLEG **SITE NUMBER :** ____________ **WESTERN PCS II**

SITUATED IN THE CITY OF HONOLULU **, COUNTY OF** OAHU **, STATE OF** HAWAII



M:\SITEDATA\CADW3\DOGLEG\B.DWG 6/12/97

RF Safety Assessment for PCS/Cellular Antennas Along the H-3 Highway Corridor

Prepared by

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September 16, 1997

Scope of Work

This report is based on a safety assessment performed at the University of Hawaii at Manoa for a consortium of wireless communication providers. Calculations are made for the radio-frequency signal levels emitted from a set of proposed PCS/cellular antennas along the H-3 Highway Corridor, and are compared to federal safety standards.

Background

Do PCS and cellular antennas produce radiation?

All wireless communication systems (including cellular and PCS systems, broadcast TV and radio, and satellite communication systems) involve the radiation of radio-frequency (RF) waves from an antenna. RF radiation falls under the category of non-ionizing radiation, which must be distinguished from ionizing radiation. Ionizing radiation is associated with x-rays and other types of high-energy sources that damage the genetic material of cells. Non-ionizing radiation, which is the type of radiation produced by cellular and PCS antennas, cannot break chemical bonds, so there is no similarity between the biological effects of ionizing and non-ionizing radiation [1].

Does RF radiation produce any biological effects?

Radio-frequency radiation does produce biological effects if the exposure is sufficiently intense. As in microwave ovens, exposure to high-power RF radiation causes heating. The effects of heating on the human body range from behavioral changes to eye damage (cataracts) [2]. As discussed later in this report, the power levels produced by cellular phone and PCS base station antennas are too low to cause heating.

Have there been any recent studies on RF radiation from cellular and PCS antennas?

More than 80 papers dealing with radio waves and PCS systems were presented at the June 1996 meeting of the Bioelectromagnetics Society, which is the principal meeting in which the biological and health effects of radio waves are discussed. An additional 100 papers covering the same subject were presented at the 2nd World Congress of Electricity and Magnetism in Medicine and Biology in June 1997. None of these papers reported repeatable results that would suggest that RF radiation exposure at levels allowed by the 1992 ANSI standard would pose any health risk to humans [3]. In one paper, Tell and Cleveland [4] reported on a survey of cellular phone base stations, showing that antennas on free-standing towers produced levels of radio waves that were "typically thousands of times below safety standards in publicly accessible areas".

How are RF levels determined?

The biological effects of RF radiation depend on the rate at which power is absorbed. This rate of energy absorption is called the Specific Absorption Rate (SAR) and is measured in watts per kilogram (W/kg). SARs are difficult to measure on a routine basis, so what is usually measured is the plane-wave power density. Average whole body SARs can then be calculated from the power density exposure. Plane-wave power density levels are measured in units of milliwatts per square centimeter (mW/cm^2) [3].

Who determines what RF levels are safe?

There are national and international safety guidelines for exposure of the public to the RF radiation levels produced by cellular and PCS base-station antennas. The most widely accepted standards are those developed by the Institute of Electrical and Electronics Engineers and American National Standards Institute (ANSI/IEEE) [5], the International Commission on Non-Ionizing Radiation Protection (ICNIRP) [6], and the National Council on Radiation Protection and Measurements (NCRP) [7]. Compared to the ANSI/IEEE standards, the ICNIRP standards are slightly lower and the NCRP standards are essentially identical.

In August 1996, the U.S. Federal Communications Commission (FCC) released radiofrequency guidelines for cellular and PCS base-station antennas. These standards are essentially identical to the ANSI/IEEE standard. Specifically, the FCC standard dictates that the maximum permissible exposure for the general public is $(f/1500)$ mW/cm^2, where f is the frequency in megahertz [8].

How are safety standards determined?

A 10-fold safety margin was applied to establish occupational exposure guidelines. An additional 5-fold safety margin was added for continuous exposure of the general public. Finally, detailed studies were done to establish the relationship of power density, which can be routinely measured, to energy absorption, which really matters. The result is a highly conservative public exposure guideline that is set at a level that is only 2% of the level where replicated biological effects have actually been observed [3].

Analysis

Our analysis is based on a worst-case scenario, in which we make the following assumptions:

- *The main beam of the antenna is aimed directly at the public*
  The only way this could happen is if the antenna became misaligned, perhaps as a result of a hurricane. In reality, the antennas are elevated high enough such that the main beam is never directly aimed at the general public. In addition, all of the data sheets provided by the consortium indicate that the antenna sidelobe levels are very low, with power levels typically -20 dB (100 times) less than the main lobe.

- *Radiated waves from all antennas within a common frequency band add constructively*
  This is a highly unlikely scenario. It is much more likely that there is partially destructive interference which reduces the plane-wave power density. Making this assumption, however, does simplify the calculations and yields a worst-case result.

