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ENVIRONMENTAL ASSESSMENT

Research & Technology Park

at the University of Hawaii at Hilo
Hilo, Hawaii

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SUMMARY AND CONCLUSIONS

This Environmental Assessment (EA) describes the anticipated impacts associated with development of a proposed Research and High Technology Park to be located above the University of Hawaii at Hilo Campus in Hilo, Hawaii. This EA has been prepared in accordance with the provisions of Hawaii Revised Statutes (HRS), Chapter 343 and Title 11; and Department of Health, Environmental Impact Rules, Chapter 200, Sections 11-200-9 through 11-200-13. In addition, a detailed master plan and associated design guidelines are being developed to assess various design alternatives and their impact on the surrounding environs.

The proposing agency, the Department of Accounting and General Services of the State of Hawaii, plans to develop approximately 12 lots with related infrastructure and landscape improvements for academically related research and research support facilities. The lots would be developed by others into research and technology oriented uses. Some land uses may include academic facilities, planetariums, and telescope support facilities. Although some commercial applications may result from the benefits of on-going research, it is not anticipated that commercial land uses would come to predominate the site.

To accommodate a portion of the housing needs for students attending the neighboring University of Hawaii-Hilo, it is anticipated that one parcel will be set aside for student housing expansion. One other support facility, not generally associated with research or high technology development, is a proposed 80,000 square foot multi-purpose arena.

Recognizing this broad diversity of planned land uses, the proposing agency (State Department of Accounting and General Services) wishes to control development and mitigate potential impacts through implementation of an approved master plan with strict adherence to design guidelines. The emphasis on standards will ensure high levels of environmental quality while maximizing opportunities presented by the diverse nature of the site.

As currently envisioned, implementation of the master plan will result in no significant impact on site geology and soils, hydrology, existing agricultural uses, flora and fauna, historic and archaeological sites, existing scenic and visual resources, air quality, or ambient noise levels.

Existing infrastructure in the UH Hilo area is adequate (with reasonable upgrading) to service the levels and types of development projected in the proposed master plan.

The proposal setforth in the proposed master plan is consistent with all relevant public land use plans and policies. The site is classified as within the State Urban District and as "University" by the County of Hawaii General Plan.

TABLE 1

PROJECT AREA LAND STATUS

ITEM	STATUS
Owner	State of Hawaii, Department of Accounting and General Services
Area	Approximately 163 acres
Tax Map Keys	3rd Division 2-4-01:7 & 41
Proposing Agency (per 343 HRS)	State of Hawaii, Department of Accounting and General Services
Approving Agency (per 343 HRS)	Governor of the State of Hawaii
State Land Use Map No.	H-67 (Hilo Quad)
SLUC Designation	Urban
General Plan Designation	University
Hawaii County Zoning	Single Family Residential District RS-10; Agricultural District A-1A
ALISH	No rated lands
Special Management Area (SMA)	Not Applicable

Based on the preliminary reviews undertaken during the master planning process, it appears that the proposed action will not significantly effect the quality of the environment and, therefore, will not require a full Environmental Impact Statement (EIS) as set forth in Chapter 343 Hawaii Revised Statues.

A Negative Declaration of Environmental Impact for the Research and Technology Park at the University of Hawaii at Hilo, (as described in the proposed master plan and design guidelines), is therefore determined.

1.0 DESCRIPTION OF THE PROPOSED PROJECT

1.1 BACKGROUND DESCRIPTION OF THE PROJECT AREA

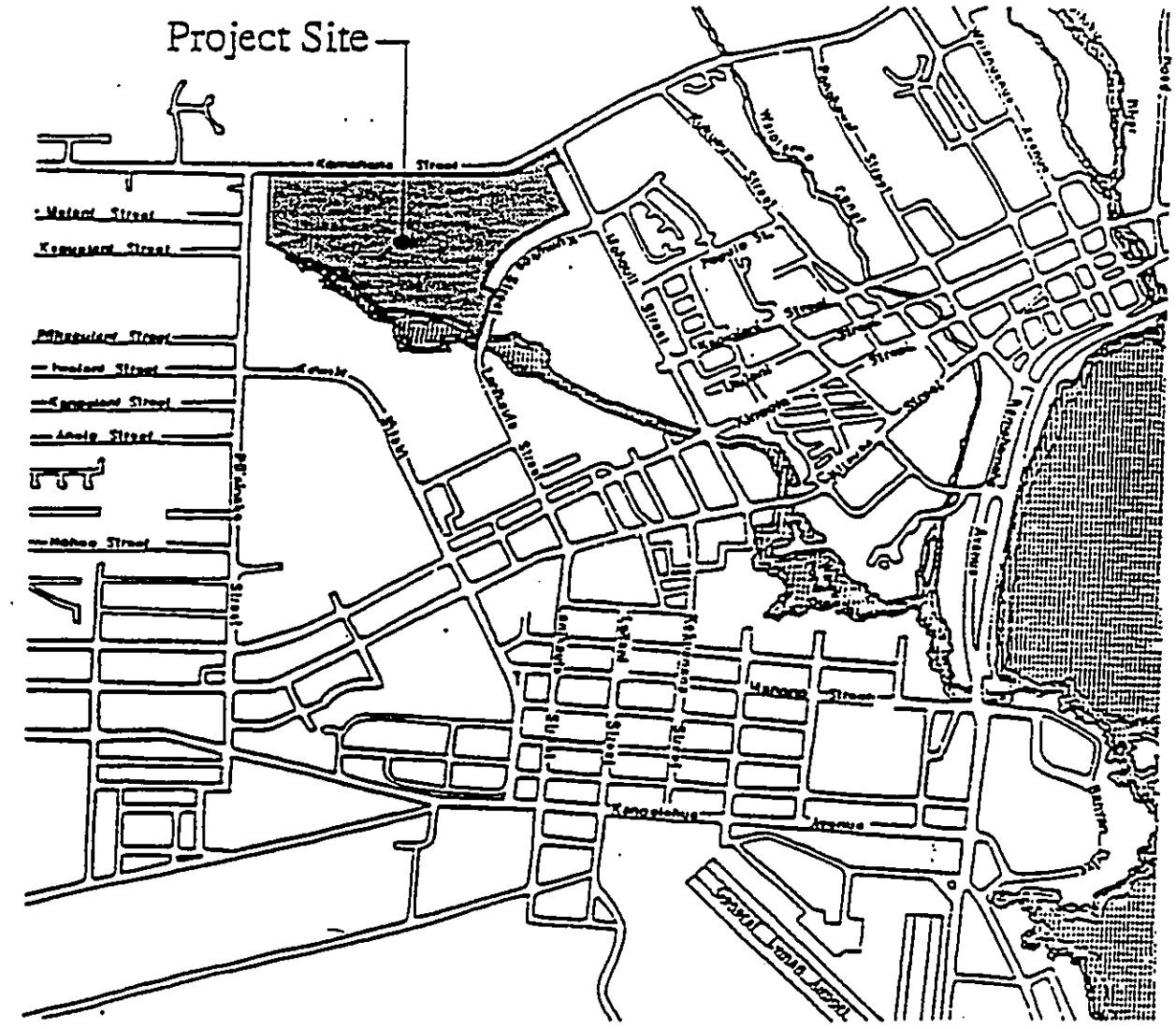
The proposed Research and Technology Park, here-in-after referred to as the Project, is located mauka of the main University of Hawaii (Hilo) campus and west of the existing Waiola Flood Control Channel (see Figures 1 and 2). The site is comprised of approximately 163 acres, including approximately 4 acres for the United Kingdom Infrared Telescope project and approximately 20 acres in use by the University of Hawaii Agricultural Center.

The University of Hawaii Hilo Campus is located on the lower slopes of Mauna Loa below the upper Waiakea Homesteads residential area. The Main (or Mauka) Campus is bounded by Lanikaula, Kapiolani, Kauwili and Puainako Streets, and the Waiola Flood Control Channel. The adjacent main University of Hawaii Hilo campus is approximately 115 acres in area. Table 1 describes the current status of project area lands.

1.2 MASTER PLAN & DESIGN GUIDE OBJECTIVES

The purpose of the Research and Technology Park is to integrate diverse research and technology functions in a controlled aesthetically pleasing environment. The stated aims of the University of Hawaii at Hilo (UHH), according the State Higher Education Functional Plan, June 1984, pp. 8-19, are to; 1) protect and enhance the quality of both the vocational-technical and liberal arts programs; and 2) accommodate the academic and social requirements of a 5,000-FTE student population, and to allow for flexible changes in the statewide university system. Enrollment at the UHH is projected to almost double from 3,541 in 1987 to 6,755 projected for the year 2003.

Long-term benefits of this approach include enhancement of the image of the University of Hawaii at Hilo, and economic growth in the Hilo area through the creation of short term construction related and long-term research and business related employment.



Location Map

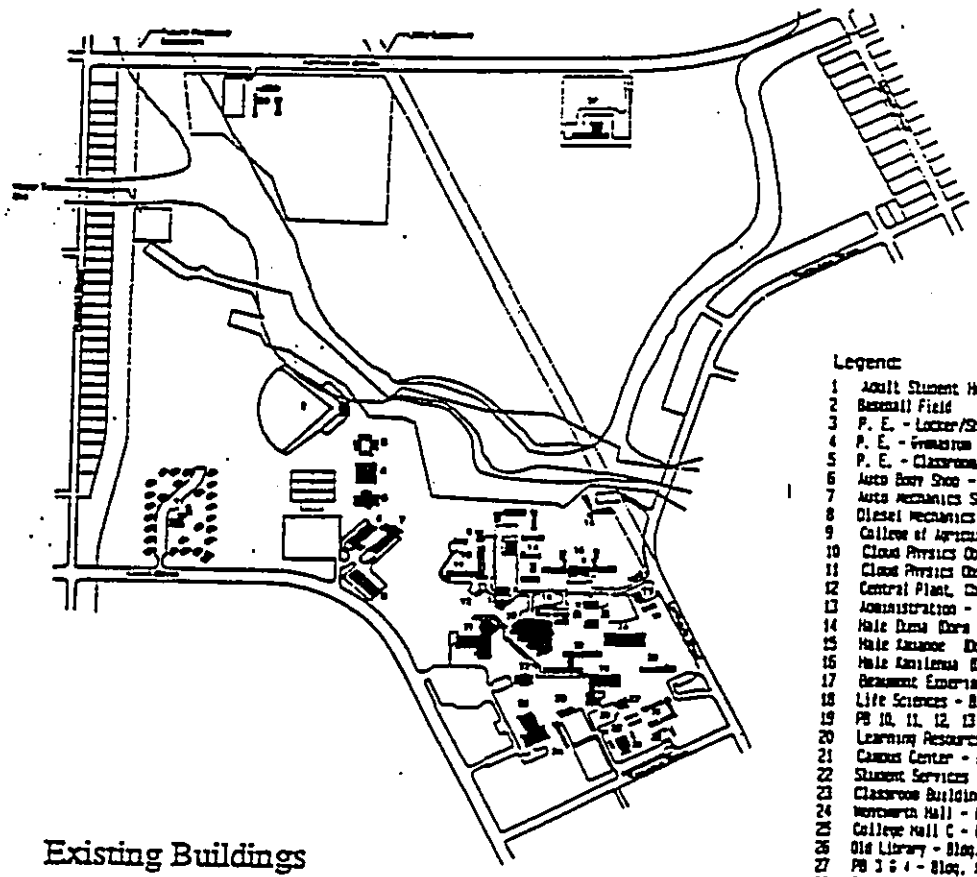
Research & Technology Park

University of Hawaii at Hilo

FIGURE 1

Site Analysis

Integral to campus planning is forming a compatible relationship between the site characteristics and the proposed land uses. The site analysis process identifies important site factors which play central roles from the site development planning phase through the design of individual buildings and complexes.



Existing Buildings

Legend:

1 Adult Student Housing
2 Baseball Field
3 P. E. - Locker/Shower - Bldg. No. 320A
4 P. E. - Gymnasium - Bldg. No. 320B
5 P. E. - Classroom/Office - Bldg. No. 320C
6 Auto Body Shop - Bldg. No. 321
7 Auto Mechanics Shop - Bldg. No. 322
8 Diesel Mechanics Shop - Bldg. No. 323
9 College of Agriculture Facilities - Bldg. No. 319
10 Cloud Physics Obs., Addition, Business Office - Bldg. No. 300A
11 Cloud Physics Obs., Auxiliary Services - Bldg. No. 300
12 Central Plant, Chill Water - Bldg. No. 334A
13 Administration - Bldg. No. 335
14 Hale Ossa Dorm III - Bldg. No. 336A - H
15 Hale Kauapoe Dorm III - Bldg. No. 343A - G
16 Hale Kaniloma Dorm II - Bldg. No. 347
17 Beaumont Environmental Station - Bldg. No. 350
18 Life Sciences - Bldg. No. 344A - D
19 PB 10, 11, 12, 13 & 14 - Bldg. No. 337A - E
20 Learning Resources Center - Bldg. No. 334
21 Campus Center - Bldg. No. 336
22 Student Services - Bldg. No. 338
23 Classroom Building 3 & 4 - Bldg. No. 333
24 Wentworth Hall - Bldg. No. 348
25 College Hall C - Bldg. No. 345C
26 Old Library - Bldg. No. 346
27 PB 3 & 4 - Bldg. No. 345C & D
28 PB 1 & 2 - Bldg. No. 345A & B
29 College Hall A & B - Bldg. No. 345A & B
30 PB 5, 6 & 7 - Bldg. No. 341A - C
31 Old Gymnasium, Auxiliary Services, Men's & Women's Locker/Shower - Bldg. No. 345D - G
32 Maintenance Shed - Bldg. No. 345H
33 PB 9 - Bldg. No. 340
34 PB 8 & 21 - Bldg. No. 339 & 339A
35 Theater/Auditorium - Bldg. No. 342
36 Agricultural Complex
37 UKOM

FIGURE 2

1.3 MASTER PLAN PROGRAM

A conceptual land use program for the Research and Technology Park is listed in Table 2. Analysis of site specific characteristics have played central roles in the site development planning phase and through the design of individual buildings and complexes.

