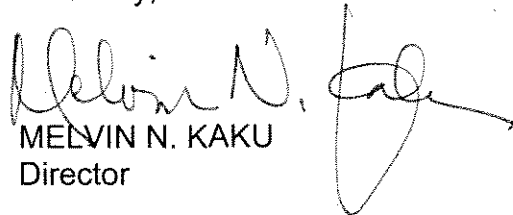




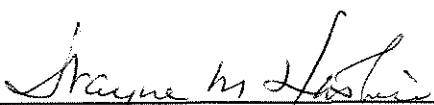
The Honorable Donovan Dela Cruz, Chair  
and Members of the City Council  
Page 2  
October 30, 2006

Your favorable and timely consideration of this resolution is requested.

Sincerely,

  
MELVIN N. KAKU  
Director

APPROVED:

  
\_\_\_\_\_  
WAYNE M. HASHIRO  
Managing Director

Enclosure

# Honolulu High-Capacity Transit Corridor Project Alternatives Analysis Report

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# ***Preface***

## **Context of the Alternatives Analysis**

This Alternatives Analysis (AA) supports the selection of a locally preferred transit alternative for the City and County of Honolulu consistent with the planning and project development process defined by the Federal Transit Administration (FTA). The first step of the process was systems planning, which culminated with the O'ahu Metropolitan Planning Organization (OMPO) including a fixed guideway transit system in the *2030 O'ahu Regional Transportation Plan* (OMPO, 2006a). This phase, Alternatives Analysis, evaluates a range of transit mode and general alignment alternatives in terms of their costs, benefits and impacts.

The Honolulu City Council will select a locally preferred alternative (LPA) based on the findings of this AA report. Subsequently, design options within the LPA will be evaluated and an Environmental Impact Statement (EIS) will be prepared according to the National Environmental Policy Act (NEPA) as part of the Preliminary Engineering phase. Final Design, construction, and operation of the LPA will follow.

## **Purpose of the Alternatives Analysis Report**

The purpose of this report is to provide the Honolulu City Council with the information necessary to select a mode and general alignment alternative for high-capacity transit service on O'ahu. The primary project study area is the travel corridor between Kapolei and the University of Hawai'i at Mānoa. The report summarizes the results of an AA that followed FTA planning guidance and provides information on the costs, benefits, and impacts of four alternatives:

- No Build Alternative
- Transportation System Management Alternative
- Managed Lane Alternative
- Fixed Guideway Alternative

## Organization of the Alternatives Analysis Report

This report is organized into a summary followed by seven chapters. Chapter 1 provides the context for the study, including a description of the corridor and the existing transportation system, planned growth and improvements in the corridor, the need for an improved transit system, and a definition of the purpose of the alternatives evaluated.

Chapter 2 describes the alternatives being evaluated and how they were selected through both technical review and public comment.

Chapters 3 through 5 evaluate the technical merits and consequences of the alternatives. Chapter 3 presents the effects that the alternatives would have on the transportation system. The physical and social environment that would be affected by the alternatives

# Table of Contents

<b>SUMMARY .....</b>	<b>S-1</b>
<b>Purpose of and Need for Transportation Improvements .....</b>	<b>S-1</b>
<b>Alternatives Considered .....</b>	<b>S-2</b>
<b>Transportation Impacts and Benefits .....</b>	<b>S-2</b>
<b>Environmental Impacts and Benefits .....</b>	<b>S-3</b>
<b>Financial Feasibility.....</b>	<b>S-4</b>
Capital Costs .....	S-4
Operating and Maintenance Costs.....	S-4
Funding Options.....	S-4
<b>Evaluation of Alternatives.....</b>	<b>S-5</b>
<b>Residents' Alternatives Preferences .....</b>	<b>S-6</b>
<b>Issues to be Resolved .....</b>	<b>S-7</b>
<b>CHAPTER 1 PURPOSE AND NEED.....</b>	<b>1-1</b>
<b>Purpose of the Project .....</b>	<b>1-1</b>
<b>Need for Transportation Improvements.....</b>	<b>1-1</b>
Improved mobility for travelers facing increasingly severe traffic congestion.....	1-1
Improved transportation system reliability.....	1-2
Accessibility to new development in 'Ewa/Kapolei/Makakilo as a way of supporting policy to develop the area as a second urban center.....	1-2
Improved transportation equity for all travelers.....	1-2
<b>Description of the Corridor .....</b>	<b>1-2</b>
Travel Patterns in the Corridor.....	1-4
<b>Existing Transportation Facilities and Services in the Corridor.....</b>	<b>1-11</b>
Street and Highway System .....	1-11
Public Transit System .....	1-12
Parking .....	1-12
<b>Performance of the Existing Transportation System .....</b>	<b>1-12</b>
Traffic Volumes .....	1-12
Traffic Operating Conditions .....	1-12
Transit Operating Conditions .....	1-13
<b>Potential Transit Markets.....</b>	<b>1-15</b>
<b>History of the Project .....</b>	<b>1-15</b>
<b>Goals and Objectives .....</b>	<b>1-16</b>
<b>CHAPTER 2 ALTERNATIVES CONSIDERED.....</b>	<b>2-1</b>
<b>Screening and Selection Process.....</b>	<b>2-1</b>
<b>Alternatives Considered .....</b>	<b>2-1</b>
<b>Alternatives Considered but Rejected .....</b>	<b>2-1</b>

<b>Alternatives Evaluated in this Alternatives Analysis</b> .....	<b>2-2</b>
Alternative 1: No Build.....	2-2
Alternative 2: Transportation System Management.....	2-3
Alternative 3: Managed Lane.....	2-3
Alternative 4: Fixed Guideway Alternative.....	2-7
<b>Costs of the Alternatives</b> .....	<b>2-16</b>
Capital Costs.....	2-16
Operating and Maintenance Costs.....	2-16
<b>Schedule</b> .....	<b>2-10</b>

Economic Risk.....	5-15
Level of FTA Funds.....	5-15
Construction Risk.....	5-16
<b>CHAPTER 6 COMPARISON OF ALTERNATIVES .....</b>	<b>6-1</b>
<b>Optimum Alternatives.....</b>	<b>6-1</b>
Managed Lane Alternative.....	6-1
Fixed Guideway Alternative .....	6-1
<b>Effectiveness at Meeting Goals and Objectives.....</b>	<b>6-5</b>
Improve Corridor Mobility .....	6-5
Encourage Patterns of Smart Growth and Economic Development.....	6-6
Find Cost-Effective Solutions .....	6-6
Provide Equitable Solutions.....	6-8
Develop Feasible Solutions.....	6-8
Minimize Community and Environmental Impacts .....	6-9
Achieve Consistency with Other Planning Efforts.....	6-9
<b>Comparison of Benefits and Consequences among the Alternatives.....</b>	<b>6-9</b>
<b>Important Trade-offs.....</b>	<b>6-13</b>
<b>CHAPTER 7 COORDINATION AND CONSULTATION .....</b>	<b>7-1</b>
<b>REFERENCES.....</b>	<b>R-1</b>



## List of Tables

Table 1-1. Existing and 2030 No Build Alternative A.M. Peak Period Speeds and Level-of-Service on H-1 .....	1-13
Table 1-2. Project Goals and Objectives.....	1-16
Table 2-1. Transit Vehicle Requirements .....	2-3
Table 2-2. Fixed Guideway Alternative Analysis Sections and Alignments.....	2-8
Table 2-3. Fixed Guideway Alternative Operating Assumptions.....	2-15
Table 3-1. Year 2030 Daily Compared to Existing Daily Trips by Transportation Analysis Area, All Modes .....	3-2
Table 3-2. Year 2030 Compared to Existing Peak-Period Work Trips by Transportation Analysis Area, All Modes .....	3-3
Table 3-3. Total Daily Person Trips by Mode .....	3-4
Table 3-4. Transit Mode Share for Home-based Work Trips by Alternative .....	3-5
Table 3-5. Park-and-Ride Lot Locations and Size for the Fixed Guideway Alternative Alignment Combinations.....	3-10
Table 3-6. A.M. Peak-hour Transit Travel Times by Alternative (in minutes) .....	3-11
Table 3-7. Daily Transit Ridership .....	3-15
Table 3-8. A.M. Peak Two-hour Transit Ridership .....	3-16
Table 3-9. Year 2030 Fixed Guideway Forecast Daily Boardings.....	3-19
Table 3-10. Systemwide Daily Travel Statistics by Alternative.....	3-20
Table 3-11. Selected Screenline Peak-hour Volumes by Alternative.....	3-23
Table 3-12. A.M. Peak-hour Screenline Volumes and Level of Service (LOS) .....	3-25
Table 3-13. P.M. Peak-hour Screenline Volumes and Level of Service (LOS) .....	3-25
Table 3-14. Summary of Transportation Effects .....	3-30
Table 4-1. Numbers of Parcels Affected (Full or Partial Acquisitions) .....	4-2
Table 5-1. Capital Cost Estimates (millions 2006 dollars).....	5-2
Table 5-2. Capital Cost Estimates of the Fixed Guideway Alternative Alignments .....	5-3
Table 5-3. Estimated Year 2030 Annual Transit Operating and Maintenance Costs (millions)	