Each wireless provider in the consortium of PCS/cellular carriers provided the following antenna data:

Table 1: Data provided by wireless carriers

Wireless Carrier	Effective Radiated Power (W)	Transmit Frequency (MHz)
GTE Mobilnet	60	880–889
Hawaiian Wireless	400	806–824
Honolulu Cellular	385	869–880
PrimeCo	500	1950–1965
Sprint PCS	250	1966–1969
Western Wireless	200	1930–1945

The plane-wave power density can be determined from these ERP levels using standard electrical engineering calculations. The plane-wave power density S is found from

$$S = \frac{ERP}{4\pi R^2},$$

where R is the distance from the antenna.

These power densities are in turn compared to the FCC standards. For the cellular band, the maximum exposure level is

$$\frac{f}{1500} = \frac{806}{1500} = 0.54\,\mathrm{mW/cm^2}.$$

For the PCS band, the maximum exposure level is

$$\frac{f}{1500} = \frac{1930}{1500} = 1.29\,\mathrm{mW/cm^2}.$$

In calculating these levels, the lowest frequency of each band was used to determine the most stringent exposure level.

Figures 1 and 2 summarize the calculations for PCS and cellular carriers separately. The plots show the plane-wave power density S as a function of the distance R. Superimposed on these graphs are the FCC standards – one standard for PCS and another for cellular. The figures are valid for both the Dogleg and Portal sites and holds for any distance from the antenna. It is seen that the RF power levels for each carrier are well below the FCC standards, even at a distance of 10 feet in front of the antenna. Note that the power density falls off as the square of the distance from the antenna. Based on available data, it is expected that the general public will be at least 30 – 50 feet away from the antennas.

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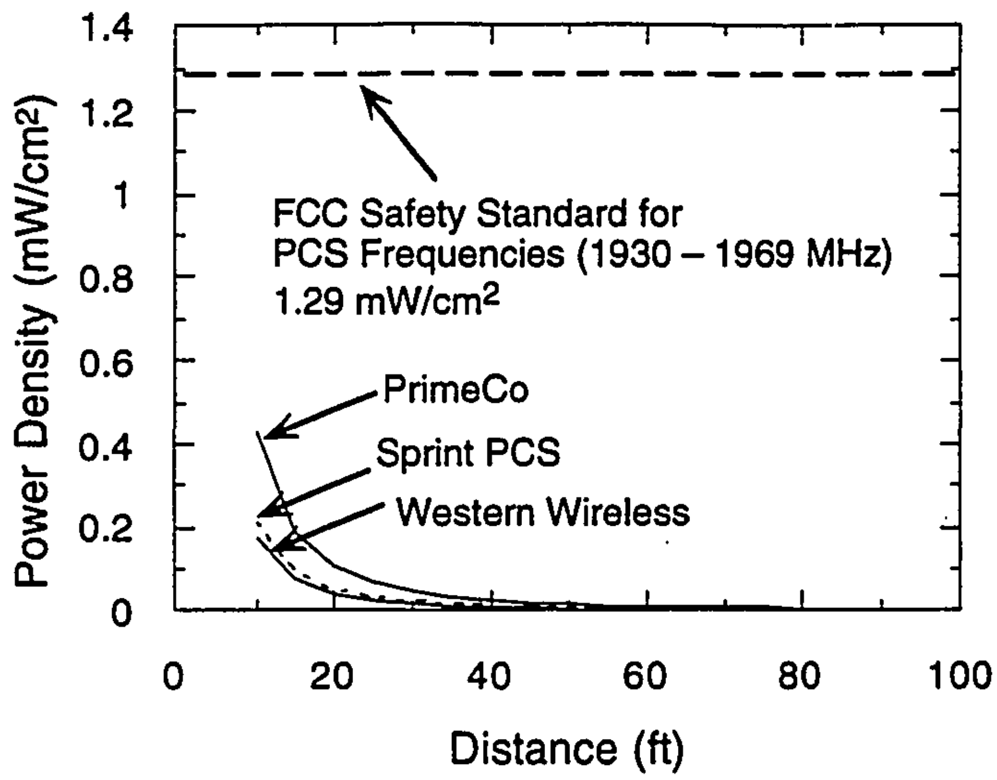