TABLE 2

MASTER PLAN PROGRAM

#	Master Plan Component	TOTAL FOOTPRINT
1.	Agriculture Center (Parcel 1)	41,650 s.f. (.96 Ac.)
	- Parking	18,200 s.f. (.42 Ac.)
	- Open Space	363,290 s.f. (8.34 Ac.)
	- Site Area	(9.72 Ac.)
2.	Telescope Support Facility NNTT Parcel #6	
	- JIT Parcel #7	(12.00 Ac.)
	- 3 additional facilities @ 4 Ac. each	(23.82 Ac.)
	- Parcels 2, 3 & 5	
3.	UKIRT (Parcel 4)	9,000 s.f. (.23 Ac.)
	- Parking	6,300 s.f. (.14 Ac.)
	- Open Space	114,560 s.f. (2.64 Ac.)
	- Site Area	(3.00 Ac.)
4.	Planetarium (Parcel #8)	10,000 s.f. (.23 Ac.)
	- Parking	122,500 s.f. (2.81 Ac.)
	- Open Space	85,374 s.f. (1.96 Ac.)
	- Site Area	(5.00 Ac.)
5.	Multipurpose Arena (Parcel #9)	80,000 s.f. (1.84 Ac)
	o Seating - 72,000 s.f.	
	o Floor Area - 8,000 s.f.	
	- Parking	700,000 s.f. (16.07 Ac.)
	- Open Space	217,800 s.f. (5.00 Ac.)
	- Site Area	(22.19 Ac.)
6.	Academic Facilities (Parcel #10)	242,766 s.f. (5.59 Ac.)
	- Parking	122,500 s.f. (1.59 Ac.)
	- Open Space	85,375 s.f. (9.01 Ac.)
	- Site Area	(16.28 Ac.)
7.	Student Housing (Parcel #11)	257,322 s.f. (5.90 Ac.)
	- Parking	332,500 s.f. (7.42 Ac.)
	- Open Space	85,375 s.f. (4.45 Ac.)
	- Site Area	(17.77 Ac.)
8.	Research and Technology Site Area	(98.50 Ac.)
	- Roadways/Drainage and Open Space	(64.50 Ac.)
	- Site Area	(163.00 Ac.)

Land uses proposed within the Project are oriented to establish compatible transitions with existing adjacent residential uses in the area. As described in the Hawaii County General Plan, generous open space buffers are provided where academically related research and research support facilities are proposed adjacent to existing residential uses.

In addition, pedestrian walkways are planned to provide a functional and aesthetic connection from the Main Campus to the proposed site. This pedestrian connection will become an important circulation pattern for both the lower and upper campuses.

Major existing facilities and land uses consist of the following;

UKIRT (United Kingdom Infrared Telescope) Base Support Facility -This facility occupies four acres of land fronting Komohana Street and has approximately 14,000 square feet. Nine telescopes are presently installed with an additional four telescopes to be installed by the year 2000.

Agricultural Complex - This complex occupies 20 acres of land north of the intersection of Puainako and Komohana Street and is the site of three programs: 1) the Hawaii Agricultural Experiment Station, 2) the Cooperative Extension Service; and 3) the College of Agriculture.

The Research and Technology Park will provide an environment for research facilities and consist of approximately eleven lots of various sizes ranging from 3 to 10 acres. Total developed area, including roads and other facilities, is approximately 64 acres. Access will be provided from an extension of the campus road connecting to Komohana Street serving as a main entrance to the Park and UHH campus. The extension of the campus road will be built by the year 1992. It is assumed that the Park will be fully occupied by the year 2003.

1.4 PROJECT SCHEDULE

Development of the proposed Research and Technology Park is anticipated to span a period of approximately 15 years. Implementation and timing of individual structures or infrastructure will be especially influenced by 1) advances in technology, 2) market conditions for new high technology products, 3) international economic and political conditions, and 4) funding from the State.

2.0 ENVIRONMENT: EXISTING CONDITIONS POTENTIAL IMPACTS AND PROPOSED MITIGATION MEASURES

2.1 PHYSIOGRAPHY AND CLIMATE

The Project site slopes downward from west to east, mauka to makai direction. The elevation of the site varies from about 320 feet above mean sea level at the mid point of Komonono Street between Puainaku and Mohuuli Streets to about 140 feet above mean sea level at the Waiola flood control channel near Lanakala Street Bridge. Average slopes are 6.8 percent across the site. Slopes range generally from 6 to 10 percent making it suitable for most construction purposes. Some minor areas having slopes of between 10 and 15 percent will be difficult to build on without substantial grading. These areas will require special consideration in detailed design and construction to ensure reasonable accessibility and protection of the environment.

Daytime temperatures range from the upper 70's to lower 80's. Nighttime temperatures range from the lower 70's to upper 60's. The highest temperature on record at Hilo Airport is 94°F the lowest is 53°F. Prevailing winds are from the northeast (tradewinds) and average about 7 miles per hour. Diurnal heating and nocturnal cooling of the land mass gives rise to onshore northeasterly breezes during the day, and offshore southwesterly breezes at night.

The annual average rainfall of approximately 150 inches is abundant. Rain falls approximately 280 days a year in the Hilo area. Approximately 70% of the time, the days are predominantly cloudy. Special siting considerations are required to ensure adequate protection from rain for building entrances, pedestrian walkways, and other types of building openings.

2.2 GEOLOGY AND SOILS

The USDA soils survey for the island of Hawaii identifies the soils of the site as characteristic of the Kehaukaha and Pahoehoe series. These soils consist of well drained, thin, organic soils, overlying Pahoehoe lava bed rock. The soil above the lava is rapidly permeable. Pahoehoe lava is very slowly permeable, but water moves rapidly through the cracks. Runoff is medium and erosion hazard is slight. The Paniawa series consists of shallow moderately well drained silty clay loams that formed in volcanic ash. Permeability is rapid, runoff is slow, and the erosion hazard is slight.

2.3 HYDROLOGY

The soil in the area consists of Keaukaha Series and Panaewa Series which is underlain by Pahoehoe lava. Both soils are characterized with rapid permeability and slow runoff with slight erosion hazard. The County of Hawaii "Storm Drain Standard", identifies 50-year and 10-year 1-hour rainfall estimates at 6.5 inches per hour and 5.5 inches per hour, respectively.

Drainage patterns follow the slope conditions, emptying into the flood control channel. A majority of the floodway is designated in the 100 year flood plain, however, no significant site development is planned for the flood control channel area. The 100 year flood plain is also located near the eastern boundary adjacent to the existing student housing area of the Main Campus.

2.4 AGRICULTURE

The Project site is located within the State's Urban District. As such, the Agricultural Lands of Importance to the State of Hawaii (ALISH) system of agricultural land classification does not rate the subject property for agricultural productivity. Consequently, use of the subject property for urban (university) land uses, already permitted within the State's Urban Land Use District, will not result in the loss of agriculturally important lands. The urban use of this site is consistent with the County of Hawaii General Plan and would result in negligible impacts relative to Hawaii County's total agricultural land resources.

2.5 FLORA AND FAUNA

The undeveloped site is densely covered with a variety of exotic and endemic plant life. The Atlas of Hawaii has classified the vegetation in and around the site as being open guava forrest with shrubs. No detailed botanical survey was performed, however, based on a previous EIS for the area, field observation and identification of various plants, a list of predominant flora was compiled and is provided in Table 3.

Although no animals were actually observed on the site, it is assumed that the following mammals could derive sufficient sustenance to survive; Mongoose (Herpestes Auropunctata), Rats (Ratusratus), House mice (Musmusculus). Data on the sites avifauna (birdlife) was derived from the Atlas of Hawaii, in addition, birds seen during the site visits are asterisked.

TABLE 3

LIST OF PREDOMINANT FLORA, EXPANSION & CAMPUS AREA
(Note: Taken from Final EIS , U.H. Hilo Long Range Development Plan, dated June 1977)

COMMON NAME	SCIENTIFIC NAME
African Tulip Tree	Spathodea campanulata
Ageratum	Ageratum conyzoides
American Guava	Psidium juajava
Banyan	Ficus sp.
Basket Grass	Oplismenua hirtellus (L.)
Beggar's Tick	Bidens pilosa
Boston Fern	N. exaltata (varieties)
Castor Bean Plant	Ricinus communis
False Staghorn Fern	Dicranopteris emarginata
Hilo Grass	Paspalum conjugation
Johnson Grass	Sorghum halapense
Koa Haole	Leucaena latisiliqua
Kukui	Aleurites moluccana
Lantana	Lantana camara
Melochia	Melochia umbellata
Monkeypod	Samanea saman
Morning Glory	Ipomoea sp.
Ohia Lehua	Metrosideros collina
Passion Fruit (Lilikoi)	Passiflora sp.
Philippine Ground Orchid	Spathoglottis plicata
Screwpine (Hala)	Pandanus odoratissimus
Sedge	Cyperus sp.
Ti Leaf (Green)	Cordyline terminalis
Trema	Tema orientalis
Wandering Jew	Tradescantia fluminensis

COMMON NAME	SCIENTIFIC NAME
English or House Sparrow*	Passer domesticus
Barred Dove *	Geopelia striata
Spotted Dove	Streptopelia chinensis
Indian Mynah *,	Aeridotheres thristis
Cardinal *	Richmondena cardinalis
White-eye	Aosterops japonica
Pacific Golden Plover	Pluvialis dominica
Ricebird	Lonchura punctata
Pueo	Asio flammeus
Mockingbird	Mimus polyglottos

All the above birds could feed or rest in the area. There are no known rare or endangered species, flora, or fauna within the Research and Technology Park area.

2.6 HISTORIC AND ARCHAEOLOGICAL SITES

There are no known historical or archaeological sites within the Research and Technology Park site, based on the State of Hawaii Historic Preservation Office's listing of significant archaeological sites. A monitoring procedure will be established to accompany the grubbing and excavation phases of development as a precautionary measure to insure full compliance with County, State, and Federal regulations. The State Historic Preservation Office will be immediately notified if artifacts or human remains are uncovered. If the need for further archaeological study of the site is indicated, the study will adhere to all applicable requirements of the Department of Land and Natural Resources.

2.7 SCENIC AND VISUAL RESOURCES

Development of the site as illustrated in Figure 3 will protect the existing visual quality of the region and integrate site design with the fabric of the surrounding area. Building configurations will be carefully evaluated to take full advantage of existing panoramic views and to minimize the impact of structures on existing views from surrounding uses.

2.8 AIR QUALITY

Construction activities such as site clearing and grading will have a short term impact on ambient air quality in the vicinity of the project site. During construction, mitigating measures such as dust abatement, landscaping, and other erosion control measures will be implemented to minimize air quality impacts. Given the 15 year development schedules, long term impacts due to air quality will be minimal.

2.9 NOISE

Potential short term noise impacts may result during construction and site preparation stages from the operation of heavy equipment. Primary noise sources after project completion will be dominated by vehicular traffic, especially at access points to the project site, and during scheduled events at the proposed arena.

Standards and guidelines for Hawaii County and the State Department of Health will be followed to mitigate the impacts of construction on ambient noise levels. The proposing agency will alleviate potential noise conflicts to the greatest extent possible through enforcement of construction noise controls.

Noise impacts generated from localized traffic will be negligible, although traffic generated by scheduled events at the proposed arena may result in occasional noise impacts. Noise abatement techniques, necessary to maintain an atmosphere conducive to education, will be required for each research and technology facility. These techniques will meet minimum health and safety requirements.

Open Space and Views

There are panoramic views of Hilo and the ocean from the higher elevations. A view corridor along the powerline and waterline easements runs diagonally across the R&T Park site. There are also axial views down Komohana Street .

Given the sloping site conditions, there are numerous opportunities for incorporating wonderful views into the design of structures at the project site.

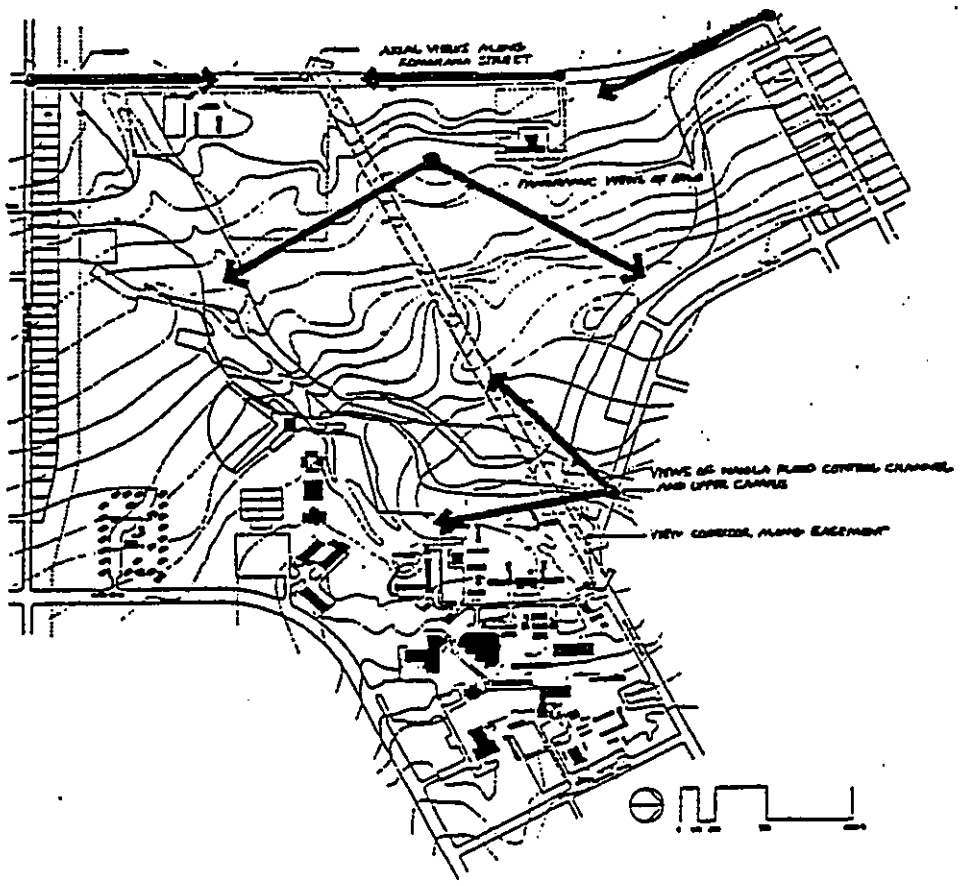


FIGURE 3

2.10 INFRASTRUCTURE REQUIREMENTS

2.10.1 Water System

The project area is made up of two (2) district pressure zones. The equivalent static head elevations of these two zones are 456 feet and 354 feet. The higher pressure zone system consists of a 12-inch diameter water main along Komohana Street. The lower pressure system consists of an 8-inch diameter water main traversing the site diagonally from Lanikaula Street to Komohana Street.