Table 6-2. Incremental Cost per Hour of Transportation System User Benefits Compared to TSM Alternative .....	6-7
Table 6-3. Effectiveness of Alternatives at Meeting Goals and Objectives in the Year 2030 ..	6-11

## List of Figures

Figure 1-1. Areas and Districts in the Study Corridor .....	1-2
Figure 1-2. Major Activity Centers in the Study Corridor.....	1-5
Figure 1-3. Population Distribution for O‘ahu .....	1-6
Figure 1-4. Employment Distribution for O‘ahu .....	1-7
Figure 1-5. Concentrations of Transit-dependent Households .....	1-10
Figure 1-6. P.M. Peak-period Scheduled Bus Trip Times.....	1-14
Figure 2-1. Managed Lane Alternative (‘Ewa Section).....	2-5
Figure 2-2. Managed Lane Alternative (Koko Head Section).....	2-6
Figure 2-3. Mixed-Mode Alternative Section I .....	2-9

## Acronyms Used in this Document

AA	Alternatives Analysis
DTS	Department of Transportation Services
EIS	Environmental Impact Statement
FGM	Fixed Guideway Modernization
FTA	Federal Transit Administration
FY	Fiscal Year
GET	General Excise and Use Tax
GO	General Obligation
HDOT	Hawai'i Department of Transportation
HOV	High Occupancy Vehicle
LOS	Level-of-Service
LPA	Locally Preferred Alternative
NEPA	National Environmental Policy Act
O&M	Operation and Maintenance
OMPO	O'ahu Metropolitan Planning Organization
ORTP	O'ahu Regional Transportation Plan
OTS	O'ahu Transit Services, Inc.
PE	Preliminary Engineering
PUC	Primary Urban Center
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act
SCC	Standard Cost Categories
TSM	Transportation System Management
UH	University of Hawai'i
USC	United States Code
V/C	Volume-to-Capacity Ratio
VHD	Vehicle Hours of Delay
YOE	Year of Expenditure

# Summary

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

travel demand. Motorists experience substantial traffic congestion and delay at most times of the day during both the weekdays and weekends. Currently, transit is caught in the same congestion. As roadways become more congested, they become more susceptible to substantial delays caused by incidents such as traffic accidents or heavy rain. Current travel times are not reliable for either transit or automobile trips.

The highest population growth rates for the island, consistent with the General Plan for the City and County of Honolulu, are projected in the 'Ewa Development Plan area. Many lower-income and minority workers live in the corridor outside of the urban core and commute to work in the Primary Urban Center Development Plan area. Many lower-income workers also rely on transit because of its affordability.

## Alternatives Considered

Four alternatives are evaluated in this report. They were developed through a screening process that considered alternatives identified through previous transit studies, a field review of the study corridor, an analysis of current population and employment data for the corridor, a literature review of technology modes, work completed by the O'ahu Metropolitan Planning Organization (OMPO) for its *2030 O'ahu Regional Transportation Plan (OMPO, 2006a)*, and public and agency comments received during a formal project scoping process. The four alternatives are described in detail in the *Honolulu High-Capacity Transit Corridor Project Alternatives Analysis Detailed Definition of Alternatives (DTS, 2006a)*. The alternatives evaluated are as follows:

- No Build Alternative
- Transportation System Management Alternative
- Managed Lane Alternative
- Fixed Guideway Alternative.

Two operational options were studied for the Managed Lane Alternative. Several alignments were studied for the Fixed Guideway Alternative, including a shorter 20-mile Alignment.

## Transportation Impacts and Benefits

In the year 2030, the only alternative that is expected to significantly affect transit mode share and attract additional transit riders is the Fixed Guideway Alternative. Many Fixed Guideway alignment options were evaluated and the Kalaeloa - Airport - Dillingham - Halekauwila alignment combination is projected to attract the highest number of daily transit trips systemwide.

In regards to serving existing and future transit markets, the Fixed Guideway Alternative does the best job in accommodating both longer corridor transit trips, as well as the increase in work commute trips to West O'ahu, which is expected to become much more pronounced in the future. Two operational concepts for the Managed Lane Alternative were evaluated, and the Two-direction Option best serves the increase in work commute trips to West O'ahu.

The Fixed Guideway Alternative most consistently results in improved transit travel times between key corridor origins and destinations. In many cases these travel times are equivalent to, or faster than, the same trip time made by private vehicle under No Build conditions, especially when considering the use of park-and-ride trips. The Fixed Guideway Alternative would produce the most reliable travel times because the vehicles would operate in their own right-of-way separate from roadways and associated congestion. The Managed Lane Alternative would provide some travel time improvements between selected origins and destinations that are well served by the facility, but in many cases the travel time savings experienced is offset by the increased congestion experienced before entering and upon exiting the facility.

Traffic congestion on key corridor facilities is expected to continue to exist under all alternatives, particularly during peak travel periods. Systemwide vehicle hours of delay

The Fixed Guideway Alternative would generate the least air pollution and require the least energy for transportation. It would provide improved connections between communities, employment, and services in the corridor. The benefits of the Full-corridor Alignment would be somewhat greater than those for the 20-mile Alignment.

## **Financial Feasibility**

### ***Capital Costs***

Capital costs for the No Build and TSM Alternatives would be \$660 and \$856 million, respectively, which accounts for bus replacement and system expansion. Total capital costs for the Managed Lane Alternative would range between \$3.6 and \$4.7 billion, of which \$2.6 to \$3.8 billion would be for construction of the managed lanes. Capital costs for the Fixed Guideway Alternative, including bus system costs, would range between \$5.2 and \$6.1 billion for the Full-corridor Alignments, of which \$4.6 to \$5.5 billion would be for the fixed guideway system. The costs would be \$4.2 billion for the 20-mile Alignment, of which \$3.6 billion would be for the fixed guideway system.

### ***Operating and Maintenance Costs***

Operating costs in 2030 for the No Build Alternative, in 2006 dollars, would be approximately \$100 million. Operating costs for the TSM Alternative would be

## Evaluation of Alternatives

The alternatives were compared regarding their ability to improve corridor mobility, support smart growth and economic development, provide a cost-effective and equitable transportation solution, be constructible, minimize community and environmental impacts, and be consistent with other planning efforts.

The relative merits of two operational options were evaluated for the Managed Lane Alternative, and one was determined to be more effective than the other. Similarly, the Fixed Guideway Alternatives were evaluated and an optimal option of the alignments



Lane Alternative has no defined funding source. Because it would be open to general purpose vehicles, including single-occupancy vehicles (cars carrying only the driver), neither the GET surcharge nor FTA funds could be used for its construction. The 20-mile Alignment for the Fixed Guideway Alternative could be funded with a combination of expected GET revenues and FTA New Starts funds. There is more uncertainty in funding of the Full-corridor Alignment. Either a larger share of FTA funds would be needed or other sources would need to be tapped.

The alternatives range widely in relation to community and environmental impacts. The No Build and TSM Alternatives would have little direct effect on existing resources; however, they also would not offer community or environmental benefits. The Managed Lane Alternative would require acquisition of private property, generate the highest levels of air and water pollution, consume the greatest amount of energy for transportation uses, and create the greatest number of noise impacts. The Fixed Guideway Alternative would require the greatest number of property acquisitions and have the greatest number of utility conflicts during construction, but it would also provide

a new safe transportation connection between communities in the corridor. It would provide the greatest environmental benefits related to air and water pollution and energy consumption.

## Issues to be Resolved

This AA report supports the selection of an LPA by the Honolulu City Council. Subsequently, an Environmental Impact Statement (EIS) will be prepared and preliminary engineering will be completed for the selected alternative. While the AA defines the alternatives under consideration, many issues have to be resolved, beginning with selection of the LPA. Many of the other issues will be resolved as the project is refined during the environmental and preliminary engineering phases. The following outstanding issues have been identified:

- Selection of mode, alignment, and limits (this will be defined in selection of the Locally Preferred Alternative)
- Selection of transit technology for the Fixed Guideway Alternative (if selected)
- Development of a financial plan to provide project funding
- Opportunities for public-private partnership to enhance the project that can be delivered with limited public funds
- Environmental commitments.



**Purpose of the Project**

The purpose of the Honolulu High-Capacity Transit Corridor Project is to provide improved mobility for persons traveling in the highly congested east-west transportation corridor between Kapolei and UH Mānoa, confined by the Wai‘anae and Ko‘olau Mountain Ranges to the north and the Pacific Ocean to the south. The project would provide faster, more reliable public transportation services in the corridor than those currently operating in mixed-flow traffic. The project would also provide an alternative to private automobile travel and improve linkages between Kapolei, the urban core, UH Mānoa, Waikīkī, and urban areas in between. Implementation of the project, in conjunction with other improvements included in the 2030 O‘ahu Regional Transportation Plan (ORTP), would moderate anticipated traffic congestion in the corridor. The project also supports the goals of the O‘ahu General Plan and the ORTP by serving areas designated for urban growth.