Figure 1: Power densities for PCS carriers

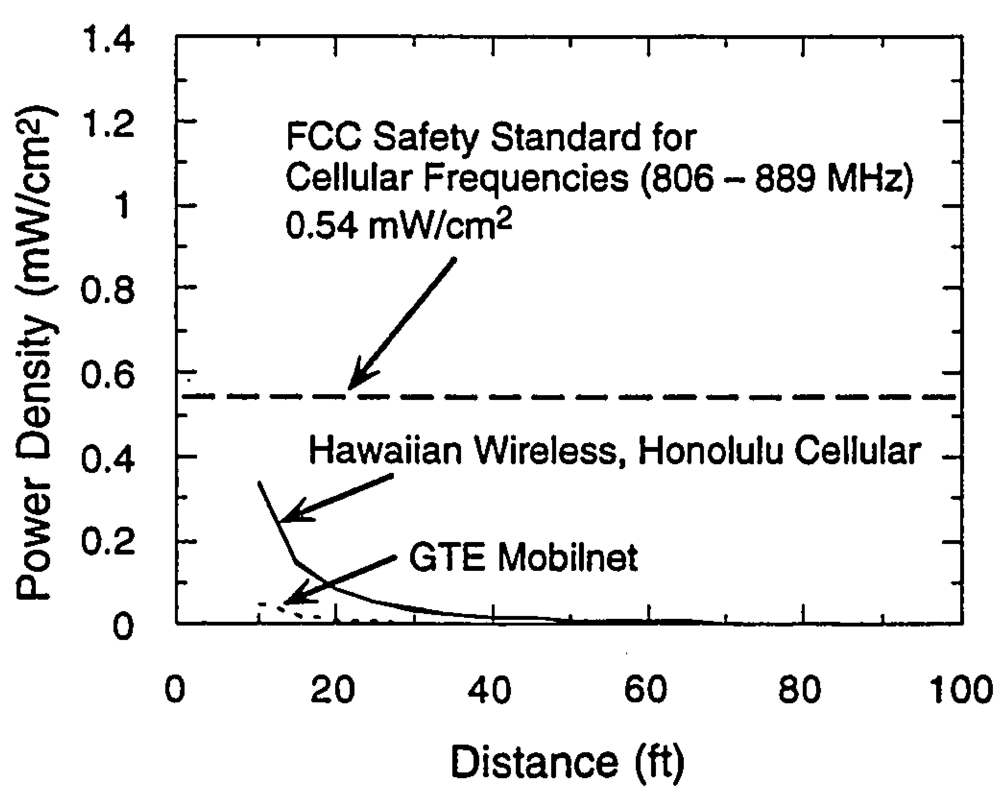


Figure 2: Power densities for cellular carriers

Site-Specific Data

Figures 1 and 2 can be used to estimate the worst-case power densities at the location of a car on the H-3 Highway. Each site is analyzed separately below.

Portal Site

Based on available drawings, the distance between the antennas and a car traveling on the highway is approximately 50 feet. Assuming that all radiated waves in the cellular band interfere constructively (an unlikely, but worst-case scenario), Table 2 shows that a power density of 0.057 mW/cm^2 is present at the location of the car, which is about 10 times less than the safety standard. For the PCS band, Table 3 shows that the worst-case power density is 18 times less than the safety standard.

Table 2: Portal Site – Cellular Carriers

Carrier	Power Density at R=50 feet (mW/cm^2)
GTE Mobilnet (2 antennas)	0.004
Hawaiian Wireless (2 antennas)	0.027
Honolulu Cellular (2 antennas)	0.026
Total	**0.057**
Safety Standard	**0.54**

Table 3: Portal Site – PCS Carriers

Carrier	Power Density at R=50 feet (mW/cm^2)
PrimeCo (2 antennas)	0.034
Sprint PCS (2 antennas)	0.017
Western Wireless (2 antennas)	0.014
Total	**0.065**
Safety Standard	**1.29**

Dogleg Site

Based on available drawings, the distance between the antennas and a car traveling on the highway is approximately 30 feet. Assuming that all radiated waves in the cellular band interfere constructively (again an unlikely, but worst-case scenario), Tables 4 and 5 below show that the worst-case power density at the location of the car is seven times less than the safety standard for both the cellular and PCS bands.

Table 4: Dogleg Site – Cellular Carriers

Carrier	Power Density at R=30 feet (mW/cm^2)
Honolulu Cellular (2 antennas)	0.073
Total	**0.073**
Safety Standard	**0.54**

Table 5: Dogleg Site – PCS Carriers

Carrier	Power Density at R=30 feet (mW/cm^2)
PrimeCo (2 antennas)	0.085
Sprint PCS (2 antennas)	0.048
Western Wireless (2 antennas)	0.038
Total	**0.17**
Safety Standard	**1.29**

Conclusions

Our calculations indicate that under *worst-case conditions* (which are highly unlikely in the first place), the expected power levels at both H-3 sites are much less than those called out by federal safety standards. It is worth reiterating that there is a 50-fold safety margin already built into the federal standards. The bottom line is that there is absolutely no reason to believe that the public will be exposed to any harmful effects from the H-3 antennas.

Qualifications of the Investigators

Wayne Shiroma has been an Assistant Professor of Electrical Engineering at the University of Hawaii at Manoa since 1996. He received the B.S. degree from the University of Hawaii at Manoa in 1986, the M.Eng. degree from Cornell University, Ithaca, New York in 1987, and the Ph.D. degree from the University of Colorado at Boulder in 1996, all in electrical engineering. He served as a Member of the Technical Staff at Hughes Space and Communications, El Segundo, CA for three years, developing solid-state power amplifiers for satellite communications. Dr. Shiroma has specialized in microwave and millimeter-wave circuits and antennas for the past 11 years, and has approximately 15 publications in this field. He has been a member of the IEEE since 1985.

Kevin Miyashiro will receive the B.S. degree in Electrical Engineering from the University of Hawaii at Manoa in December 1997, and will be entering the M.S. Program in Electrical Engineering in January 1998. He is currently an undergraduate research assistant at the UH Microwave/Millimeter Research Laboratory, working on research funded by NASA and

TRW. He has a cumulative GPA of 3.94, is a member of IEEE, and serves as Vice President of Eta Kappa Nu, the electrical engineering honor society.