The entire project site area will be serviced by the higher pressure system. The new system shall consist of 12-inch and 8-inch diameter water lines located along the new roads. The new system shall connect to the existing 12-inch diameter water main.

2.10.2 Sanitary Sewer System

Much of the existing UH Hilo Campus is served by cesspools. The existing sanitary sewer system in the area consists of separate 8-inch diameter sewer lines along Lanikaula Street and Kawili Street. The proposed sewer system for the Research and Technology Park shall consist of 8-inch sewer line within the new roads and shall connect to the existing sewer line along Lanikaula Street.

2.10.3 Storm Drainage System

The existing area is presently undeveloped with the exception of the UKIRT facility and agricultural complex. The site slopes toward the Flood Control Channel generally range from 6 to 10 percent.

The proposed storm drainage system shall consist of catch basins and drain lines to intercept and convey storm runoff to the flood control channel. Generally, the development of an area increases the amount of storm runoff due to the establishment of impervious surfaces. The amount of additional runoff entering the flood control channel will be limited by drywells utilized to dispose of the additional runoff. The drywells will not be concentrated within one area, but located throughout the site, generally at catch basin locations.

2.10.4 Electrical and Telephone Services

An existing 50 foot wide utility easement includes overhead electric and telephone poles and lines. The overhead lines traverse the site within the easement between Komohana Street northeast to Lanikaula Street. Poles and overhead lines consist of Hawaii Electric Company 46 KV and 12 KV distribution circuits and Hawaiian Telephone Company telephone cables.

The electric and telephone utilities will be distributed underground along the new roadway system eliminating the unsightly poles and overhead lines. The underground distribution system will not only accommodate the electric and telephone distribution lines, but also provide necessary electric and telephone service to provide sufficient capacity to meet future requirements.

A street lighting system, in conformance to the County of Hawaii Outdoor Lighting Ordinance and illumination requirements, will be provided along the new roadways. All wiring will be underground. Street light standards will consist of buried concrete bases, galvanized steel poles, and low pressure sodium luminaires.

2.10.5 Vehicular Circulation and Traffic

A detailed analysis of existing traffic conditions and a traffic impact assessment of future conditions after development was prepared to evaluate the overall traffic impact of the proposed project. (See Appendix A)

The proposed Research and Technology Park project is expected to have an impact on traffic flow along Komohana Street, but is not expected to have a significant impact on traffic flow on Lanikaula Street.

At present, Komohana Street (between Pu'ainaka and Mohouli Streets) is capable of handling the traffic during the morning and afternoon peak hours. However, motorists attempting to turn left from the Agricultural Complex experience very long delays (LOS E).

At the current traffic growth rate, Komohana Street will reach capacity before 2003 even without the Research and Technology Park project. Motorists attempting left turn movements into and off of Komohana Street from the proposed campus road intersection will experience very long (LOS E) or extreme delays (LOS F), respectively, during the morning peak hour. With the project's traffic included, motorists attempting the same left turn movements will experience extreme delays (LOS F) during the morning peak hour.

The analysis shows that the proposed intersection of Komohana Street with the campus road will need to be signalized to reduce extreme delays expected for drivers turning into and out of the campus during the morning and afternoon peak hours. The intersection should be signalized when traffic conditions warrant signalization according to standard traffic practices.

To further minimize impacts and increase the efficiency of signalization, the following is recommended:

a) Left-turn and right-turn pockets on the Komohana Street campus entrance and exclusive left and right turn lanes for vehicles exiting the campus road.

b) Access to the Research and Technology facilities from Komohana Street, including the existing UKIRT facilities and Agricultural Complex, should be restricted to reduce the number of congestion points. Traffic should be directed to the Campus Road entrance to access all park facilities.

The existing intersection of Lanikaula Street with the campus road is expected to operate at an acceptable level-of-service. Only the left-turn movement from the campus road onto Lanikaula Street will operate with long delays, LOS D. Due to the few number of motorists expected to turn left this is not expected to be a significant problem.

Arena Traffic

The arena is expected to generate major traffic flow during off peak times. Events at the arena, such as commencement ceremonies and sporting events, are expected to be scheduled during the weekends and off peak hours on weekdays. This study only addresses traffic during the peak hour and therefore traffic from arena activities was not included in the analysis. However, because of the potentially large number of vehicles will be existing at the same time after arena events, it is recommended that off-duty police officers be engaged to direct traffic at the two exits (Komohana and Lanikaula Street intersections) whenever special events are held at the arena.

2.11 PUBLIC SERVICES

2.11.1 Police Protection

The Hilo police are currently dispatched from the department headquarters located on Kapiolani Street, in close proximity to the Research and Technology Park site. The proposing agency will apprise the police department of the progress of the project so that adequate protection can be provided. University security and/or private security services can be expected to augment the capabilities of the Hilo police.

2.11.2 Fire Protection

The project will be served by the existing Hilo fire station. The existing fire station is expected to adequately serve the proposed development. Appropriate fire hydrants and other fire protection facilities will be provided as necessary. The proposing agency will apprise the fire department of project development to ensure adequate fire protection at all times.

2.12 SOCIOECONOMIC

During the construction stages of project development, there will be a temporary increase in the number of construction jobs in the Hilo area. Consequently, an associated multiplier effect in related job creation and retail sales should be expected. Upon completion of the various construction phases, there will be permanent jobs created for a maintenance staff and additional faculty positions. As previously indicated, student enrollment is anticipated to increase from 3,541 in 1987 to 6,755 projected for the year 2003.

The proposed buildings will provide facilities for research and development of new technology. This kind of basic support for Hawaii's educational system will provide opportunities for improving scientific output, for extending the University's capability to undertake more technologically advanced projects, and expanding the opportunities for interaction between the scientists and faculty, staff and students.

The facilities proposed for the research and technology park will enhance the capability of high-tech industries and their ability to expand on the Island of Hawaii. Support for the existing high technology infrastructure located in the County of Hawaii is essential to maintain continued growth in this important industry.

3.0 RELATION TO PUBLIC LAND USE PLANS AND POLICIES

3.1 CHAPTER 205 HAWAII REVISED STATUTES

The project site is located within State's Urban Land Use District. The site is comprised of generally vacant open space land located adjacent to the University of Hawaii - Hilo main campus and west of the Waiola Flood Control Channel. No significant negative impacts on the environmental, cultural, recreation, scenic, historic, or other resources of the area are anticipated from conversion of the existing open space land uses to those already permitted by the State's Urban Land Use District regulations. Development of the site as proposed is consistent with the intent and uses permitted within State's Urban Land Use District.

The site is adjacent to existing residential areas, the University of Hawaii Hilo campus, and is accessible to existing and proposed commercial, business and government areas.

3.2 CHAPTER 343, HAWAII REVISED STATUTES ENVIRONMENTAL IMPACT STATEMENT (EIS) REGULATIONS

Inasmuch as the proposed Research and Technology Park will utilize State funds, the proposed project is subject to the provisions of Chapter 343, Hawaii Revised Statutes and the Office of Environmental Quality Control (OEQC), Chapter 200 of Title 11, Administrative Rules. Consequently, an Environmental Impact Statement (EIS) would be required "provided that approval of an agency shall be required and that the agency finds that the proposed action may have significant environmental effects" [Section 11-200-6(b)].

As previously described, it has been determined that development of the proposed "Urban" site for university, academic, or research related uses, directed toward the successful application of technology for commercial purposes, is not expected to have a "significant environmental effect" on the subject property or the surrounding environment.

3.3 HAWAII COUNTY GENERAL PLAN

Development of uses described in the proposed master plan would conform to the designation of the property as "University" by the County of Hawaii General Plan.

University uses are considered compatible with the academic and research oriented uses proposed for the Research and Technology Park.

3.4 HAWAII COUNTY ZONING

The subject property is located within the State Land Use urban District, and is designated for "University Use" in the Hawaii County General Plan. It is also within the Single-Family Residential District (RS-10) with a portion in the Agricultural Zoning District (A-1a). Appropriate zoning reviews, approvals, and possible amendment(s) to the existing zoning districts will be necessary, however, the existing UHH campus is also located within the RS-10 zoning district.

3.5 HAWAII REVISED STATUTES, CHAPTER 205A, COASTAL ZONE MANAGEMENT ACT

The objectives of the Hawaii Coastal Zone Management (CZM) Act as set forth in Chapter 205A, Hawaii Revised Statutes, applies to the protection and maintenance of valuable coastal resources. The proposed project conforms to the applicable CZM objectives as follows:

The project site is not located in the Hawaii County Special Management Area (SMA). A SMA permit will therefore not be required for the Research and Technology Park development.

The project site is well inland from shoreline areas, thereby protecting coastal ecosystems from disruption. The site is not subject to tsunami or storm waves. Development will not occur within the on-site 100 year flood plain.

Erosion control measures will be undertaken during project construction to mitigate the potential impact of near shore siltation during intense storm events. Design of project drainage systems will follow all design standards of the County of Hawaii to ensure the safe conveyance and discharge of storm water runoff. Protection of groundwater resources will also be enhanced by the installation of a centralized sewage collection, treatment, and disposal system.

3.6 IDENTIFICATION OF AGENCIES CONTACTED

County of Hawaii Planning Department

Office of Environmental Quality Control (OEQC)

State Department of Accounting and General Services (DAGS)

State Land Use Commission (SLUC)

561DR_1_.WP5

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EXECUTIVE SUMMARY

This traffic study identifies and evaluates the probable impact of traffic generated by the proposed Research and Technology Park Project (R&T Project).

The R&T Project is located at the University of Hawaii in Hilo on the island of Hawaii. The 163 acre project site is located adjacent to and east of Komohana Street. At present, the site is vacant except for two existing research facilities which will remain.

The project includes campus facilities and lots for research activities. The campus facilities include teaching labs, a library, classrooms, student housing, athletic facilities, a planetarium, and other campus facilities. There will be about eleven lots of various sizes ranging from 3 to 10 acres for research facilities. The infrastructure for these lots such as roadways and utilities will be provided. It is assumed that the research lots will be fully occupied by the year 2003.

Access to the project will be from an extension of the campus road connecting to Komohana Street which will serve as a main entrance to the UHH campus. The extension of the campus road will be built by the year 1992.

The study focuses on the proposed campus road intersection with Komohana Street and the existing campus road intersection with Lanikaula Street. The campus road will provide access between master plan "mauka campus" with the existing "makai campus". Impacts are assessed at both entrances during the morning and afternoon peak hour periods when the proposed project traffic is expected to have the greatest impact on the existing streets.

Conclusions and Recommendations

The proposed Research and Technology Park project is expected to have an impact on traffic flow along Komohana Street. The project is not expected to have a significant impact on traffic flow on Lanikaula Street.

At the current traffic growth rate, Komohana Street (between Pu'ainako and Mohouli Streets) will reach capacity before 2003 *even without the R &T Project*. Motorists attempting to turn left from the Agricultural Complex onto Komohana Street will experience very long delays during the morning and afternoon peak hours.

By the year 2003 with the project, traffic conditions at the proposed intersection of Komohana Street with the campus road are expected to be congested. Motorists attempting left turn movements into and out of the proposed Campus Access Road are expected to experience extreme delays (LOS F) during the morning peak hour. During the afternoon peak hour, motorists attempting the left turns out of the Campus are also expected to experience extreme delays (LOS F).

If traffic volumes increase as expected, the proposed intersection of Komohana Street with the Campus Access Road will need to be signalized to reduce extreme delays to vehicles entering or exiting the project. The intersection should be periodically monitored to determine when traffic conditions warrants signalization according to standard traffic practices.

To further minimize impacts of the proposed project and provide for a smooth traffic operation we recommend the following:

- Channelize the intersection of Komohana Street and the Campus Access Road. Construct left-turn storage and right-turn lanes along Komohana Street. Construct exclusive left and right turn lanes for vehicles exiting the Campus Access Road. Figure 11 shows the schematic plan of the intersection.

- The Campus Access Road should be used to access all park facilities. Direct access to the R&T Project from Komohana Street should be prohibited and the existing accesses to the UKIRT facilities and Agricultural Complex should be eliminated to reduce the number of congestion points.

The existing intersection of Lanikaula Street with the campus road is expected to operate at an acceptable level-of-service. Only the left-turn movement from the campus road onto Lanikaula Street will operate with long delays, LOS D. Due to the few number of motorists expected to turn left this is not expected to be a significant problem.

Phasing of Improvements

Table 7 below shows the recommended improvements in relation to the phasing of the project.