**Need for Transportation Improvements**

***Improved mobility for travelers facing increasingly severe traffic congestion.***

The existing transportation infrastructure in the corridor between Kapolei and UH Mānoa is overburdened handling current levels of travel demand. Motorists experience

exists to offer an alternative way to travel within the corridor independent of current and projected highway congestion.

***Improved transportation system reliability.***

As roadways become more congested, they become more susceptible to substantial delays caused by incidents, such as traffic accidents or heavy rain. Even a single driver unexpectedly braking can have a ripple effect delaying hundreds of cars. Because of the operating conditions in the study corridor, current travel times are not reliable for either transit or automobile trips. To get to their destination on time, travelers must allow extra time in their schedules to account for the uncertainty of travel time. This is inefficient and results in lost productivity. Because the bus system primarily operates in mixed-traffic, transit users experience the same level of travel time uncertainty as automobile users. A need exists to reduce transit travel times and provide a more reliable transit system.

***Accessibility to new development in 'Ewa/Kapolei/Makakilo as a way of supporting policy to develop the area as a second urban center.***

Consistent with the General Plan for the City and County of Honolulu, the highest population growth rates for the island are projected in the 'Ewa Development Plan area (comprised of the 'Ewa, Kapolei and Makakilo communities), which is expected to grow by 170 percent between 2000 and 2030. This growth represents nearly 50 percent of the total growth projected for the entire island. The Wai'anae, Wahiawā, North Shore.

confined by the Wai'anai and Ko'olau Mountain Ranges to the north (mauka direction)  
and the Pacific Ocean to the south (makai direction). Between Pearl City and Aiea, the

Naval Air Station) covers 3,700 acres adjacent to Kapolei and is planned for redevelopment. The Department of Hawaiian Home Lands is also a major landowner in the area and has plans for residential and retail development. In addition, developers have several proposals to continue the construction of residential subdivisions.

Continuing Koko Head, the corridor follows Farrington and Kamehameha Highways through a mixture of low-density commercial and residential development. This part of the corridor passes through the makai portion of the Central O'ahu Sustainable Communities Plan area.

Farther Koko Head, the corridor enters the Primary Urban Center Development Plan area, which is bounded by commercial and residential densities that begin to increase in the vicinity of Aloha Stadium. The Pearl Harbor Naval Reserve, Hickam Air Force Base, and Honolulu International Airport border the corridor on the makai side. Military and civilian housing are the dominant land uses mauka of Interstate Route H-1 (the H-1

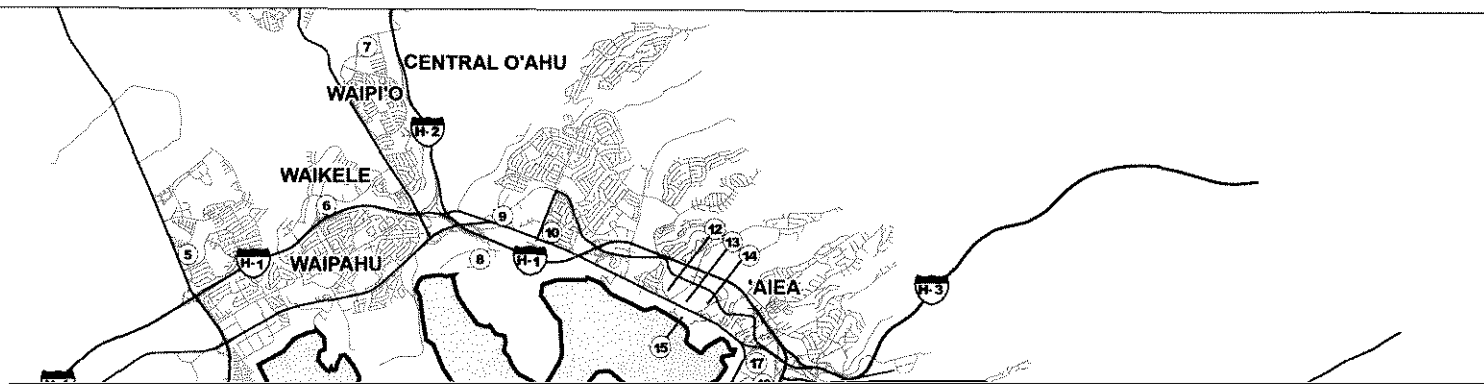
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LEGEND

Major Roads

Activity Centers

0 0.2 0.4 0.8 1.2 Miles





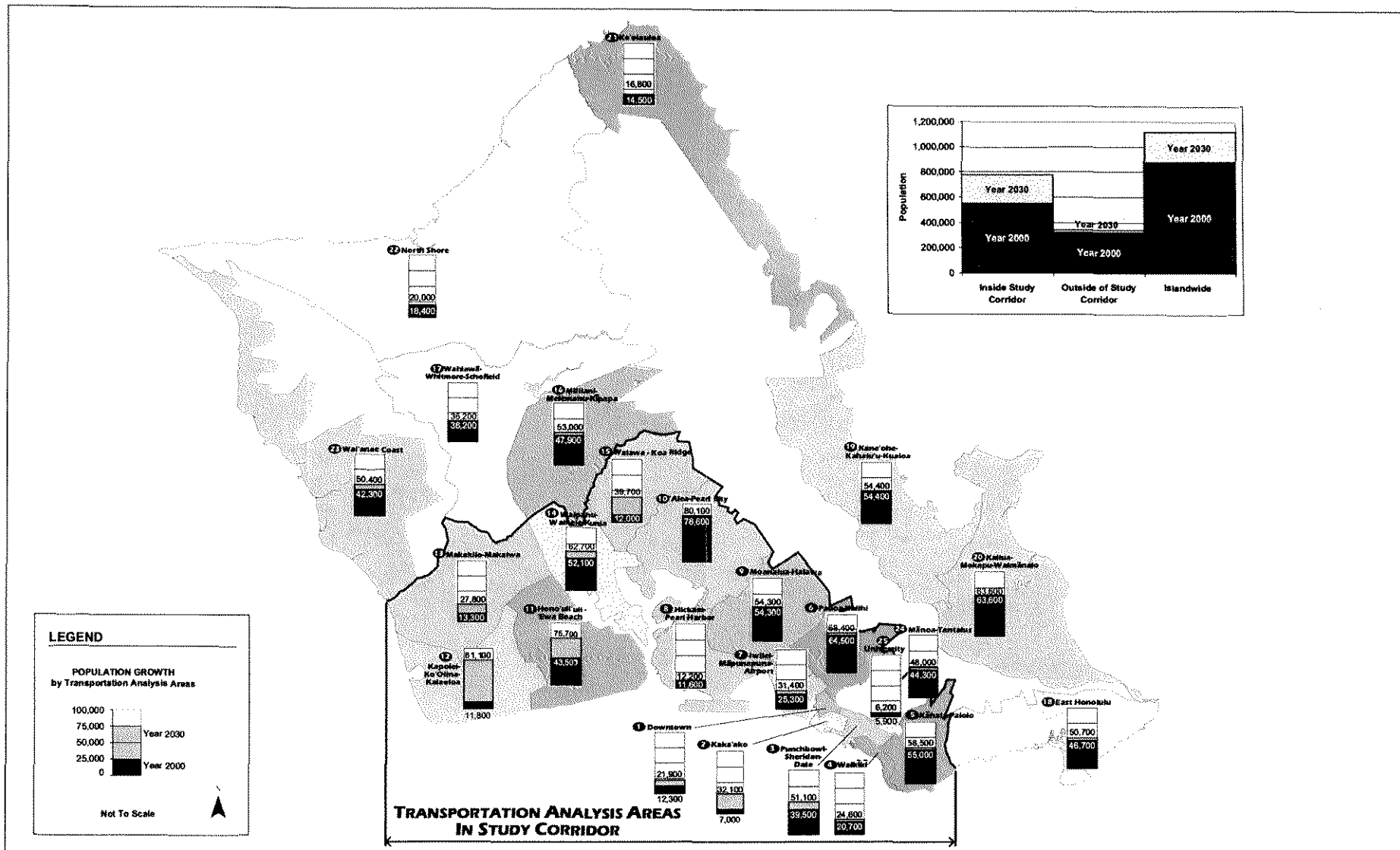
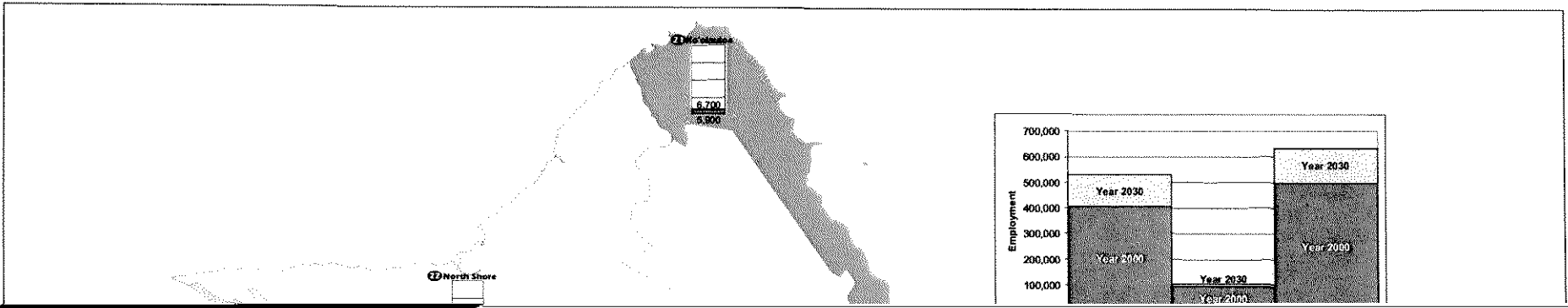