References

[1] J. E. Moulder and K. R. Foster, "Biological effects of power-frequency fields as they relate to carcinogenesis," *Proc. Soc. Exper. Biol. Med.*, **209**: 309–324, 1995.

[2] International Commission on Non-Ionizing Radiation Protection, "Health issues related to the use of hand-held telephones and base transmitters," *Health Physics*, **70**: 587–593, 1996.

[3] J. E. Moulder, "Cellular phones and human health", http://www.mcw.edu/gcrc/cop/cell-phone-health-FAQ/toc.html, v. 1.9.0, 1997.

[4] R. A. Tell and R. F. Cleveland, "An investigation of radiofrequency fields near base-station antennas used for cellular radio," *Proceedings of the Bioelectromagnetics Society Conference*, June 1996.

[5] IEEE Standards Coordinating Committee 28 on Non-Ionizing Radiation Hazards: Standard for safety levels with respect to human exposure to radio frequency electromagnetic fields, 3 kHz to 400 GHz (ANSI/IEEE C95.1-1991), The Institute of Electrical and Electronics Engineers, New York, 1992.

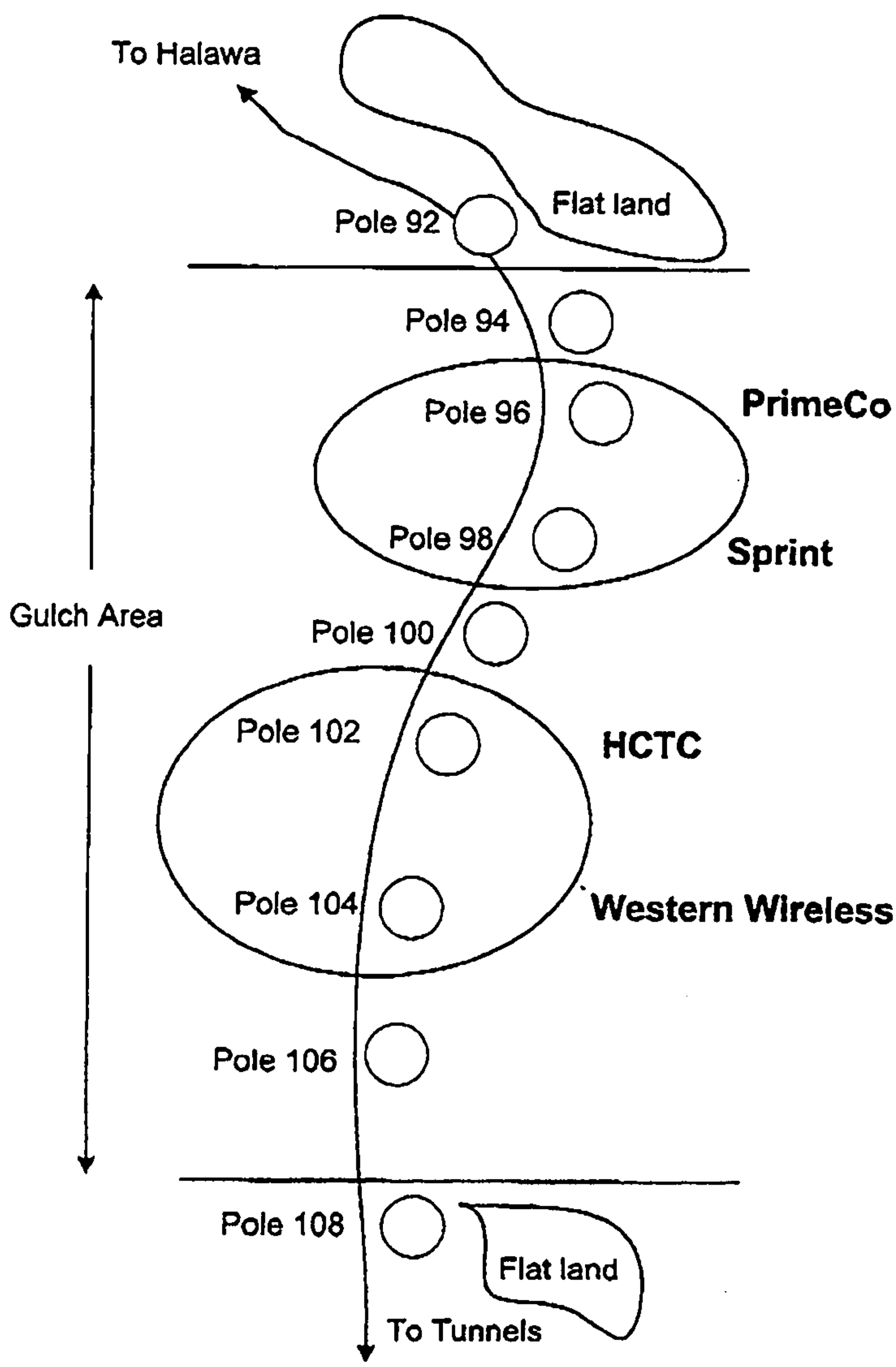
[6] International Commission on Non-Ionizing Radiation Protection: Electromagnetic fields (300 kHz to 300 GHz), Environmental Health Criteria 137, World Health Organization, 1993.