Table 7. Recommended Improvements

Year of Completion	Development	Recommended Improvement
1992	Campus Road Extension to Komohana Street and UKIRT Road	Channelize intersection Provide access to UKIRT Facility
1993	Student Housing and Ag Complex Road	Provide access to Ag Complex
1995	General Classrooms	
1997	Teaching Labs, Multi-Purpose Arena, Student Housing (Increment 2), P.E. Facility and Track & Field	
1998	Student Housing Food Service Maintenance & Operations Student Health Facility	
2000	Student Housing (Increment 3)	
2003	Library	

All recommended roadway improvements should be constructed when the Campus Road Extension to Komohana Street is built in 1992. Underground ductlines for traffic control signals should also be installed during the construction of the intersection so that when traffic signal warrants are met, the traffic control signal equipment can be easily installed and made operational.

A separate analysis, not part of this impact study, is required to meet the specific requirements of signal warrant assessment as set forth by the Manual of Uniform Traffic Control Devices. We cannot determine when traffic control signals are needed at the intersection without conducting periodic traffic counts to determine whether traffic signals are warranted at the intersection.

The traffic flow along Komohana Street will be impacted when the Campus Access Road is connected to it, in the year 1992. Delays and queueing to southbound traffic will occur during the morning as vehicles attempt left turn movements into the campus. To minimize the impact, the intersection should be channelized upon construction. Without the left turn storage lane, through traffic along Komohana Street will be forced to stop when vehicles turn left into the campus causing delays and queues along Komohana Sreet.

Arena Traffic

The arena is expected to generate major traffic flow during off peak times. Events at the arena, such as commencement ceremonies and sporting events, are expected to be scheduled during the weekends and off peak hours on weekdays. This study only addresses traffic during the peak hour and therefore traffic from arena activities was not included in the analysis. However, because of the large number of vehicles expected to exit at the same time after arena events, we recommend off-duty police officers be engaged to direct traffic at the two exits (Komohana and Lanikaula Street intersections) whenever special events are held at the arena.

PROJECT DESCRIPTION

The State of Hawaii is proposing the Research & Technology Park project at the University of Hawaii at Hilo. The project is located in Hilo on the island of Hawaii, on a 163 acre lot. The project site in located adjacent to and East of Komohana Street. The site location and roadway network in the vicinity are shown in Figure 1.

The R&T Project consists of campus facilities and lots for research activities. The campus facilities include teaching labs, a library, classrooms, student housing, athletic facilities, a planetarium, and other campus facilities. The research facilities will be located on eleven lots ranging from 3 to 10 acres for a total of 64 acres. This project will provide the infrastructure for these lots such as roadways and utilities. The site plan of the project is shown in Figure 2.

At this time, two astronomical research organizations have expressed interest in locating base support facilities at the project. Other research activities that may use the project are not known at this time. It is assumed that the research lots will be fully occupied by the year 2003.

Development of the campus facilities will be completed in twelve phases with construction beginning in 1993. The development phases and completion dates of the campus facilities are listed in Table 1 below.

Table 1. Phasing of Campus Facilities

Phase	Development	Date of Completion
1	Student Housing (Increment 1)	November 1993
2	General Classrooms	February 1995
3	Teaching Labs	June 1997
4	Multi-Purpose Arena	December 1997
5	Student Housing (Increment 2)	November 1997
6	P.E. Facility	February 1997
7	Track & Field	April 1997
8	Student Housing Food Service	March 1998
9	Maintenance & Operations	March 1998
10	Student Health Facility	May 1998
11	Student Housing (Increment 3)	November 2000
12	Library	February 2003

The planetarium will be used for research and as a tourist attraction and will accommodate 350 parking stalls.

The athletic facilities will include a multi-purpose sports arena and soccer and track field. The sports arena is to be used for sporting events, commencement ceremonies, and concerts. The arena is planned to have 8,000 seats and 2,000 off street parking stalls. The arena's parking area will be shared with the academic facilities during the daylight hours. The arena's parking demand is anticipated to be during the late afternoon and evening hours while the students' demand will generally be during the early morning to early afternoon hours.

An extension of the existing campus road will provide access to the project site. The new "main" entrance of the campus road will intersect with Komohana Street between Pu'ainako and Mohouli Streets. The existing "back" entrance of the campus road intersects

Lanikaula Street. The campus road will provide access between the master plan "mauka campus" with the existing "makai campus".

Extension of the campus road to Komohana Street will be completed and in use by the year 1992. This first phase of a five phase improvement of the campus road will also construct the cul-de-sac from the main campus road to the UKIRT facility. Additional cul-de-sacs off the campus road, including the Agricultural complex cul-de-sac, will be constructed in the third phase which is planned for completion in 1995. Sidewalks, curb, gutter, landscape and drainage will be developed in the fifth phase. Phases 2 and 4 will involve electrical, sewer and water supply to the roadway. Completion of the entire five phases will be in the year 2003.

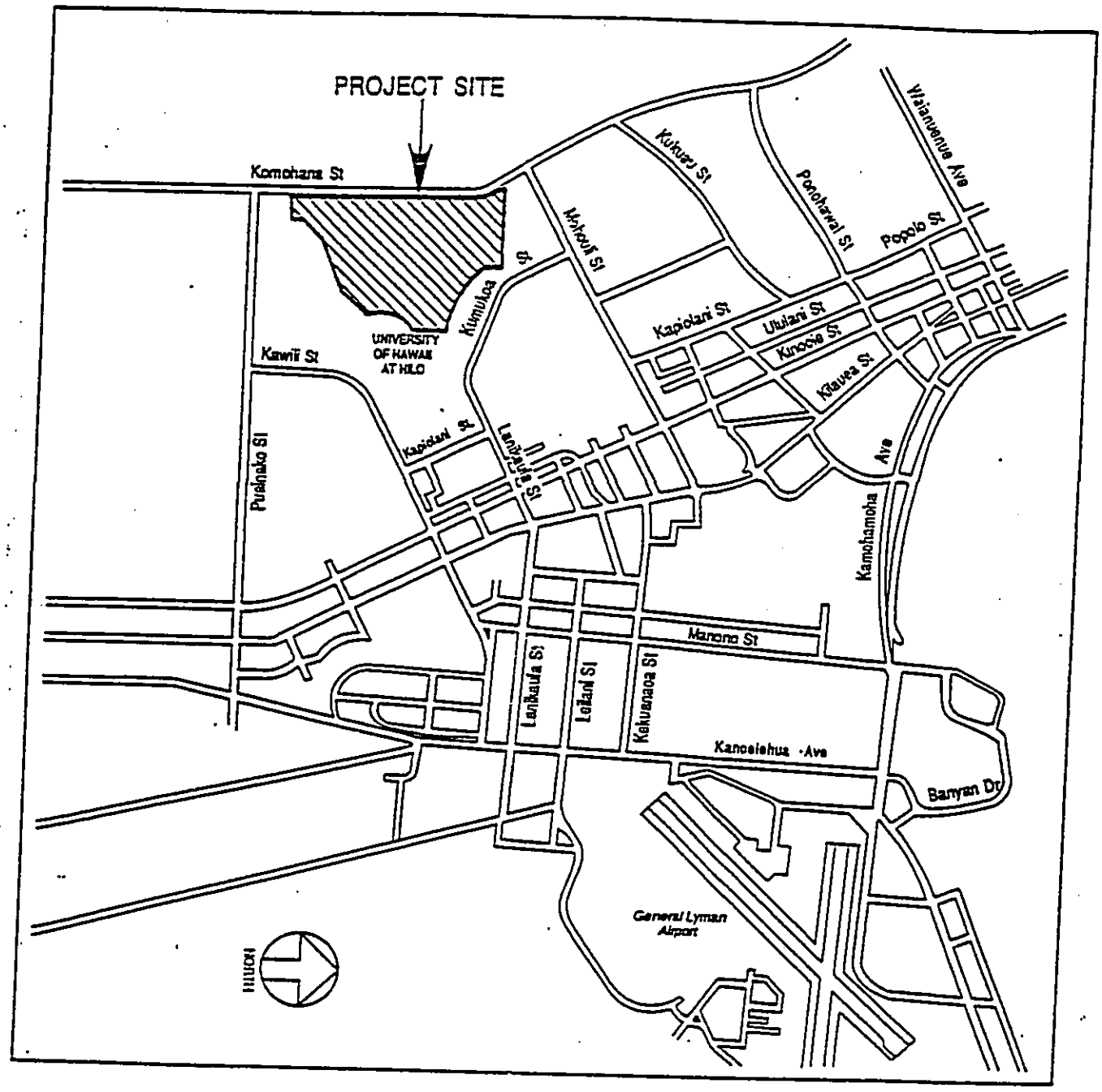
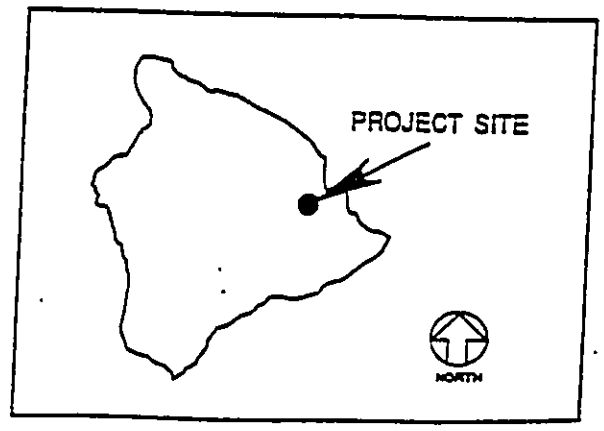


Figure 1. Project Location and Roadway Network



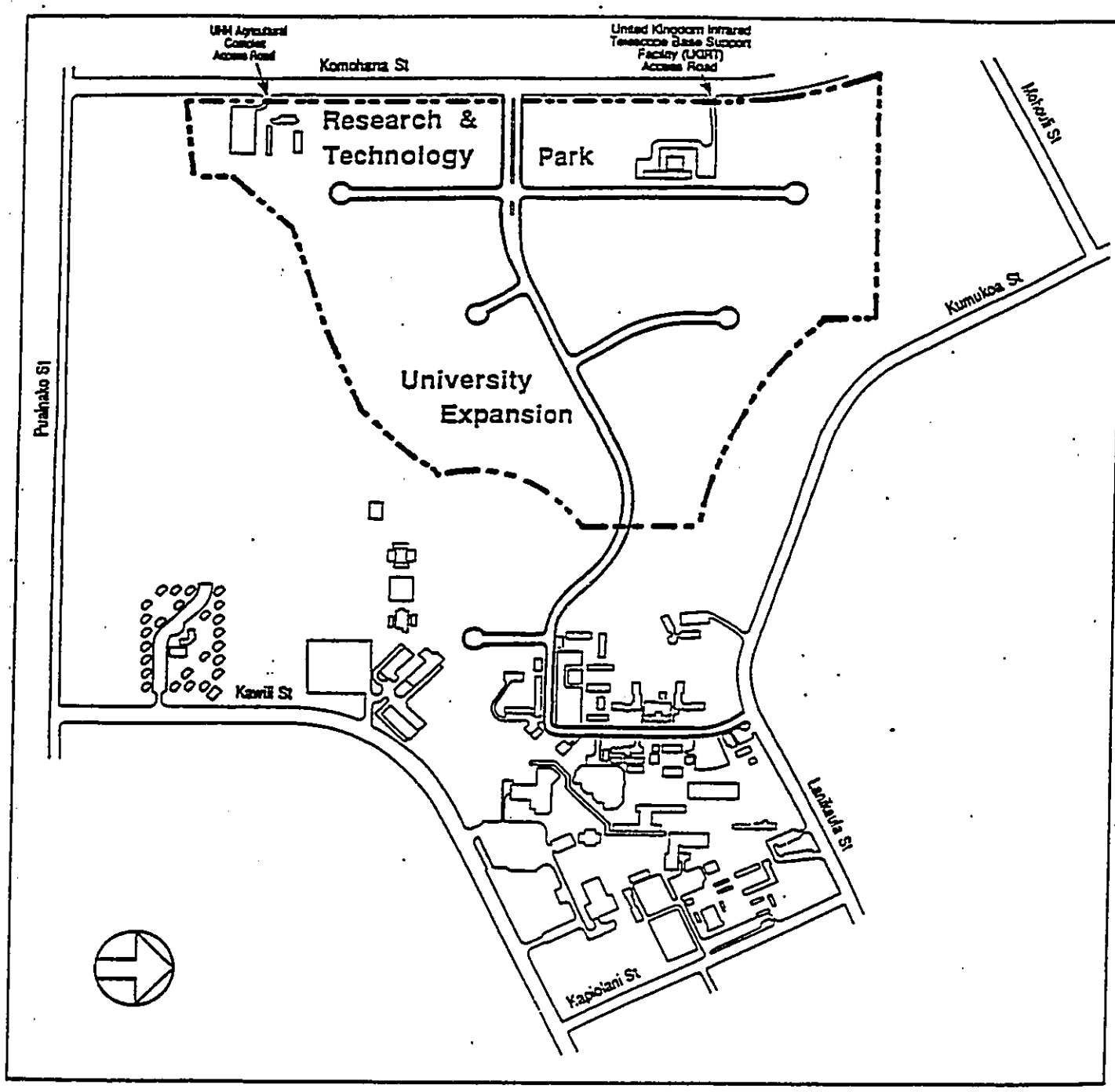


Figure 2. Project Site Plan

AREA CONDITIONS

Study Area

The analysis primarily focuses on the traffic conditions at the intersection of Komohana Street with the proposed main access to the project site and the intersection of Lanikaula Street with the existing campus road. These two intersections provide access to the proposed R&T Park.