Figure 1-3. Population Distribution for O'ahu



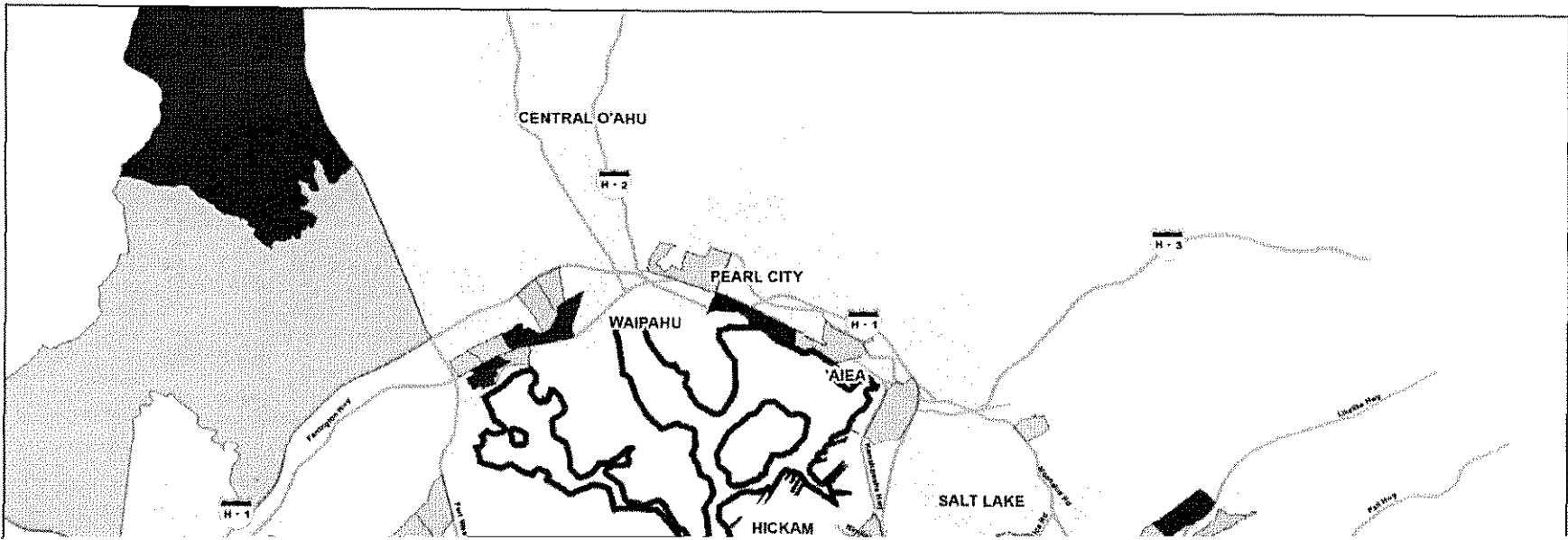


Trip origins correlate closely with the level of population in a given area, while trip destinations correlate to a high degree with the level of employment. Based on these data, 1,826,000 or 68 percent of the 2,698,000 islandwide daily trips and 335,000, or 64 percent of the 523,000 peak-period work-related trips are currently generated within the study corridor. The study corridor attracts an even higher percentage of islandwide trips with 2,092,000, or 78 percent of daily trips and 424,000 or 82 percent of peak-period work-related trips having destinations within the study corridor.

More trips will originate and remain within the Primary Urban Center in 2030 than they do today. However, the greatest increases in trips will be to and from the 'Ewa Development Plan area. These patterns illustrate the continued transportation importance of the study corridor with peak-period travel becoming less directional and more work trips destined for Kapolei.

### **Transit Travel Patterns**

An on-board transit survey was conducted on all of TheBus routes in December 2005 and January 2006. Information obtained from the survey included the origins and



### ***Peak-Period Transit Work Trips***

Nearly 34 percent of all peak-period work trips are destined to Downtown, while Punchbowl-Sheridan-Date and Waikīkī each are destinations for about 12.5 percent of trips. Combined, these areas are the destinations of approximately 60 percent of the islandwide peak-period home-based work trips. Waikīkī, Punchbowl-Sheridan-Date, Pauoa-Kalihi, Waipahu-Waikele-Kunia, and Kāhala-Pālolo together account for about 50 percent of the home-based origins for work trips taken during the peak period on TheBus.

## **Existing Transportation Facilities and Services in the Corridor**

The study corridor is currently served by roadway and transit systems, parking facilities, and pedestrian and bicycle facilities. Existing development throughout the study corridor combined with the previously described geographic boundaries limits the potential for new roadways or expansion of existing facilities.

### ***Street and Highway System***

The study corridor is served primarily by the H-1 Freeway, Farrington Highway, Kamehameha Highway, Nimitz Highway, and Moanalua Road (Route H201). The H-2 Freeway provides access to the corridor from Central O‘ahu, and the H-3 Freeway provides access to the corridor from the Windward side. Because of the constraints posed by geography and existing development, the expansion of existing roadways or the addition of new roadways in many sections of the corridor would be extremely difficult and/or expensive. As a result, some sections of the corridor are served by a relatively small number of facilities, and the lack of redundancy in the system at these locations can cause severe traffic problems should any of the facilities become overly congested or incapacitated. An example of this is in Pearl City where only three primary roadways, H-1 Freeway, Moanalua Road, and Kamehameha Highway, serve the high volume of traffic traversing this area. Of these roadways, the H-1 Freeway carries 70 to 75 percent of the a.m. and p.m. peak-hour traffic. Hence, when traffic is congested on H-1 through this location, traffic is affected for miles along the adjacent corridor segments.

To better utilize the existing roadway facilities, both the Hawai‘i Department of Transportation (HDOT) and the City and County of Honolulu have implemented a number of roadway management strategies, including the use of contraflow lanes and high-occupancy vehicle (HOV) lanes. A contraflow lane is a strategy wherein a lane that typically provides vehicular travel in one direction is reversed during certain times of the day. Current contraflow lanes operate on the H-1 Freeway, Nimitz Highway, Kapi‘olani Boulevard, Ward Avenue, Atkinson Drive, and Wai‘alae Avenue during the a.m. peak period. During the p.m. peak period, contraflow lanes operate on Kapi‘olani Boulevard.

HOV lanes are freeway or surface street lanes designated for exclusive use by buses, carpools, and vanpools. HDOT operates HOV lanes on several state highways during certain times of the day. HOV lanes currently operate on the H-1 and H-2 Freeways, the Moanalua Road, the H-1 Zipper Lane and Shoulder Express Lane, and Nimitz Highway.

## **Public Transit System**

O'ahu Transit Services, Inc. (OTS) operates the public transit system (TheBus) on the island of O'ahu under contract to the City and County of Honolulu. TheBus system serves more than 80 percent of the developed areas of the island and carries approximately 73 million passengers per year and experiences about 236,600 boardings on an average weekday. Annual transit passenger miles per-capita is higher in Honolulu than in all other major U.S. cities without a fixed guideway transit system.

## **Parking**

Downtown Honolulu parking rates are high; however, many employers subsidize parking for their employees. Daily parking rates are the third-highest in the United States behind New York and Boston, while monthly parking rates are in the top 15 (Colliers, 2005). Downtown parking availability is considered limited, and garages have an average waiting list of three months for monthly parking. Parking availability also is limited in Waikiki and near UH Mānoa.

## **Performance of the Existing Transportation System**

### **Traffic Volumes**

The highest daily traffic volumes occur near Downtown Honolulu. More than 398,000 vehicles cross Nu'uaniu Stream daily on a total of nine roadways. During the a.m. and p.m. peak hours, more than 26,000 vehicles cross Nu'uaniu Stream each hour.

At the facility level, the Interstate Freeway system carries a considerable amount of the island's traffic, with the H-1 being the most heavily traveled freeway on O'ahu. At the Kalauao Stream screenline in Pearl City, approximately 20,000 and 17,000 vehicles currently travel on H-1 (both directions combined) during the a.m. and p.m. peak hours, respectively. Approximately 245,000 vehicles travel through this section of H-1 daily.