[7] National Council on Radiation Protection and Measurements, "Biological effects and exposure criteria for radiofrequency electromagnetic fields," NCRP Report No. 86, 1986.

[8] "Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation" (FCC 96-326), Federal Communication Commission, Washington, D.C., August 1996.

H-3 "Dogleg" Site

(Pole numbers indicate existing lightstand number.)



Notes: 1. The radio cabinets for Western and HCTC will be located under the H-3 on a "common area" between poles 102 and 104. The radio cabinets for Sprint and PrimeCo will be located on a "common area" between poles 96 and 98.

2. The common area for each site (two) will be 20' x 20' and will be located approximately equidistant between each set of two poles.

H-3 Equipment Location - Picture Descriptions

Picture #1.

Location of the electronic equipment cabinets as shown by the red arrow. The cabinets will be mounted below the roadway on the Honolulu side of the tunnel, therebye virtually eliminating any visual impact.

Picture #2.

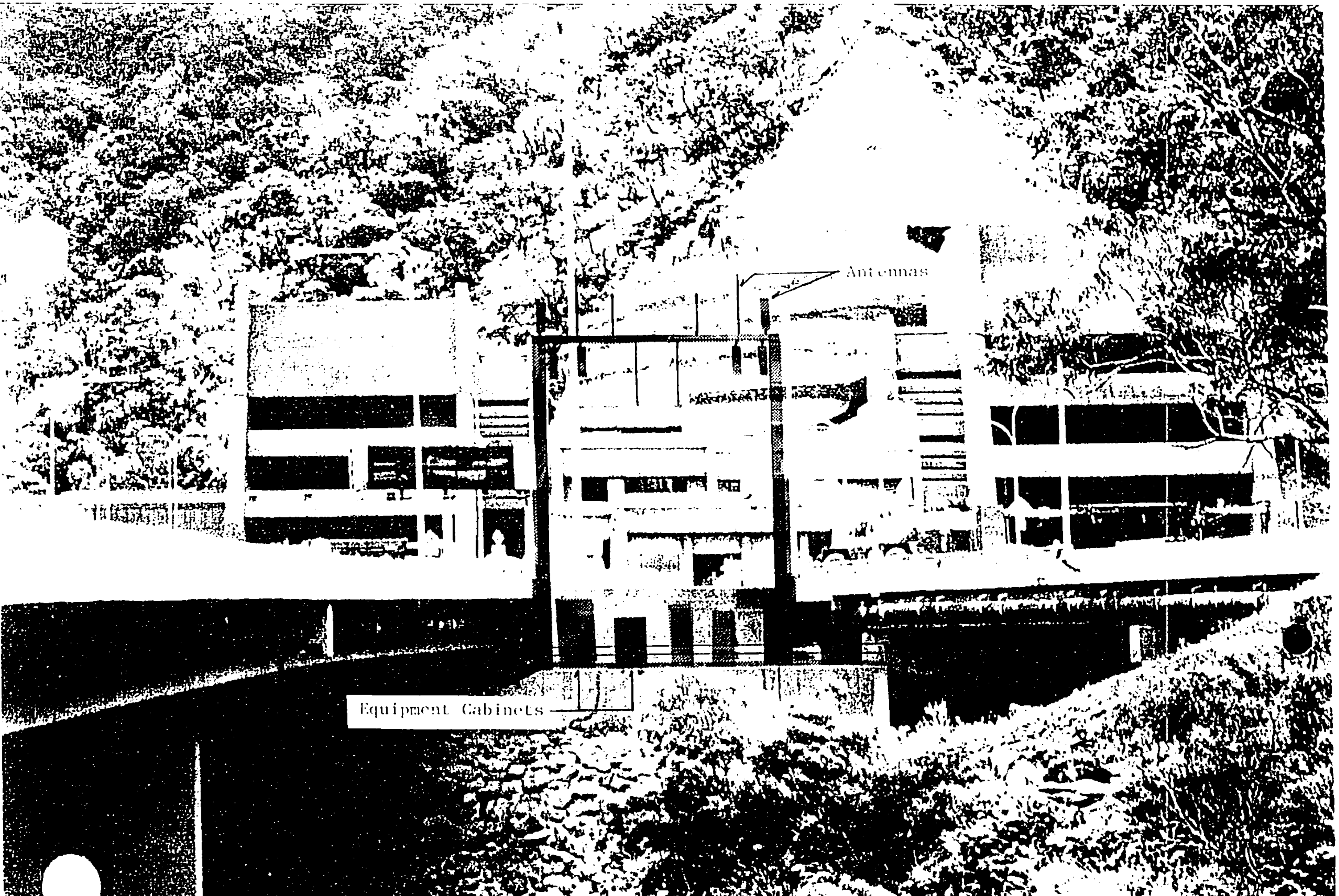
View of the tunnel entrance approaching from Honolulu. The red arrow points to the location of the antennas which will be mounted as shown on the enclosed drawings. The antennas and their mount will blend with the existing light pole and sign clutter.

Picture #3 & #4.