Land Uses

The project site is presently vacant and covered with natural vegetation except for two existing research facilities, the United Kingdom Infrared Telescope (UKIRT) Base Support Facility and the Agricultural Complex. The UKIRT facility provides support services for the operations of the telescopes at the summit of Mauna Kea with a staff of technicians, administrative, and clerical personnel. The Agricultural Complex houses the College of Agriculture and a research center, which includes laboratories, libraries, and offices.

The existing land uses immediately surrounding the project site are mainly educational and residential. To the North and South are residential subdivisions. To the East, is the existing UHH Campus while residential subdivisions lie further east. Waiakea Elementary, Intermediate, and High Schools are located across Kawili Street South-East of the project site. To the West, across Komohana Street, is more vacant land over-grown with natural vegetation.

Future conditions that will affect traffic in the study area include the increased enrollment of the UHH campus and the Waiakea Schools.

The UHH student population (head count) is targeted to be about 6700 students (with the R&T Project) by the year 2003, an increase of 3200 students over the present enrollment of 3500 students. The R&T Project is expected to accommodate about 1900 of the total 6700 students. The balance of 1300 students are expected to use the facilities on the lower campus.

The Department of Education projects that Waiakea Elementary, Intermediate, and High Schools will increase in student enrollment from 3650 students to 4200 students by the year 1993. Based on the growth rate from 1988 to 1993, student population is expected to grow to 5300 by the year 2003.

The Hilo area in general is expected to grow at a slow rate to the year 2003. There were no other significant developments identified that would affect the traffic conditions in the study area.

Roadway System

Direct access to the present UHH Campus is served by the major collector roads, Kumukoa/Lanikaula Streets, Kawili Street and Kapiolani Street. Connecting these roadways are other major collector roads, Komohana Street, Pu'ainako Street, and Mohouli Street, as shown in Figure 2.

Komohana Street is a two-lane primary crosstown street maintained by the County of Hawaii. It is a major north-south arterial road, carrying traffic between the residential areas of Pu'ainako/Waiakea Uka and the Commercial/Business District of Downtown Hilo. The posted speed along the portion of Komohana Street fronting the project site is 45 miles per hour.

Kumukoa Street is an extension of Lanikaula Street and is controlled and maintained by the County of Hawaii. It serves as a primary route for access into the present UHH

Campus. It also serves as an alternate route for drivers travelling mauka/makai (east/west) between Komohana Street and Kinoole Street via Mohouli Street. The road is a two-lane urban street with curbside parking permitted along Lanikaula Street.

Kapiolani and Kawili Streets provide access to the present UHH Campus from directions on the South and East. About 75% of the present parking areas are accessed from these two streets. Both streets are two-lane roads maintained by the County of Hawaii. Kawili Street also serves as the primary access to Waiakea Intermediate and High Schools across the UHH campus, while Kapiolani Street is a short connector road running along the east boundary of UHH campus between Lanikaula Street and Kawili Street.

At this time there are no known future roadway improvements that would affect traffic in the study area. The future roadway system is assumed to remain the same as present.

Existing Traffic Conditions

A review of State Department of Transportation traffic count data in the area indicated that the morning peak hour generally occurs between 7:00 to 8:00 am and the afternoon peak hour generally occurs between 4:30 and 5:30 pm. Traffic impacts were assessed during the morning and afternoon peak hours when traffic from the proposed project is expected to have the most impact on the study intersections.

The intersections of Komohana Street at the UHH Agricultural Complex access driveway, and Kumukoa/Lanikaula Street at the UHH campus access road were selected for the field count. Field traffic counts and surveys were conducted on Wednesday, July 20, 1988 between 4:15 pm and 5:45 pm; and on Thursday, July 21, 1988 between 6:45 am and 8:15 am. The weather was cloudy and dry. There were no unusual traffic conditions or activities observed in the general location that may have affected the field counts.

Manual counts were taken of all passenger cars, trucks, buses, bicycles, motorcycles and pedestrians by turning movements and direction of approaches. The turning movement and direction counts were taken to establish a baseline condition upon which future traffic can be forecasted.

Based on the field counts the morning peak hour,which occurs between 7:00 am to 8:00 am, and the afternoon peak hour, 4:30 pm to 5:30 pm, were adjusted to reflect traffic when the University is in session. Figures 3 and 4, respectively, show the estimated afternoon and morning peak hour volumes and direction of movement at the two intersections.

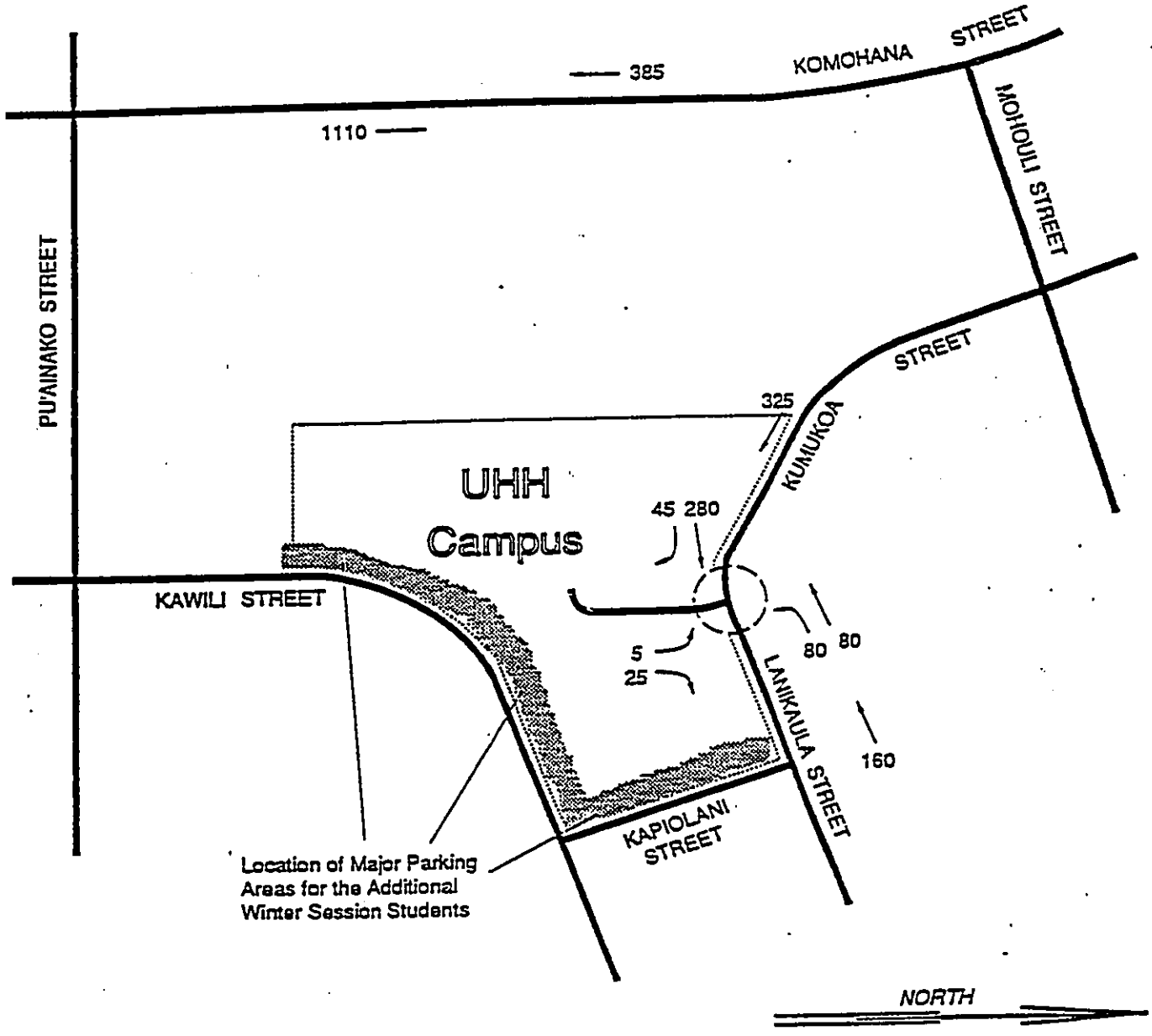


Figure 3. 1988 Morning Peak Hour Traffic

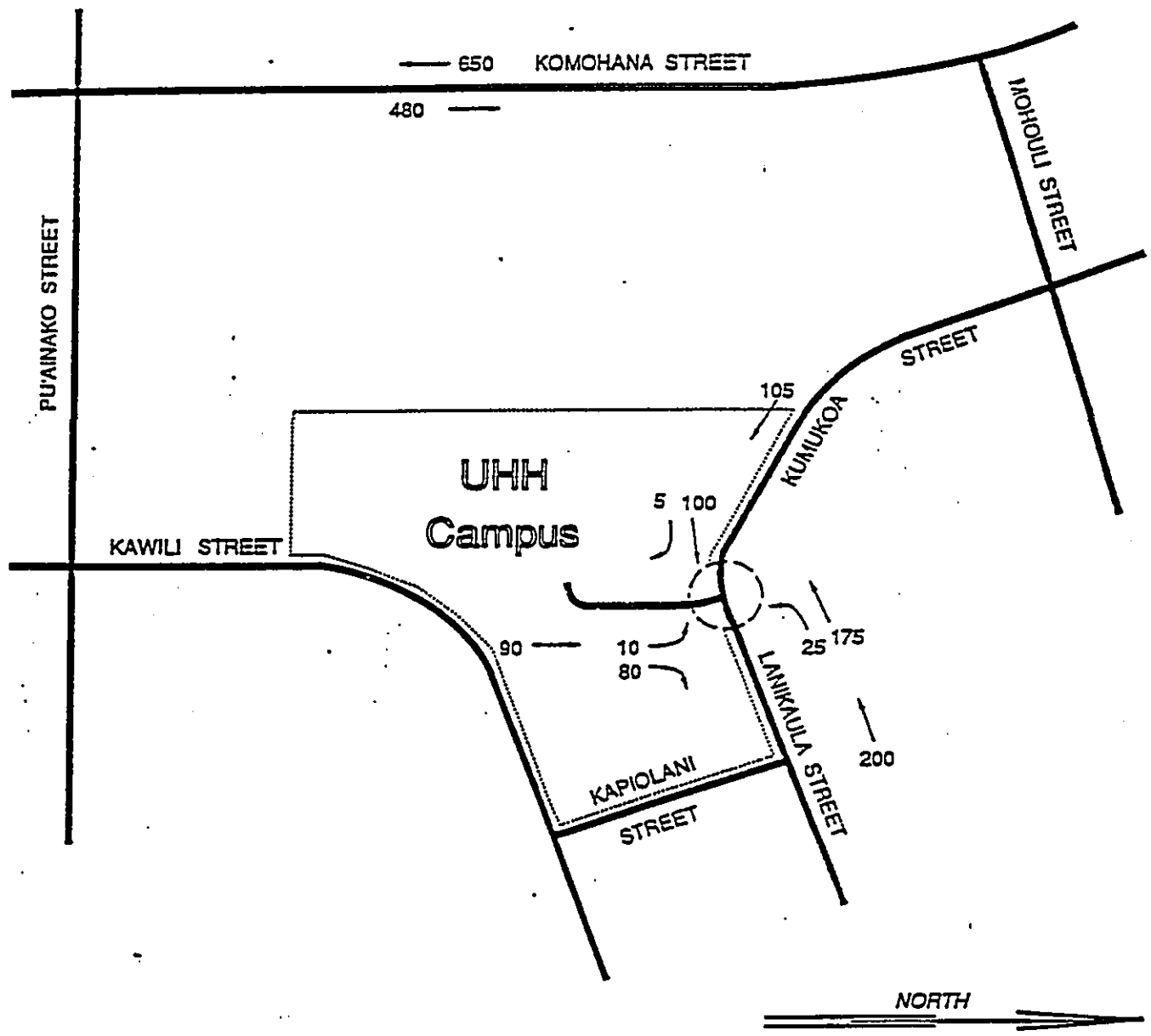


Figure 4. 1988 Afternoon Peak Hour Traffic

TRAFFIC IMPACT ANALYSIS

A general review of the study area, the existing roadway network, and plans for future development was conducted. Existing traffic counts were obtained from State Department of Transportation to determine the peak periods of existing traffic in the study area. Field counts of the morning and afternoon peak hours were adjusted to reflect traffic when the University is in session.

Future traffic *with* and *without* the R&T Park were estimated for the year 2003 when the project is expected to be fully developed. Standard vehicle forecast methods of trip generation, distribution and assignment were used to determine future traffic volumes from new developments in the study area.

Intersection level-of-service analysis of the study sites were conducted for the conditions with and without the project. The analysis was carried out in accordance with the latest Highway Capacity Manual (HCM) analysis techniques (Special Report 209, 1985).

Capacity and Level-of-Service of Komohana Street

The capacity and level-of-service of Komohana Street was estimated using techniques from the HCM. Level-of-Service (LOS) is classified into six categories ranging from LOS A, where motorists can drive at their desired speed, to LOS F, motorists experience heavily congested flow with traffic demand exceeding capacity. The capacity of a two-lane rural road occurs at LOS E. The definition of LOS for two-lane rural highway is given in Appendix A.

The two-way capacity of Komohana Street was estimated to be about 2,010 vehicles per hour. The present highest 15 minute flow rate during the morning is 1,650 vehicles per hour (vph) and 1250 vph during the afternoon peak hour. At these volumes, the analysis estimates that Komohana Street is operating at LOS E during the morning peak hour and LOS D during the afternoon. During the field review, however, the level-of-service was estimated to be about LOS D during the morning and LOS C during the afternoon.

2003 Traffic Without Project

Future non-project traffic along Komohana Street and Lanikaula Street was forecasted based on past trends and traffic estimated from future developments such as the increased enrollment of the University and Waiakea Schools.