### **Traffic Operating Conditions**

The operating conditions of a roadway can be represented by a variety of measures, including the volume-to-capacity (V/C) ratio, operating speeds, and the density of traffic on the facility. These measures can be used to determine level-of-service (LOS). A roadway's V/C ratio compares the volume of traffic traveling on the roadway to the physical capacity of the roadway. Speeds are typically a reflection of the amount of congestion on a roadway or its geometric design characteristics. Traffic density is measured in terms of vehicles per mile per lane and is a function of both volumes and speeds. LOS is a grading scale from A through F for roadway operation; LOS A represents the best condition and LOS F represents more vehicles attempting to use a roadway than the capacity is able to accommodate.

In general, congested conditions (e.g., LOS E or F) occur during the a.m. and p.m. peak

changed their time of travel, resulting in extended peak traffic conditions. Weekday a.m. and p.m. peak traffic conditions generally last three to four hours each. Weekend traffic during the mid-day also resembles weekday peak-period conditions.

Recent traffic counts for the corridor indicate that existing travel conditions are congested during the a.m. peak hour for Koko Head-bound traffic crossing the Kalauao Stream in Pearl City (V/C ratio of 1.06 [LOS F]) and the Kapālama Canal closer to Downtown (V/C 1.04 [LOS F]). These conditions are also indicated by estimated travel speeds along H-1 in the corridor, as shown in Table 1-1. The table indicates that existing speeds between the Waiawa Interchange and Downtown in the general purpose lanes range from 14 to 20 mph (LOS F) and will generally get worse by the year 2030 despite many planned roadway improvements.. The only location where speeds in the corridor on H-1 are predicted to increase in 2030 as compared to today is east of the Middle Street merge, where the addition of a lane is expected to result in an average a.m. peak period speed of 24 mph, which still indicates LOS F at this location.

**Table 1-1. Existing and 2030 No Build Alternative A.M. Peak Period Speeds and Level-of-Service on H-1**

Location	2005		2030	
	Speed (mph)	Level-of-Service <sup>1</sup>	Speed (mph)	Level-of-Service
<b>Waiawa Interchange - Koko Head Bound</b>				
General Purpose Traffic	19	F	12	F
HOV Lane Traffic	24	F	14	F
Zipper Lane Traffic	39	F	37	F
<b>Kalauao Stream - Koko Head Bound</b>				
General Purpose Traffic	20	F	15	F
HOV Lane Traffic	46	E	24	F
Zipper Lane Traffic	37	F	36	F
<b>East of Middle Street Merge - Koko Head Bound</b>				
General Purpose Traffic	14	F	24	F
<b>Liliha Street - Koko Head Bound</b>				
General Purpose Traffic	19	F	12	F
<b>East of Ward Avenue - 'Ewa Bound</b>				
General Purpose Traffic	21	F	18	F
<b>West of University Avenue - 'Ewa Bound</b>				
General Purpose Traffic	36	F	34	F

<sup>1</sup>Level-of-Service is calculated based on vehicle density, a function of traffic volume and speed.

Based on recent traffic counts as well as field observations, the p.m. peak period is also experiencing a high level of congestion in the corridor. Analysis of operations at Kalauao Stream and Kapālama Canal show p.m. peak-hour levels-of-service of E for each; however, H-1 itself is over capacity and operating at LOS F.

### **Transit Operating Conditions**

The public transit system, TheBus, uses the general roadway network described above. The major factors influencing bus operating conditions are the traffic conditions under



which the service operates, passenger loading time, and bus-stop spacing. Honolulu has substantial traffic congestion, high ridership and load factors, and closely spaced bus stops. Combined, these factors result in declining bus operating speeds over recent years, which are not competitive with the private automobile. Between 2002 and 2006, islandwide average bus speeds decreased four percent to 13.4 miles per hour. Because congestion in the study corridor is greater than in other parts of O'ahu, the decrease in ~~average bus speed in the corridor is greater than the islandwide average. To account for~~

As roadways become more congested, they become more susceptible to substantial delays caused by incidents such as traffic accidents or heavy rain. As a result, current transit schedules in the corridor are not reliable. Recent statistics from TheBus indicate that on a systemwide basis 27 percent of all buses were more than five minutes late. During the a.m. peak period, express buses were more than five minutes late 38 percent of the time (OTS, 2006).

Transit speed and reliability with mixed-traffic operations will continue to diminish in the corridor as the number of transit passengers increases and traffic volumes approach roadway capacity on more streets.

## Potential Transit Markets

A comparison of the location and number of new employment opportunities in relation to population growth shows that many workers will still be required to travel to the Primary Urban Center for work (Figure 1-4). Despite the large growth of employment opportunities in the Kapolei area, population is projected to outpace and exceed the available employment in the area. Additionally, there will be a bidirectional flow of traffic throughout the day as more City and County administrative offices move their daily operations to Kapolei and other employment grows in the area. Both of these factors point to increased travel on the transportation system between Kapolei and the Primary Urban Center and represent an important potential future transit market.

Relatively large areas within the corridor are transit-dependent because they contain a large number of zero-car households relative to other parts of O'ahu. Persons living in zero-car households are much more likely to use transit than other residents. These concentrations of zero-car household areas include much of the Primary Urban Center (including the Central Business District, Chinatown, Kaka'ako, Kalihi-Pālana, and Iwilei) and some Waipahu neighborhoods as indicated in Figure 1-5. These areas represent a robust transit market because they already rely on existing transit and are likely to use an improved system.

Finally, although the primary market for the transit corridor improvements are for the residents, the visitor industry and location of visitor attractions within the corridor combine to create a transit market for visitors traveling within the corridor. O'ahu hosts more than 4.4 million visitors annually (DBEDT, 2005). Many of these visitors stay in the Waikīkī area and travel to points of interest outside of Waikīkī, including many of the activity centers in the corridor (Figure 1-2).

## History of the Project

During the summer of 2005, the State legislature recognized the need and public support for a high-capacity transit system on O'ahu and passed Act 247. Act 247 authorized the County to levy a general excise tax surcharge to construct and operate a mass transit project serving O'ahu. The City Council subsequently adopted Ordinance 05-027 to levy a tax surcharge to fund public transportation. With secure local funding established for the first time, the City began the AA process to analyze the feasibility of a high-capacity transit system in the corridor between Kapolei and UH Mānoa. A range of alternatives

was evaluated and screened to select alternatives that would provide the most improvement to person-mobility and travel reliability in the study corridor. FTA published a Notice of Intent to Prepare an AA and an EIS in the *Federal Register* on December 7, 2005, and DTS published an EIS Preparation Notice in the State of Hawai'i *Environmental Notice* on December 8, 2005. The public was asked to comment on the proposed alternatives, the purpose and need for the project, and the range of issues to be evaluated at a series of scoping meetings in December 2005.

## Goals and Objectives

Several project goals were developed to address the transportation needs identified in the

### **Screening and Selection Process**

During the fall of 2005 and winter of 2006, the City and County of Honolulu conducted an alternatives screening that is documented in the *Honolulu High-Capacity Transit Corridor Project Alternatives Screening Memorandum* (DTS, 2006b). The alternatives screening was approached through a top-down analysis completed in five major steps. The first step was to gather input needed for the analysis. The input included the purpose and need for the project, past studies and their recommendations, requirements of the FTA process, adopted community and area plans, and a visual assessment of the entire corridor as it currently exists. The second step used the information gathered to identify a comprehensive list of potential alternatives. The third step included developing screening criteria and undertaking the initial screening of all potential alternatives to identify those that address the needs of the corridor and do not have any “fatal flaws.” Those surviving alternatives were then presented to the public and interested public agencies and officials for comment through a scoping process in the fourth step. Finally, input from the scoping process was collected and analyzed, and refinements were made to the alternatives. Once the evaluations were completed, the modal, technology, and alignment options were matched to create the alternatives that are carried forward into this AA.

### **Alternatives Considered**

Multiple sources were accessed for input to determine the initial options screened. The goal was to screen as broad a range of feasible alternatives as possible to ensure that the best solutions for the corridor would be considered. A long list of alternatives was developed based on these previous studies, a field review of the study corridor, an analysis of current population and employment data for the corridor, and a literature review of modal technologies.

The alternatives considered during screening included a No Build Alternative, a Transportation System Management Alternative, and a number of “build” alternatives. Transit technologies that were examined included conventional bus, guided bus, light rail transit, personal rapid transit, people mover, monorail, magnetic levitation, rapid rail, commuter rail, and waterborne ferry service. Several highway improvements considered during OMPO’s 2030 ORTP planning process also were reviewed for their ability to improve transit capacity and reliability, including a bridge or tunnel crossing of Pearl Harbor to connect ‘Ewa with the PUC and the construction of a two-lane elevated structure from the Waiawa Interchange to Iwilei, which would be used by transit vehicles and potentially carpools and single-occupant vehicles willing to pay a congestion-based toll. In addition, 75 Fixed Guideway alignment options were screened.