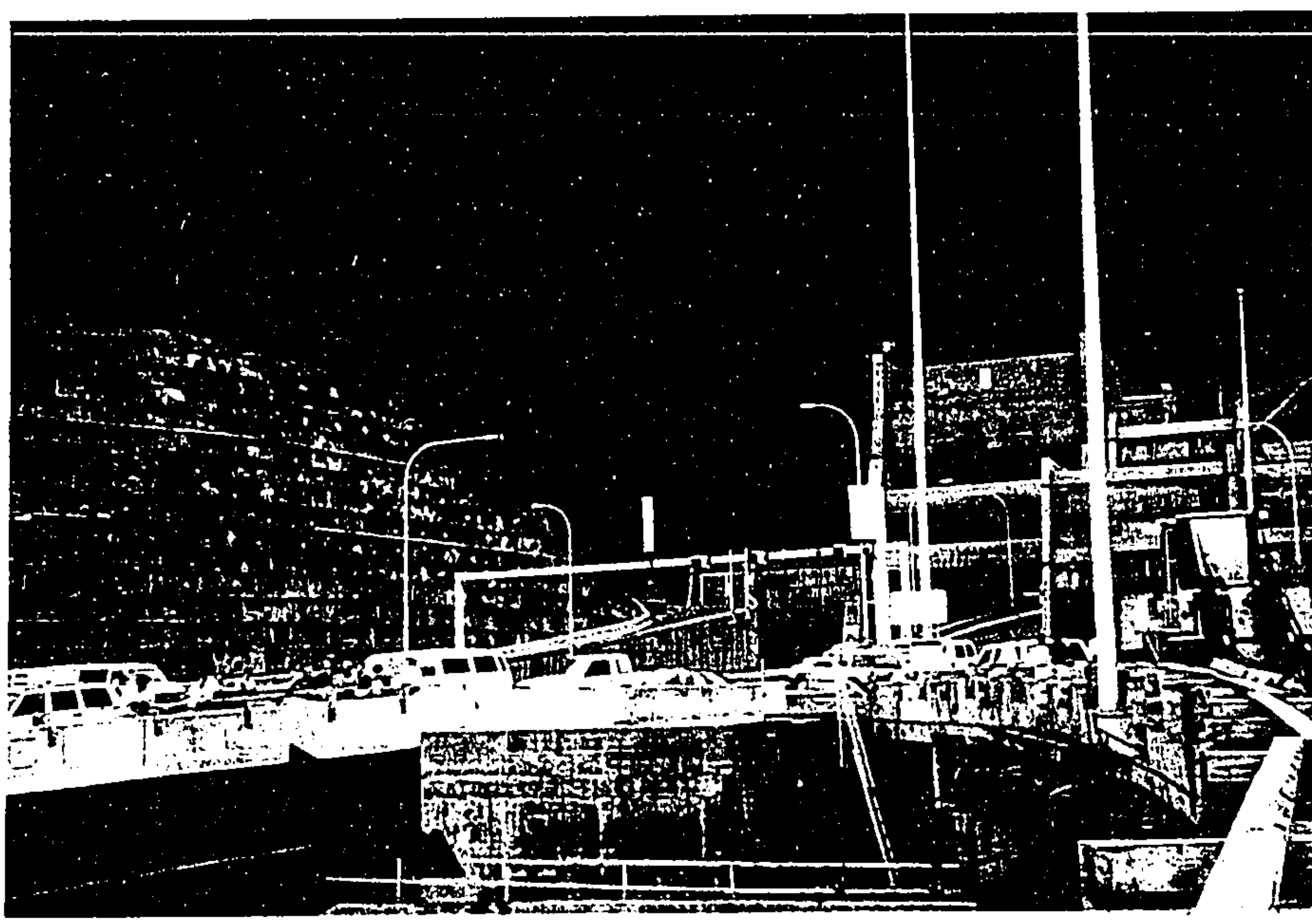
View of the light standards at the "dogleg" antenna location going toward Honolulu. The antennas will be mounted on the standards as shown on the enclosed drawings.

Picture #5.

View of the light standards at the "dogleg" antenna location looking mauka.