Using traffic count data along Komohana Street, from 1971 to present, a traffic growth trend was mathematically derived by linear regression. The results of the analysis are shown graphically on Figure 5. The analysis indicates that traffic along Komohana Street grew by about 4% annually. This method of projecting a growth trend in traffic from past traffic data, assumes traffic volume increases from developments outside or beyond the immediate project area.

Growth in traffic on Komohana Street is expected to be limited during the morning peak hour due to the capacity of the two-lane roadway. At present, the street is operating near capacity (LOS E) during the morning peak hour and at LOS D during the afternoon peak hour. At the projected growth rate, Komohana Street will have reached capacity at about 2,010 vehicles per hour during the morning peak hours by the year 2003.

At capacity level, delays from congestion on Komohana Street will cause motorists to seek more desirable alternative routes to reduce delays in the North-South direction such as Kinoole Street, Kanoelehua Avenue, and Kilauea Street. Therefore it is expected that traffic on Komohana Street will continue to grow until capacity is reached. Thereafter, motorists will find other more desirable routes in the North-South direction.

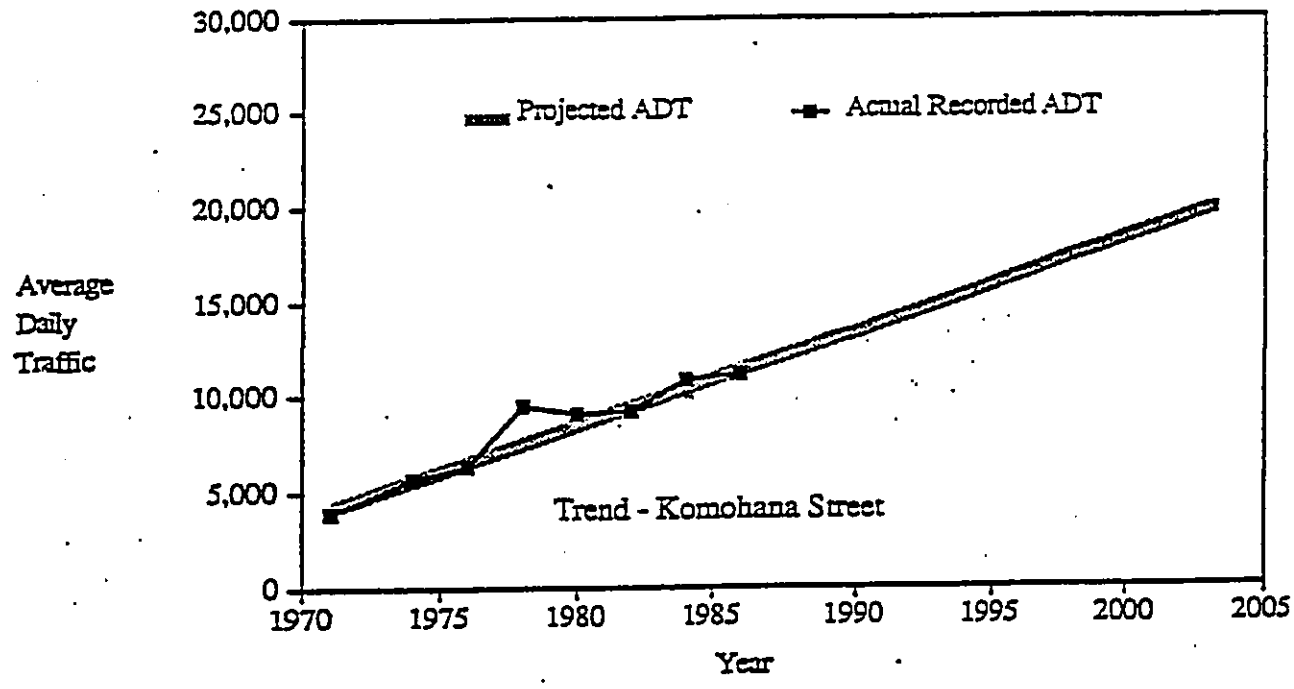


Figure 5. Trend Analysis

Additional trips generated by increased enrollment at the existing UHH campus were added to the traffic on the surrounding roadway network. The trips generated from these developments were estimated from the Trip Generation Report by the Institute of Transportation Engineers. The average trip rates per student for Community Colleges were used. During the morning peak hour, it is estimated that 0.150 trips/student will enter UHH and 0.031 trips/student will exit. During the afternoon peak hour, it is estimated that 0.039 trips/student will enter UHH and 0.081 trips/student will exit.

Based on an increase in enrollment of 1300 students, approximately 195 trips will enter and 40 trips will exit during the morning peak hour and 50 trips will enter and 105 trips will exit during the afternoon peak hour. Trips were then distributed and assigned as described in the following sections on "Trip Distribution" and "Trip Assignment".

Increased enrollment in the Waiakea Schools is not expected to affect traffic on Komohana and Lanikaula near the UHH Campus. The boundary for the Waiakea School District is located along Lanikaula Street and runs through the UHH Campus. It was assumed that traffic related to the Waiakea Schools will be generated from the south and would therefore not affect the intersections along the north boundary.

2003 Traffic With Project

Trip Generation

Vehicle trips generated by the R&T Project were estimated using average trip rates from the Trip Generation Report (Fourth Edition) 1987, Institute of Transportation Engineers (ITE). Table 2 shows the estimated entering and exiting trips for the R&T Project for the morning and afternoon peak periods on the adjacent streets.

The trip rates are based on average conditions and used to calculate vehicle trips entering and exiting different land uses. The average trip rates per student for Community Colleges were used. During the morning peak hour, it is estimated that 0.150 trips/student will enter UHH and 0.031 trips/student will exit. During the afternoon peak hour, it is estimated that 0.039 trips/student will enter UHH and 0.081 trips/student will exit. The research facility's enter/exit rates per acre are 3.45 trips/acre entering and 0.71 trips/acre exiting for the morning peak hour and 1.55 trips/acre entering and 2.98 trips/acre exiting for the afternoon peak hour.

Table 2. Trip Generation

		Morning Peak Hour		Afternoon Peak Hour	
LAND USE	UNITS	ENTER TRIPS	EXIT TRIPS	ENTER TRIPS	EXIT TRIPS
Campus	1900 students	310	30	35	195
Research	42 acres	145	30	65	125
Total		455	60	100	320

Trip Distribution

The trips generated by the R & T Project were distributed to surrounding areas based on the approximate population distribution of the South Hilo District. About 50% of the population is located to areas North of the Campus, 30% to the South, and 20% to the East. The population distribution in the South Hilo area was assumed to remain the same through the year 2003 because of the very low growth rate predicted for Hilo.

Traffic Assignments

The traffic generated by the R&T Project was assigned to the future roadway network based on the trip distribution and the desirability of routes. All trips generated by the research facilities were assumed to enter and exit by the intersection of Komohana Street and the Campus Road. Trips generated by the additional students were split in half using both the Komohana Street and Lanikaula Street entrances.

Figure 6 shows the traffic assignment percentages for the traffic generated at the R & T Park and UHH. Table 3 shows the traffic forecasts at the study intersections during the morning peak hour. Table 4 shows the traffic forecasts at the study intersections during the afternoon peak hour. The forecasted traffic without and with the project is shown graphically in Figures 7 through 10.

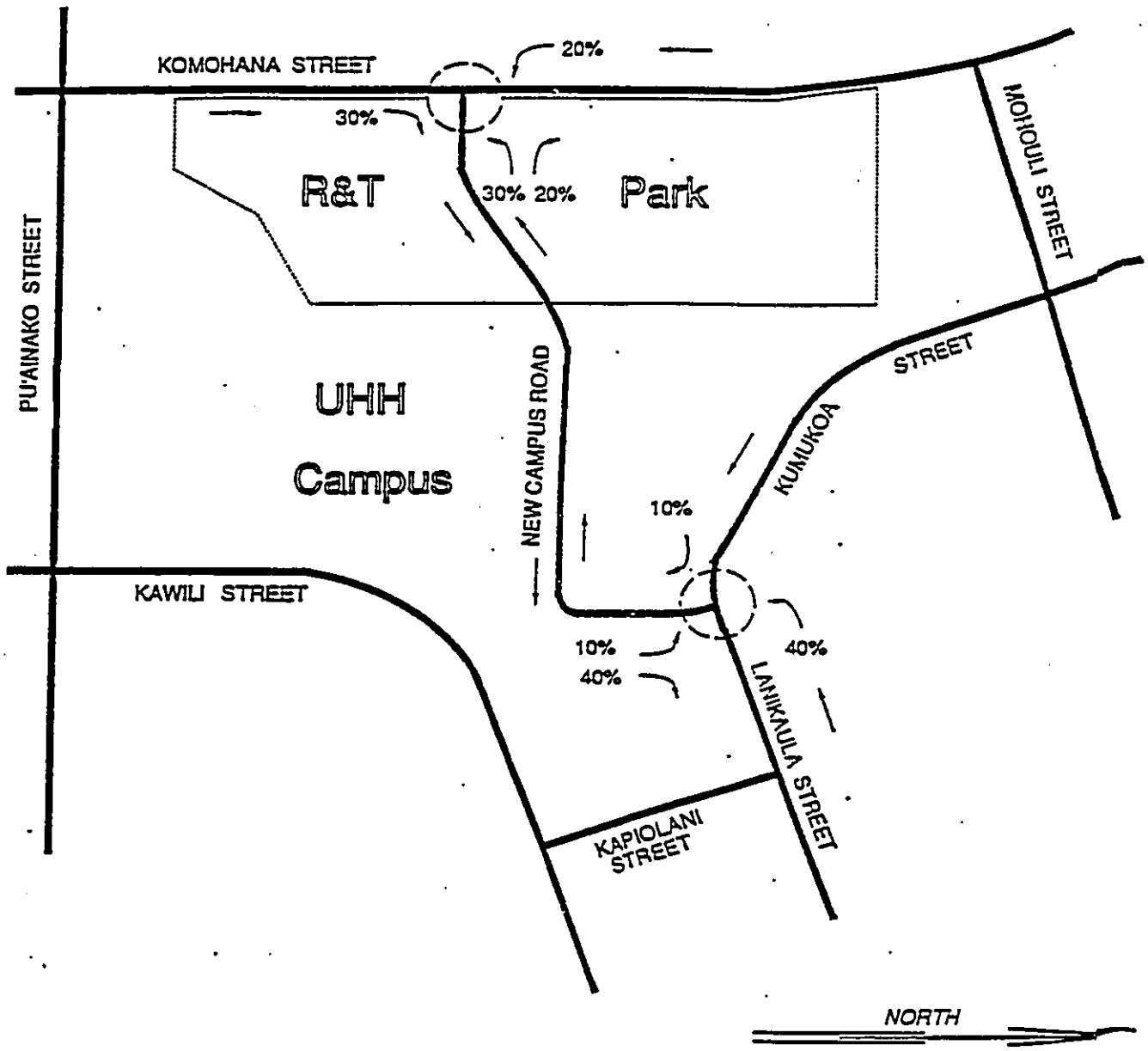


Figure 6. Distribution & Assignment for
R&T Park and UHH Traffic

Table 3. Morning Peak Hour Forecast Traffic at Intersection of Komohana Street & Proposed Main Entrance

Street Approach & Turning Movement	1988	2003 w/o Project	2003 w/ Project
Komohana Street			
Northbound			
TH	1110	1475	1360
RT	NA	105	240
Southbound			
TH	385	410	370
LT	NA	70	160
Proposed Main Entrance			
Westbound			
LT	NA	20	40
RT	NA	15	25

Morning Peak Hour Forecast Traffic at Intersection of Lanikaula Street & Existing Campus Road

Street Approach & Turning Movement	1988	2003 w/o Project	2003 w/ Project
Lanikaula Street			
Eastbound			
TH	280	415	415
RT	55	35	80
Westbound			
TH	75	120	120
LT	95	135	320
Existing Campus Road			
Northbound			
LT	5	5	15
RT	30	30	50

Table 4. Afternoon Peak Hour Forecast Traffic at Intersection of Komohana Street & Proposed Main Entrance

Street Approach & Turning Movement	1988	2003 w/o Project	2003 w/ Project
Komohana Street			
Northbound			
TH	480	695	695
RT	NA	25	50
Southbound			
TH	650	1010	1010
LT	NA	15	35
Proposed Main Entrance			
Westbound			
LT	NA	20	120
RT	NA	15	80

Afternoon Peak Hour Forecast Traffic at Intersection of Lanikaula Street & Existing Campus Road

Street Approach & Turning Movement	1988	2003 w/o Project	2003 w/ Project
Lanikaula Street			
Eastbound			
TH	100	155	155
RT	5	5	20
Westbound			
TH	175	275	275
LT	25	30	70
Existing Campus Road			
Northbound			
LT	10	20	40
RT	80	75	165