### **Alternatives Considered but Rejected**

All of the alternatives considered are detailed in the *Honolulu High-Capacity Transit Corridor Project Alternatives Screening Memorandum* (DTS, 2006b). The following alternatives were eliminated before undertaking this AA.



projects are those programmed in the 2030 O'ahu Regional Transportation Plan prepared by OMPO. The committed highway elements of the No Build Alternative are also included in the build alternatives.

The No Build Alternative's transit component would include an increase in fleet size to accommodate the anticipated growth in population, while allowing service frequencies to remain the same as today. Bus fleet requirements are listed in Table 2-1.

**Table 2-1. Transit Vehicle Requirements**

Alternative	Bus		Fixed Guideway	
	Peak	Fleet	Peak	Fleet
<b>2005 Existing Conditions</b>				
Existing Conditions	409	525	0	0
<b>Alternative 1: 2030 No Build</b>				
No Build Alternative	511	614	0	0
<b>Alternative 2: 2030 Transportation System Management</b>				
TSM Alternative	638	765	0	0
<b>Alternative 3: 2030 Managed Lane</b>				
Two-Direction Option	705	846	0	0
Reversible Option	755	906	0	0
<b>Alternative 4: 2030 Fixed Guideway</b>				
Kalaeloa - Salt Lake - North King - Hotel	441	529	72	90
Kamokila - Airport - Dillingham - King with a Waikīkī Branch	435	525	68	90
Kalaeloa - Airport - Dillingham - Halekauwila	448	540	74	90
20-mile Alignment East Kapolei to Ala Moana Center	497	596	54	70

### **Alternative 2: Transportation System Management**

The Transportation System Management (TSM) Alternative would provide an enhanced bus system based on a hub-and-spoke route network, conversion of the present a.m. peak-hour-only zipper-lane to both a morning and afternoon peak-hour zipper-lane operation, and relatively low-cost capital improvements on selected roadway facilities to give priority to buses. Bus fleet requirements are listed in Table 2-1. The TSM Alternative includes the same committed highway projects as assumed for the No Build Alternative.

### **Alternative 3: Managed Lane**

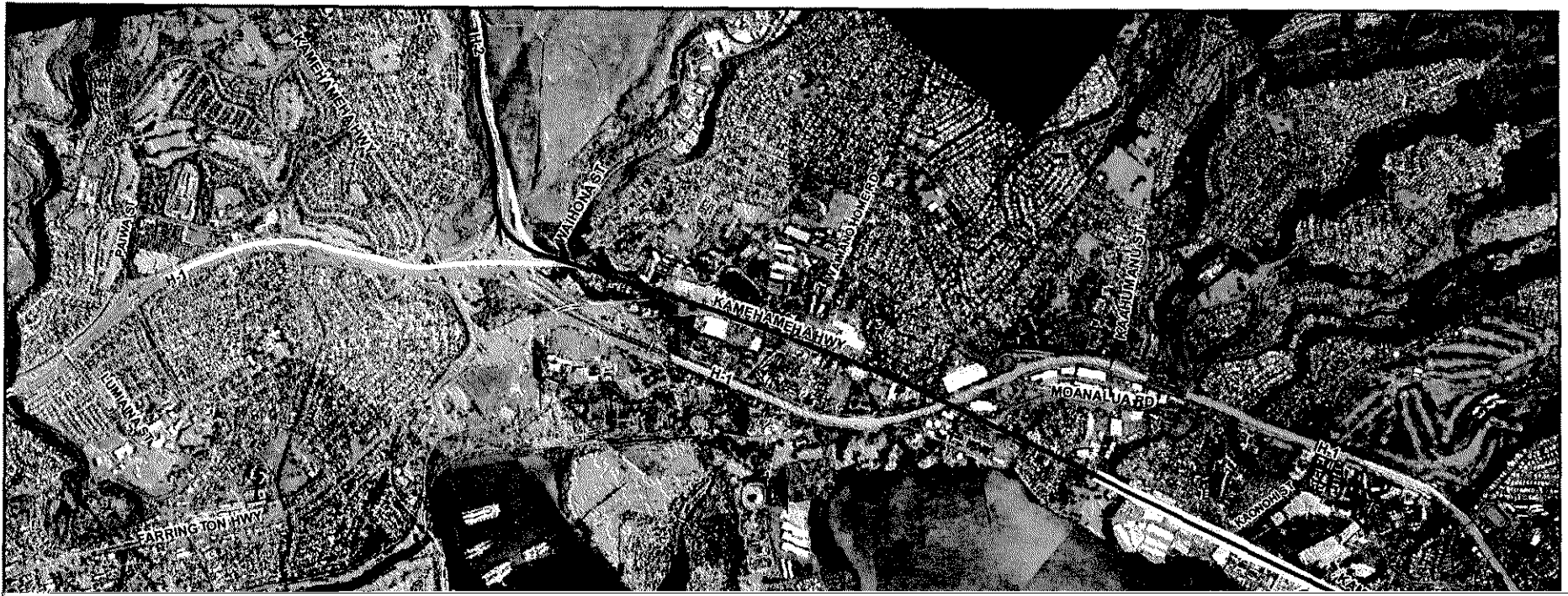
The Managed Lane Alternative would include construction of a two-lane, grade-separated facility between Waipahu and Downtown Honolulu (Figure 2-1 and Figure 2-2) for use by buses, paratransit vehicles, and vanpool vehicles. The managed lane facility would integrate with HDOT's proposed Nimitz Flyover project that is included in the 2030 O'ahu Regional Transportation Plan (OMPO, 2006a). HOV and toll-paying, single-occupant vehicles also would be allowed to use the facility provided that sufficient capacity would be available to maintain free-flow speeds for buses and the above-noted paratransit and vanpool vehicles. Variable pricing strategies for single-occupant vehicles would be implemented to maintain free-flow speeds for transit and HOVs. Two design

and operational variations of the Managed Lane Alternative are evaluated: a Two-direction Option (one lane in each direction) and a two-lane Reversible Option. For both options, access to the facility in West O'ahu would be via ramps from the H-1 and H-2 Freeways just prior to the Waiawa Interchange. Both options would require modification to the Nimitz Flyover project's design and would terminate with ramps tying into Nimitz Highway at Pacific Street. The H-1 zipper lane would be maintained in the Two-direction Option but discontinued in the Reversible Option.

An intermediate bus access point would be provided in the vicinity of Aloha Stadium. Bus service using the managed lane facility would be restructured and enhanced, providing additional service between Kapolei and other points 'Ewa of the Primary Urban Center, and Downtown Honolulu and UH Mānoa.

### **Characteristics of the Managed Lane Alternative**

The Two-direction Option would serve express buses operating in both directions during the entire day. The Reversible Option would serve peak-direction bus service, while reverse-direction service would use H-1. Twenty-nine bus routes, with approximately 93 buses per hour, would use the managed lane facility during peak hours for either option. One limited-stop route and one local route would continually operate in the managed lane. A total of 27 peak-period express routes would operate in the peak direction using the managed lane facility. Of these, three are new express routes serving developing areas and nine are new routes developed for exclusive use of the managed lane. The nine new managed lane express bus system routes originate from Kalaeloa, Kapolei, or Central O'ahu and terminate at the Alana'i Transit Center, Waikīkī, or UH Mānoa. Other







**Alternative 4: Fixed Guideway Alternative**








The Fixed Guideway Alternative would include the construction and operation of a fixed

Boulevard to Nimitz Highway/Halekauwila Street/Kapi'olani Boulevard.

**Table 2-2. Fixed Guideway Alternative Analysis Sections and Alignments**

Section	Alignments Being Considered	Number of Stations
I. Kapolei to Fort Weaver Road	Kamokila Boulevard/Farrington Highway	5
	Kapolei Parkway/North-South Road	6
	Saratoga Avenue/North-South Road	9
	Geiger Road/Fort Weaver Road	7
II. Fort Weaver Road to Aloha Stadium	Farrington Highway/Kamehameha Highway	5
III. Aloha Stadium to Middle Street	Salt Lake Boulevard	2
	Mauka of the Airport Viaduct	3
	Makai of the Airport Viaduct	4
	Aolele Street	4
IV. Middle Street to	North King Street	3

**LEGEND**

-  Station Locations
-  Potential Park & Ride
-  Potential Maintenance & Storage Facility  
(Only one site to be selected)
-  Kamokila Blvd/Farrington Hwy
-  Kapolei Parkway/North South Road
-  Saratoga Ave/North-South Road
-  Geiger Rd/ Fort Weaver Road