Antennas
Equipment Cabinets

#1



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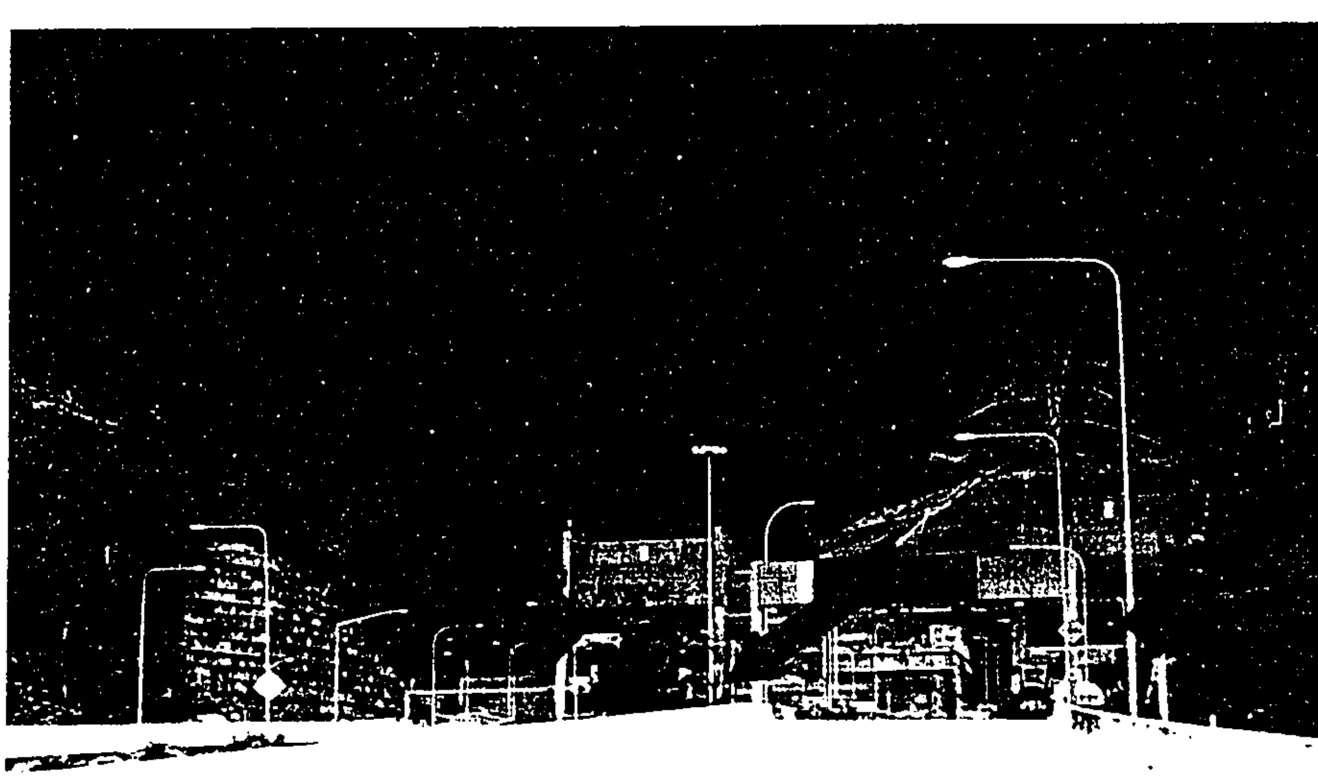

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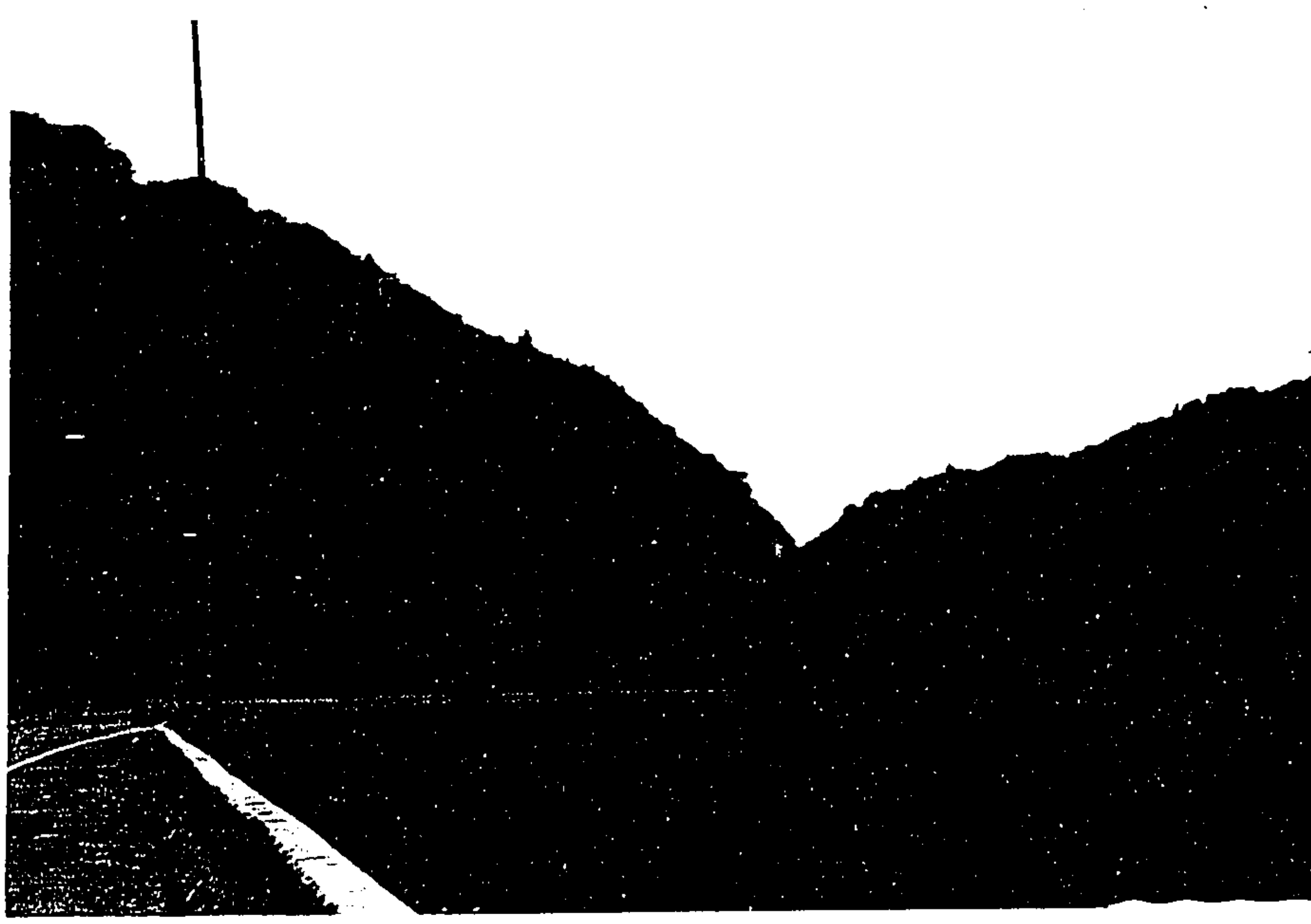