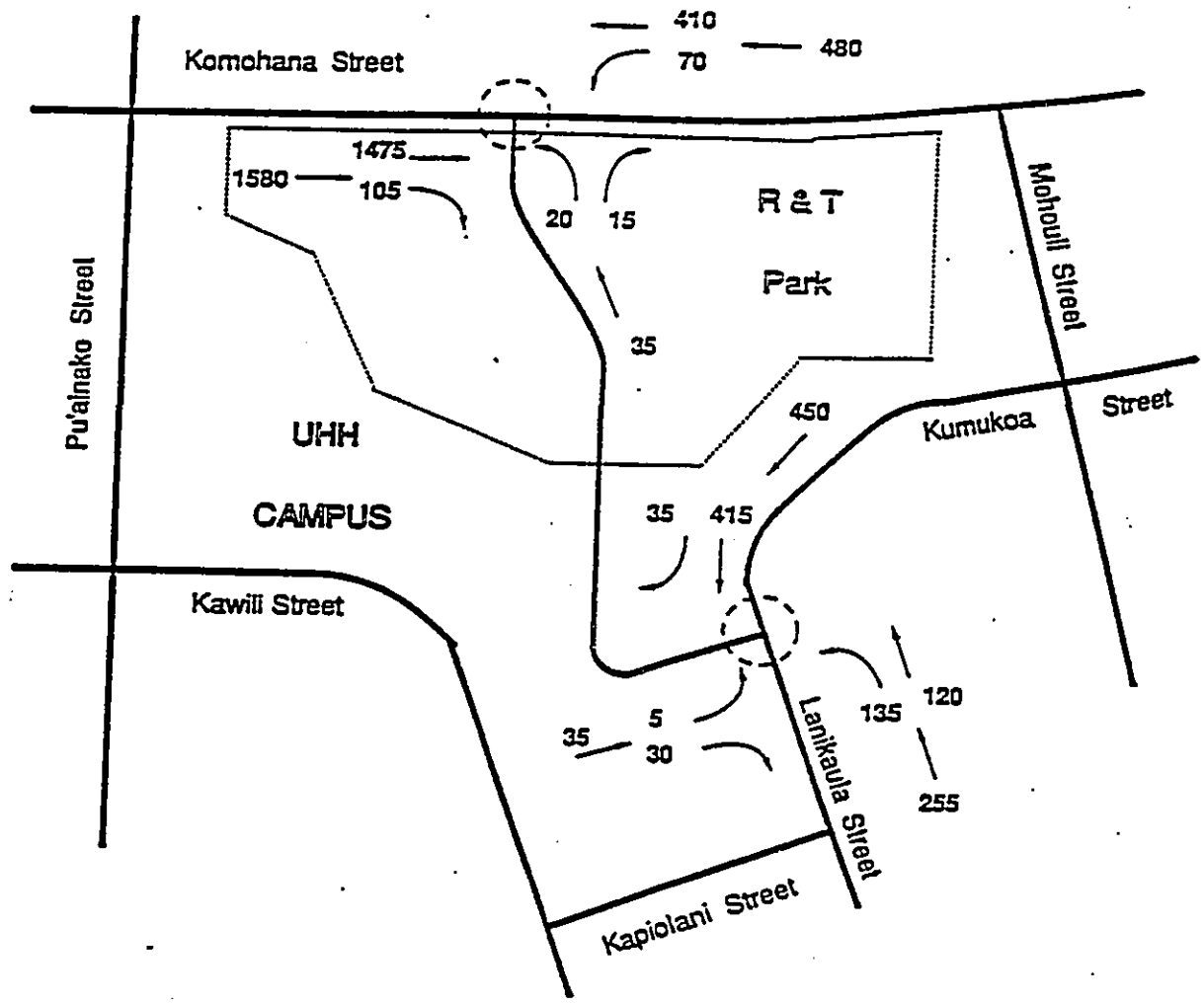


Figure 7. Forecast Morning Peak Hour Traffic *Without* Project Traffic.

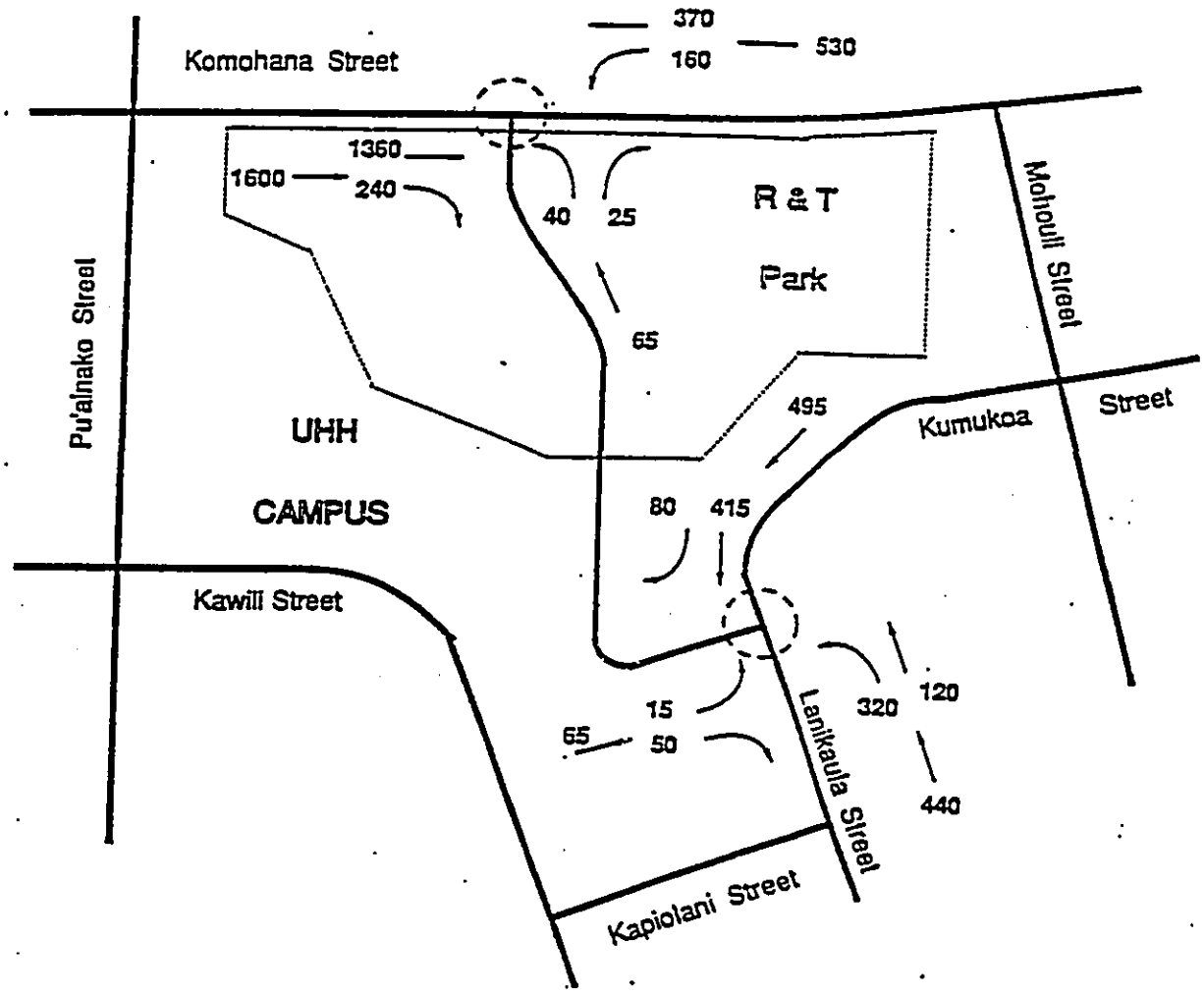


Figure 8. Forecast Morning Peak Hour Traffic *With* Project Traffic

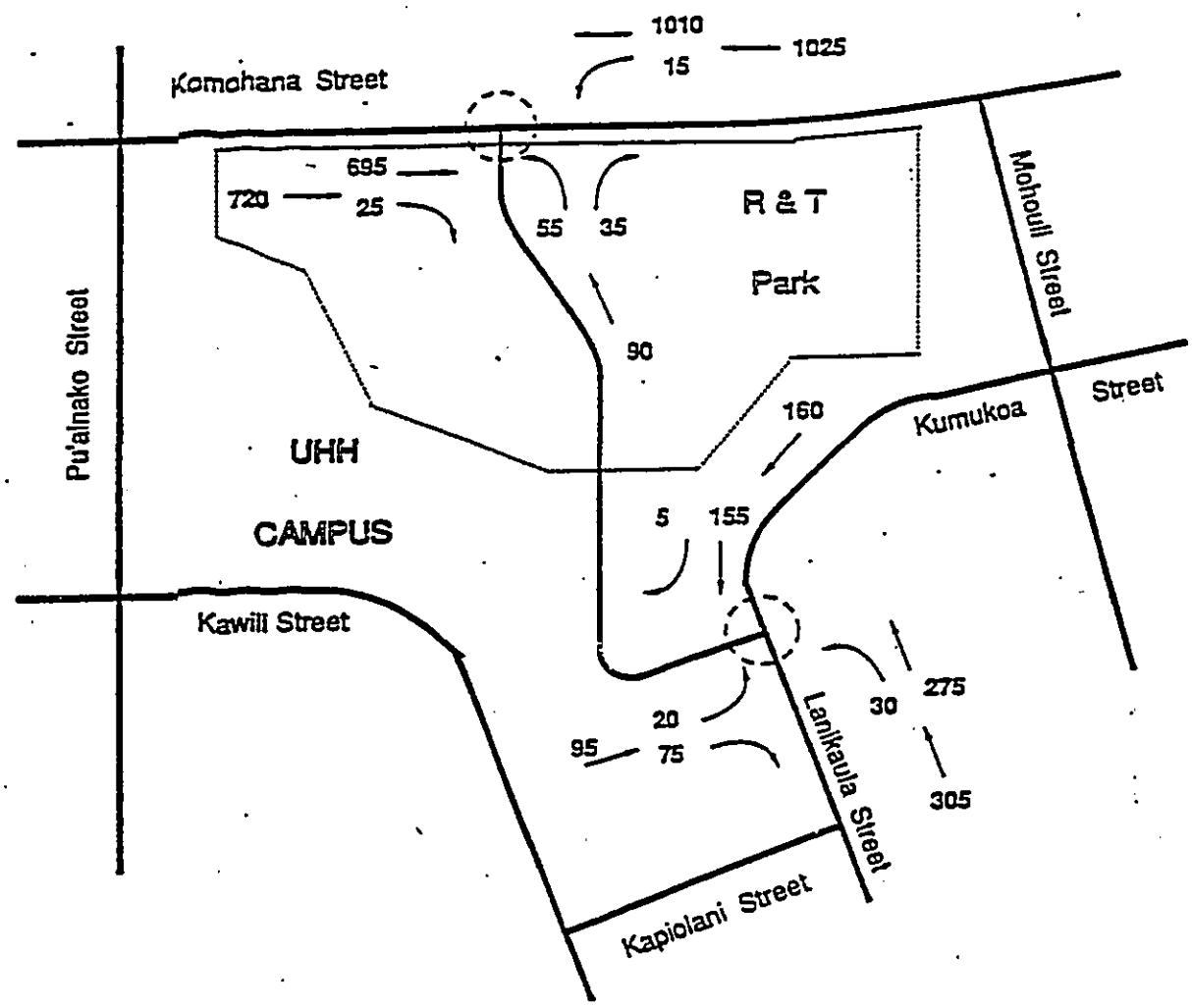


Figure 9. Forecast Afternoon Traffic *Without* Project Traffic

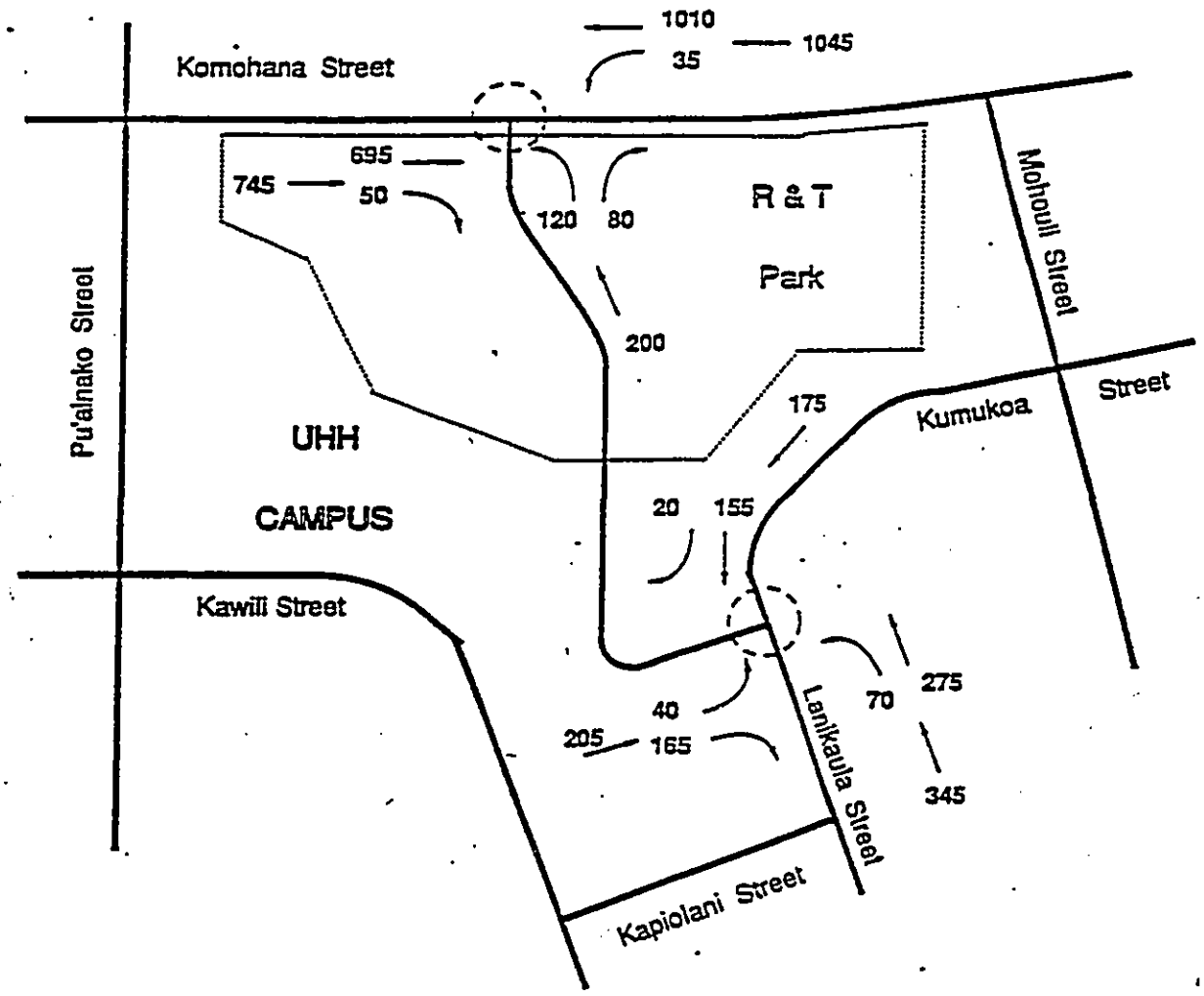


Figure 10. Forecast Afternoon Traffic *With* Project Traffic

Traffic Impacts

Traffic impacts at the study intersections were assessed by the change in Level-of-Service (LOS) for the forecasted conditions without the project and with the project. The intersections were analyzed as unsignalized stop-controlled intersections using standard analysis techniques specified in the HCM. The LOS analysis for Komohana Street traffic for 1988 and 2003 without the project was accomplished assuming one car attempting each turning movement.