0 1,000 2,000 4,000 Feet



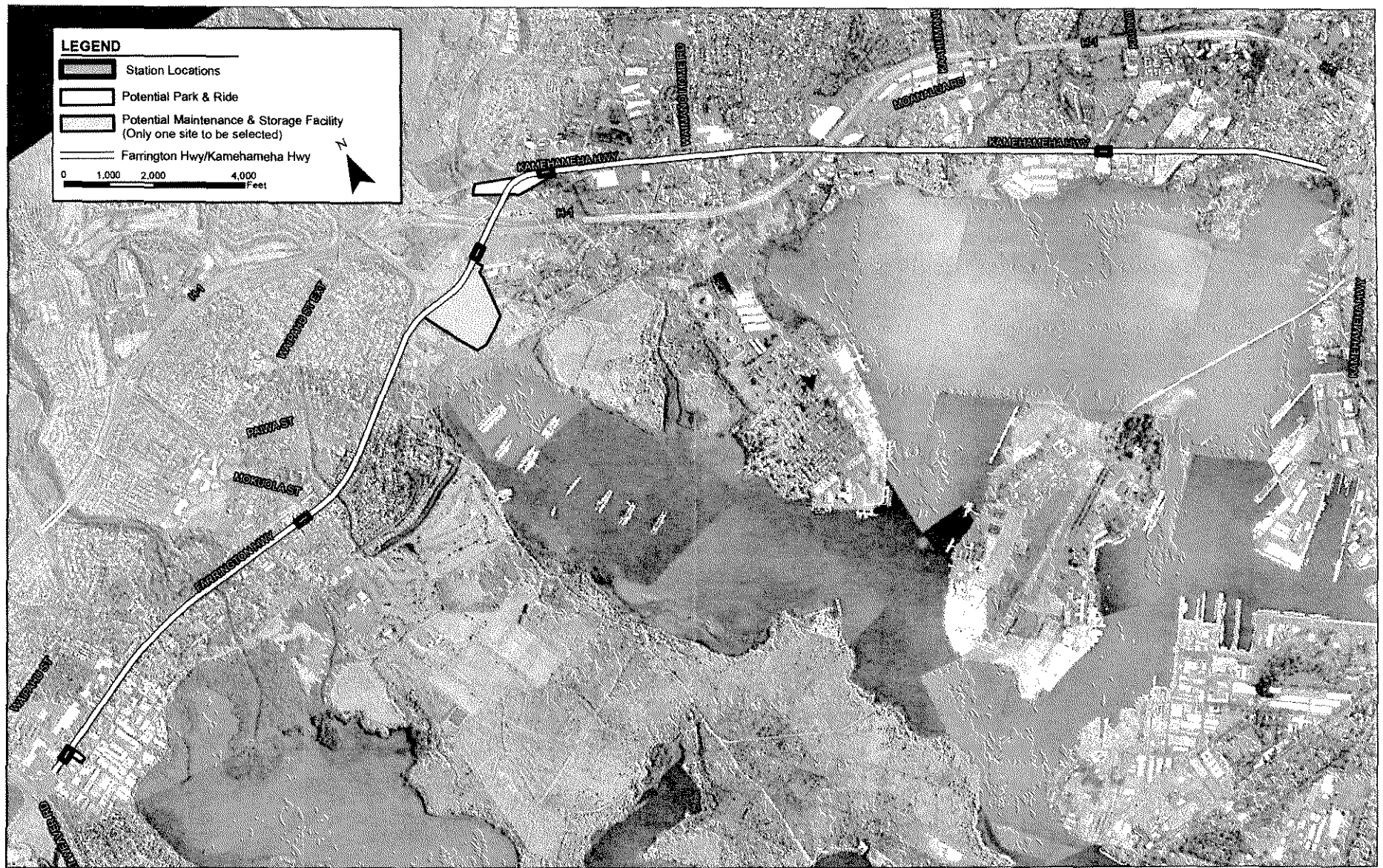
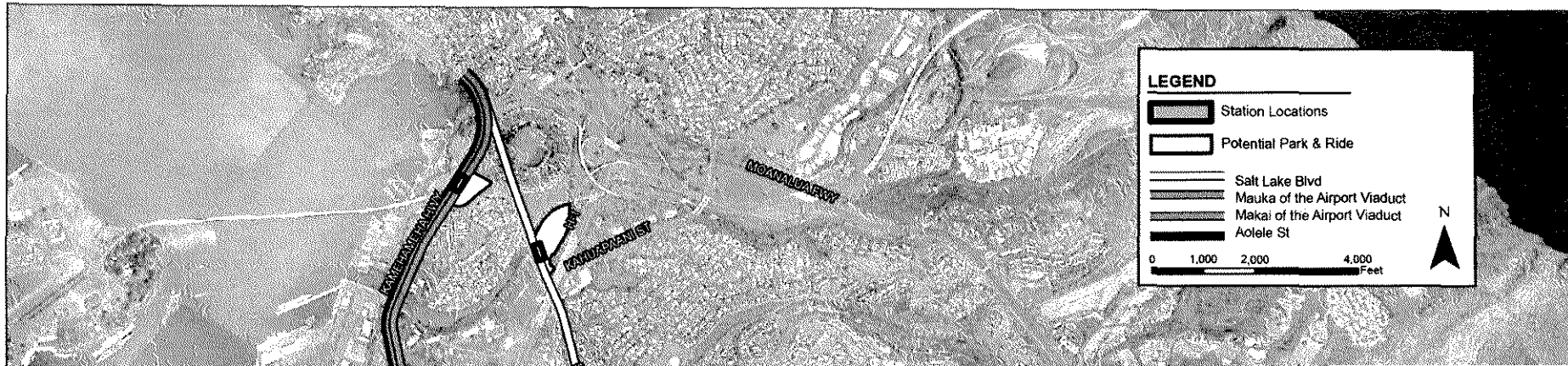
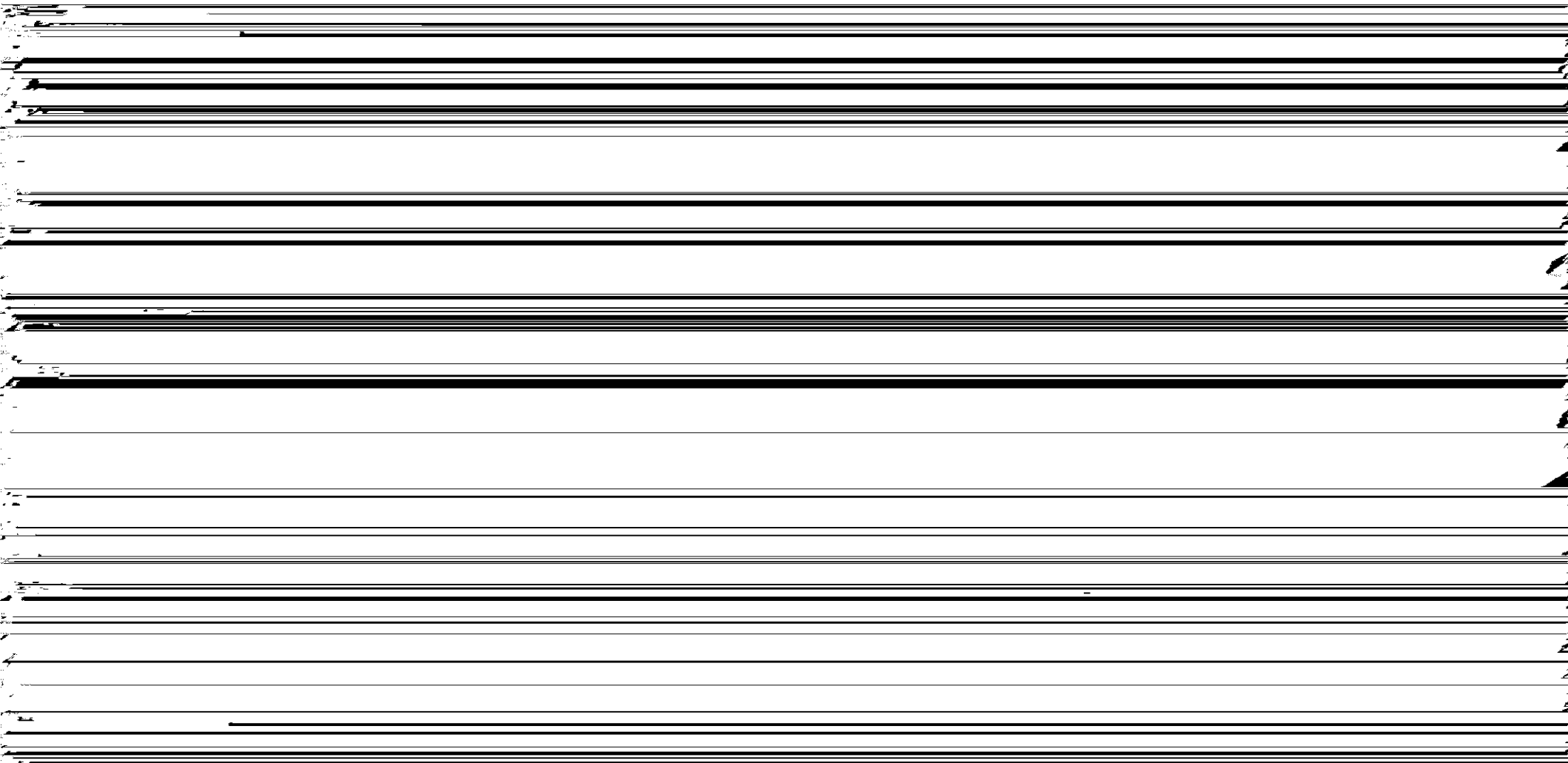
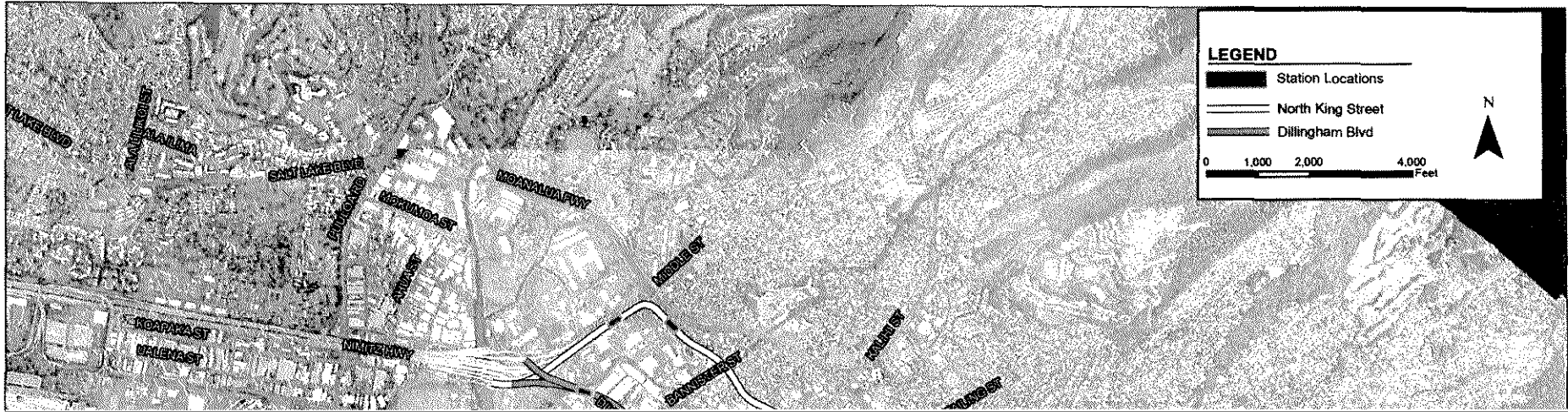
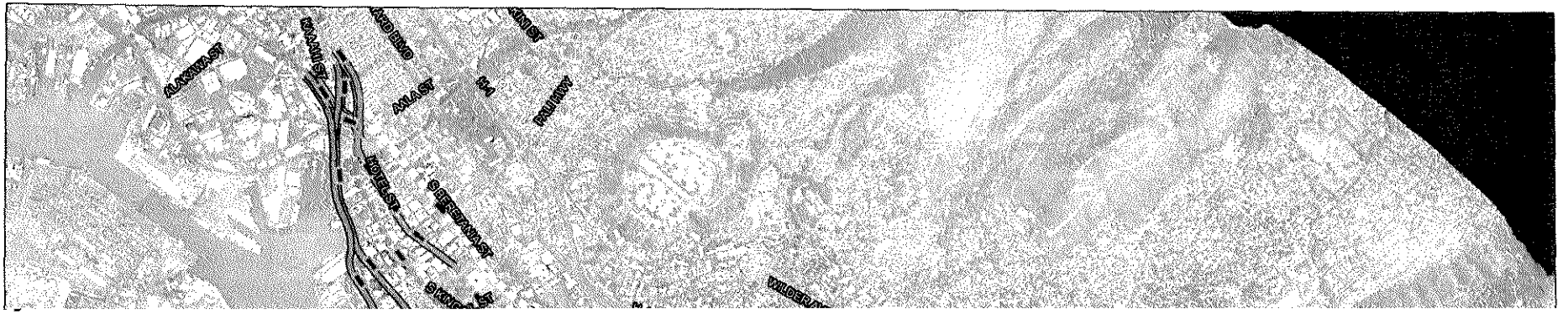