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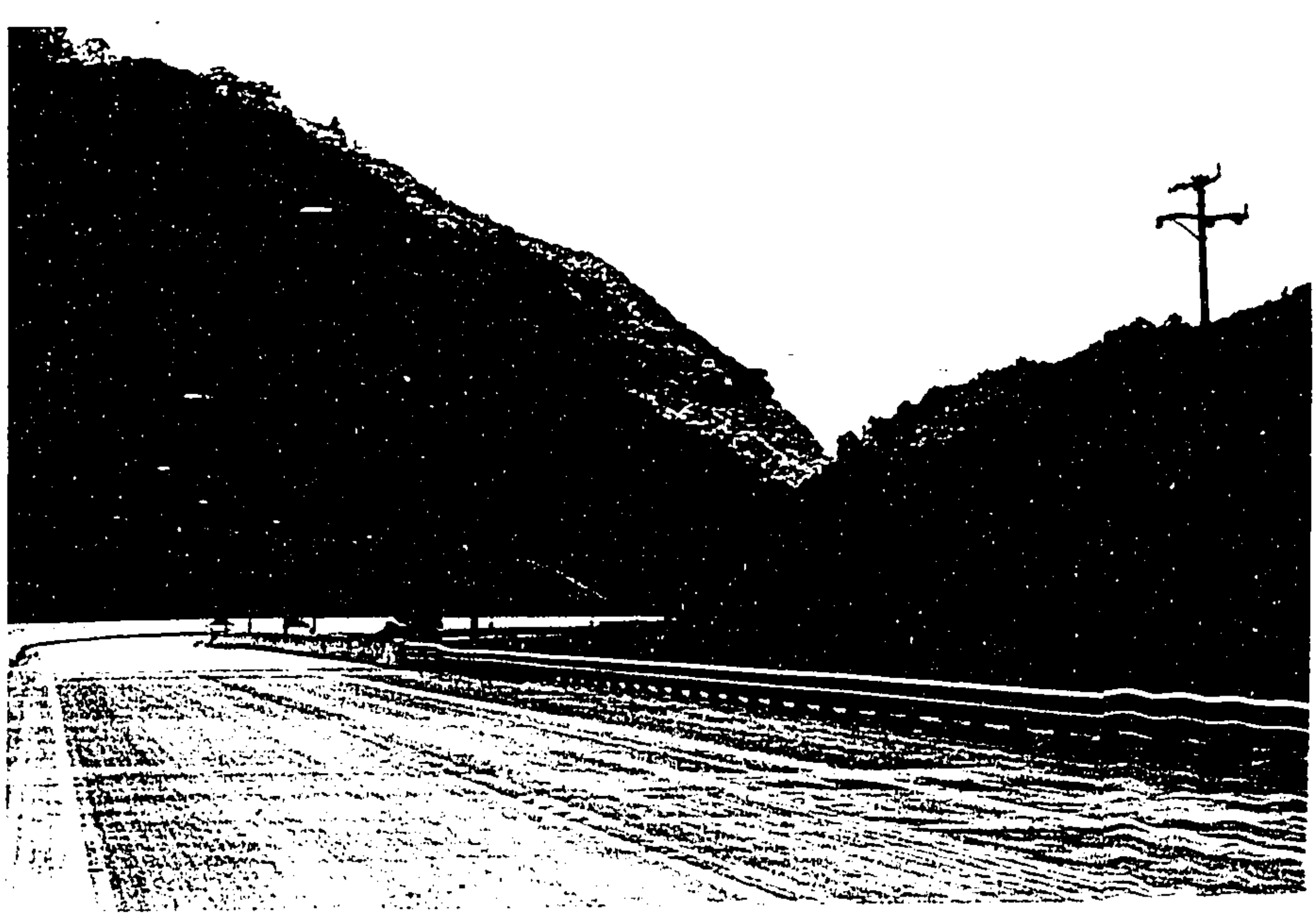

#5