The LOS for the traffic movements in an intersection is classified into six categories ranging from little or no delay (LOS A) to extreme traffic delays (LOS F). Appendix A provides the definitions for each LOS category. Tables 5 and 6 show the results of the unsignalized intersection analysis.

At present, drivers attempting to turn left from the Agricultural Complex onto Komohana Street currently experience very long delays (LOS E) during the morning peak hour and long delays (LOS D) during the afternoon. The intersection of Lanikaula Street and the existing campus road currently operates at very good level-of-service.

In the year 2003 even without the R&T Park project, drivers attempting left turn movements from the proposed campus road onto Komohana Street will experience extreme delays (LOS F) during the morning peak hour and very long delays (LOS E) during the afternoon. Drivers attempting left turn movements from Komohana Street into the campus road will experience very long delays (LOS E) during the morning peak hour. The delays are mainly due to the volume of traffic on Komohana Street. The intersection of Lanikaula Street and the existing campus road will continue to operate at good level-of-service.

With the project's traffic included, the LOS for left turn movements out of the campus road onto Komohana Street will remain at LOS F during the morning peak hour and drop from LOS E to F during the afternoon. The LOS for left turn movements from Komohana Street into the campus will drop from LOS E to F.

Table 5. Level-of-Service for
Intersection at Komohana Street and Proposed Main Entrance

Street Approach & Turning Movement		1988[1] AM	1988[1] PM	2003 w/o Project AM	2003 w/o Project PM	2003 w/ Project AM	2003 w/ Project PM
Komohana Street							
Southbound	LT	B	A	E	A	F	A
Proposed Main Entrance							
Westbound	LT	E	D	F	E	F	F
	RT	D	A	D	B	D	B

[1] LOS at Agricultural Complex Driveway

Table 6. Level of Service for
Intersection of Lanikaula & Existing Campus Road

Street Approach & Turning Movement		1988 AM	1988 PM	2003 w/o Project AM	2003 w/o Project PM	2003 w/ Project AM	2003 w/ Project PM
Lanikaula Street							
Eastbound	LT	A	A	A	A	B	A
Existing Campus Road							
Northbound	LT	A	A	B	A	D	A
	RT	A	A	A	A	A	A

The intersection of Lanikanla Street and the campus road will remain at good level-of-service (LOS B or better), except for the left turn movement out of the Campus Road which will operate at LOS D during the morning peak hour.

Analysis of Signalized Intersection of Komohana Street and Campus Road

As an unsignalized intersection, the proposed intersection of Komohana Street with the Campus Road is expected to operate with extreme delays for vehicles turning left into or out of the Campus Road. The intersection was therefore analyzed as a signalized intersection to determine if it would operate under capacity.

The Operational Analysis procedure from the HCM was used to estimate the capacity of the signalized intersection and its level of service. In the analysis, the signal timing was assumed and the volume of North-South traffic was limited by the capacity of Komohana Street.

The results of the analysis indicate that the intersection of Komohana Street and the Campus Road could operate under capacity at LOS D with the addition of a left-turn pocket and a right-turn pocket on Komohana Street.

CONCLUSION AND RECOMMENDATIONS

The proposed Research and Technology Park project is expected to have an impact on traffic flow along Komohana Street. The project is not expected to have a significant impact on traffic flow on Lanikaula Street.

At the current traffic growth rate, Komohana Street (between Pu'ainako and Mohouli Streets) will reach capacity before 2003 *even without the R &T Project.* Motorists attempting to turn left from the Agricultural Complex onto Komohana Street will experience very long delays during the morning and afternoon peak hours.

By the year 2003 with the project, traffic conditions at the proposed intersection of Komohana Street with the campus road are expected to be congested. Motorists attempting left turn movements into and out of the proposed Campus Access Road are expected to experience extreme delays (LOS F) during the morning peak hour. During the afternoon peak hour, motorists attempting the left turns out of the Campus are also expected to experience extreme delays (LOS F).

If traffic volumes increase as expected, the proposed intersection of Komohana Street with the Campus Access Road will need to be signalized to reduce extreme delays to vehicles entering or exiting the project. The intersection should be periodically monitored to determine when traffic conditions warrants signalization according to standard traffic practices.

To further minimize impacts of the proposed project and provide for a smooth traffic operation we recommend the following:

- Channelize the intersection of Komohana Street and the Campus Access Road. Construct left-turn storage and right-turn lanes along Komohana Street. Construct exclusive left and right turn lanes for vehicles exiting the Campus Access Road. Figure 11 shows the schematic plan of the intersection.

- The Campus Access Road should be used to access all park facilities. Direct access to the R&T Project from Komohana Street should be prohibited and the existing accesses to the UKIRT facilities and Agricultural Complex should be eliminated to reduce the number of congestion points.

The existing intersection of Lanikaula Street with the campus road is expected to operate at an acceptable level-of-service. Only the left-turn movement from the campus road onto Lanikaula Street will operate with long delays, LOS D. Due to the few number of motorists expected to turn left this is not expected to be a significant problem.

Phasing of Improvements

Table 7 below shows the recommended improvements in relation to the phasing of the project.

Table 7. Recommended Improvements

Year of Completion	Development	Recommended Improvement
1992	Campus Road Extension to Komohana Street and UKIRT Road	Channelize intersection Provide access to UKIRT Facility
1993	Student Housing and Ag Complex Road	Provide access to Ag Complex
1995	General Classrooms	
1997	Teaching Labs, Multi-Purpose Arena, Student Housing (Increment 2), P.E. Facility and Track & Field	
1998	Student Housing Food Service Maintenance & Operations Student Health Facility	
2000	Student Housing (Increment 3)	
2003	Library	

All recommended roadway improvements should be constructed when the Campus Road Extension to Komohana Street is built in 1992. Underground ductlines for traffic control signals should also be installed during the construction of the intersection so that when traffic signal warrants are met, the traffic control signal equipment can be easily installed and made operational.

A separate analysis, not part of this impact study, is required to meet the specific requirements of signal warrant assessment as set forth by the Manual of Uniform Traffic Control Devices. We cannot determine when traffic control signals are needed at the intersection without conducting periodic traffic counts to determine whether traffic signals are warranted at the intersection.

The traffic flow along Komohana Street will be impacted when the Campus Access Road is connected to it, in the year 1992. Delays and queueing to southbound traffic will occur during the morning as vehicles attempt left turn movements into the campus. To minimize the impact, the intersection should be channelized upon construction. Without the left turn storage lane, through traffic along Komohana Street will be forced to stop when vehicles turn left into the campus causing delays and queues along Komohana Sreet.

Arena Traffic

The arena is expected to generate major traffic flow during off peak times. Events at the arena, such as commencement ceremonies and sporting events, are expected to be scheduled during the weekends and off peak hours on weekdays. This study only addresses traffic during the peak hour and therefore traffic from arena activities was not included in the analysis. However, because of the large number of vehicles expected to exit at the same time after arena events, we recommend off-duty police officers be engaged to direct traffic at the two exits (Komohana and Lanikaula Street intersections) whenever special events are held at the arena.

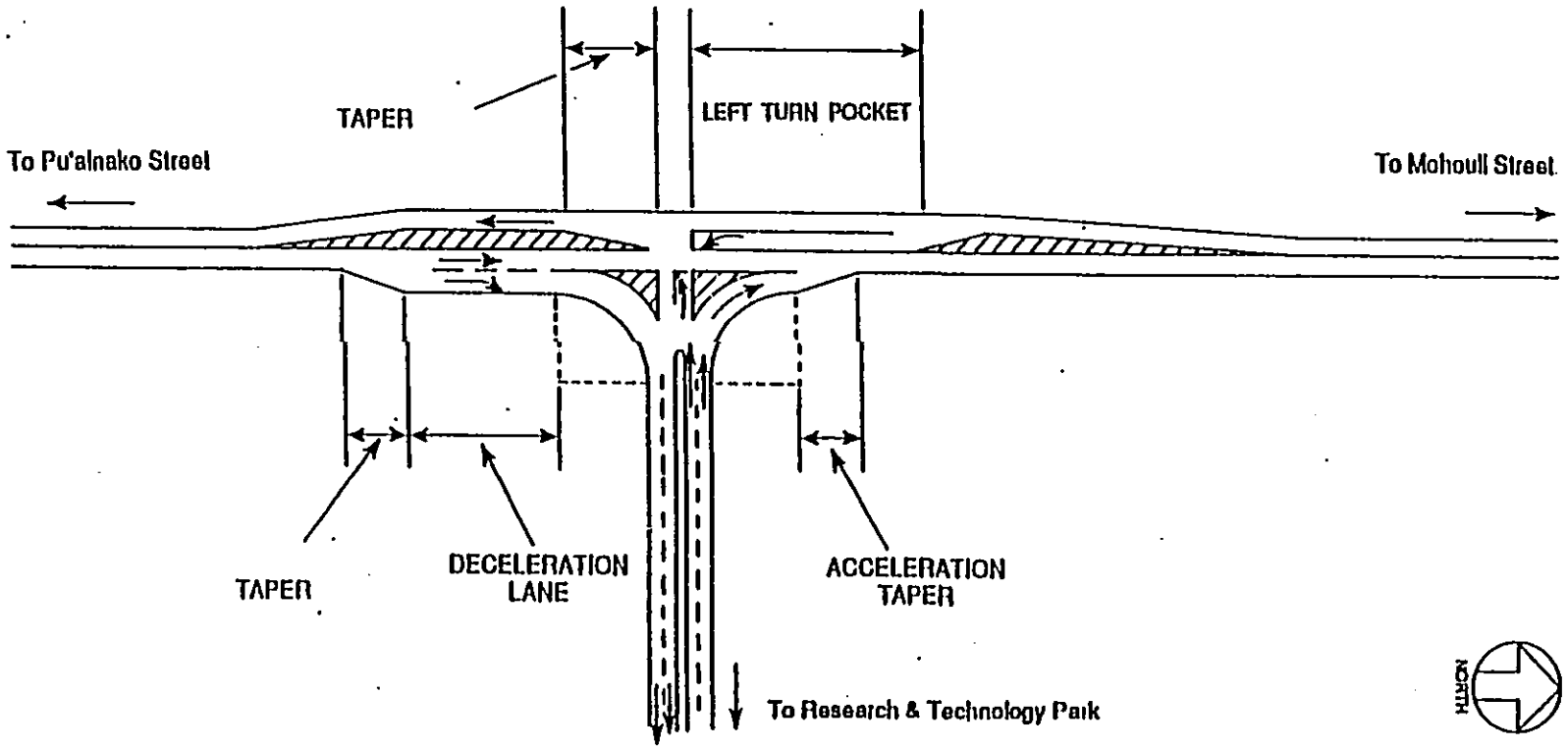


Figure 11. Schematic Intersection Layout

APPENDIX B

Definition of Level-of-Service
for
Unsignalized Intersections and Two-lane Highways

APPENDIX B

DEFINITION OF LEVEL-OF-SERVICE

For unsignalized intersections, the traffic most impacted will be the minor or cross-street with the stop or yield control. The major roadway will have the right-of-way. The level-of-service is the amount of delay expected for the average vehicle desiring to cross or enter the major road. The following gives a general description of the measure.

The concept of levels of service is defined as a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. A level of service definition generally describes these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety.

Six levels of service are defined for each type of facility for which analysis procedures are available. They are given letter designations, from A to F, with level-of-service A representing the best operating conditions and level-of-service F the worst.

Level-of-Service definitions--In general, the various levels of service are defined as follows for uninterrupted flow facilities:

Level-of-service A represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist, passenger, or pedestrian is excellent.

Level-of-service B is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is slight decline in the freedom to maneuver within the traffic stream from LOS A. The level of comfort and convenience provided is somewhat less than at LOS A, because the presence of others in the traffic stream begins to affect individual behavior.

Level-of-service C is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by the presence of others, and maneuvering within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably at this level.

Level-of-service D represents high-density, but stable, flow. Speed and freedom to maneuver are severely restricted, and the driver or pedestrian experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

Level-of-service E represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to maneuver within the traffic stream is extremely difficult, and it is generally accomplished by forcing a vehicle or pedestrian to "give way" to accommodate such maneuver. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is generally high. Operations at this level are usually unstable, because small increases in flow or minor perturbations within the traffic stream will cause breakdowns.

Level-of-service F is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go wave, and they are extremely unstable. Vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop in a cyclic fashion. Level-of-service F is used to describe the operating conditions within the queue, as well as the point of the breakdown. It should be noted, however, that in many cases operating conditions of the vehicles or pedestrians discharged from the queue may be quite good. Nevertheless, it is the point at which arrival flow exceeds discharge flow which causes the queue to form, and level-of-service F is an appropriate designation for such points.

These definitions are general and conceptual in nature, and they apply primarily to uninterrupted flow. Levels of service for interrupted flow facilities vary widely in terms of both the user's perception of service quality and the operational variables used to describe them.