Figure 2-4. Fixed Guideway Alternative Section II











**Table 2-3. Fixed Guideway Alternative Operating Assumptions**

Time of Day <sup>1</sup>	System Headway <sup>2</sup>
4 a.m. to 6 a.m.	6 minutes
6 a.m. to 9 a.m.	3 minutes
9 a.m. to 3 p.m.	6 minutes
3 p.m. to 6 p.m.	3 minutes
6 p.m. to 8 p.m.	6 minutes
8 p.m. to 12 a.m.	10 minutes

<sup>1</sup>System is closed from 12 a.m. to 4 a.m.

<sup>2</sup>With Waikiki Branch, branch-line headway to Waikiki and UH Mānoa would be twice that of the main line.

A vehicle loading standard of one standee per 2.7 square feet of floor space has been used. The system is planned to operate with multicar or articulated trains approximately 175 to 200 feet in length, with each train able to carry a minimum of 300 passengers. This would provide a peak capacity of at least 6,000 passengers per hour per direction. The number of vehicles required to provide this service is listed in Table 2-1, assuming two vehicles per train. With the exception of the Hotel Street alignment, the system would be expandable to longer trains of up to 300 feet in the future to increase capacity by 50 percent. Also, the system could be operated with shorter headways to increase peak capacity.

### **Optimum Fixed Guideway Alignment**

Each of the Fixed Guideway alignment options discussed above is evaluated in the following chapters of this report in relation to transportation benefits, environmental and social consequences, and costs. The findings within each of these topics are synthesized at the beginning of Chapter 6 (Comparison of Alternatives) to determine the optimal combination of alignments. The comparison results in an optimal alignment of Saratoga Avenue/North-South Road to Farrington Highway/Kamehameha Highway to Aolele Street to Dillingham Boulevard to Nimitz Highway/Halekauwila Street/Kapi'olani Boulevard, which is the Kalaeloa - Airport - Dillingham - Halekauwila combination Figure 2-8.

### **Twenty-mile Alignment**

To provide an alternative with lower cost than the Full-corridor Alignments, a 20-mile Alignment was identified for evaluation. The 20-mile Alignment provides a substantial benefit to users with a lower capital cost.

Several portions of the corridor could be selected within the range of sections and alignments considered for the Fixed Guideway Alternative; however, the optimum shortened alignment should be able to provide substantial benefit to transit users independent of the remainder of the system under long-range consideration. As indicated by the financial analysis presented in Chapter 5, there is a substantial level of uncertainty in development of a fixed guideway system for the entire length of the study corridor (Kapolei to UH Mānoa) with known available funds from tax sources, combined with a

reasonable projection of Federal funds. With this in mind, the following items were considered in defining possible shortened alignments from the alignments considered for the entire length of the study corridor.

- The alignment must, at minimum, reach Downtown Honolulu
- The alignment should serve as much of the study corridor as practical
- The alignment selected in each section should provide the greatest user benefit while considering the cost of the alignment.

The 20-mile Alignment evaluated in Chapter 6 (Comparison of Alternatives) could be constructed and operated within the funding assumptions that are established in Chapter 5. When the additional future funding sources become more certain over the course of project development, the 20-mile Alignment could be modified to accommodate the changed condition. The 20-mile Alignment includes the portion of the Optimum Fixed Guideway Alignment discussed above that would begin makai of UH West O'ahu and continue to Ala Moana Center. In its entirety, the 20-mile Alignment would begin at one station Wai'anae of UH West O'ahu near Kapolei Parkway and North-South Road. The alignment would include a design variation to serve UH West O'ahu and cross D.R. Horton land to Farrington Highway then continue Koko Head following Kamehameha Highway to Aolele Street and Dillingham Boulevard, and then continue elevated following Nimitz Highway and Halekauwila Street to Ala Moana Center (Figure 2-9).

## **Costs of the Alternatives**

The costs for each alternative are detailed in Chapter 5. They are summarized in this section to provide a comparison among the alternatives.

### **Capital Costs**

Capital costs for the No Build and TSM Alternatives would be \$660 and \$856 million, respectively, which accounts for bus replacement and system expansion. Total capital costs for the Managed Lane Alternative would range between \$3.6 and \$4.7 billion, of which \$2.6 to \$3.8 billion would be for construction of the managed lanes. Capital costs for the Fixed Guideway Alternative, including bus system costs, would range between \$5.2 and \$6.1 billion for the Full-corridor Alignments, of which \$4.6 to \$5.5 billion would be for the fixed guideway system. The costs would be \$4.2 billion for the 20-mile Alignment, of which \$3.6 billion would be for the fixed guideway system.

### **Operating and Maintenance Costs**

Operating costs in 2030 for the No Build Alternative, in 2006 dollars, would be approximately \$192 million. Operating costs for the TSM Alternative would be approximately \$42 million greater than for the No Build Alternative. Transit operating costs for the Managed Lane Alternative would range between approximately \$251 and \$261 million as a result of additional buses that would be put in service under that alternative. These costs do not include the cost of maintaining the managed lane facility. The total operating costs for the Fixed Guideway Alternative, including the bus and fixed guideway, would range between approximately \$248 and \$256 million.

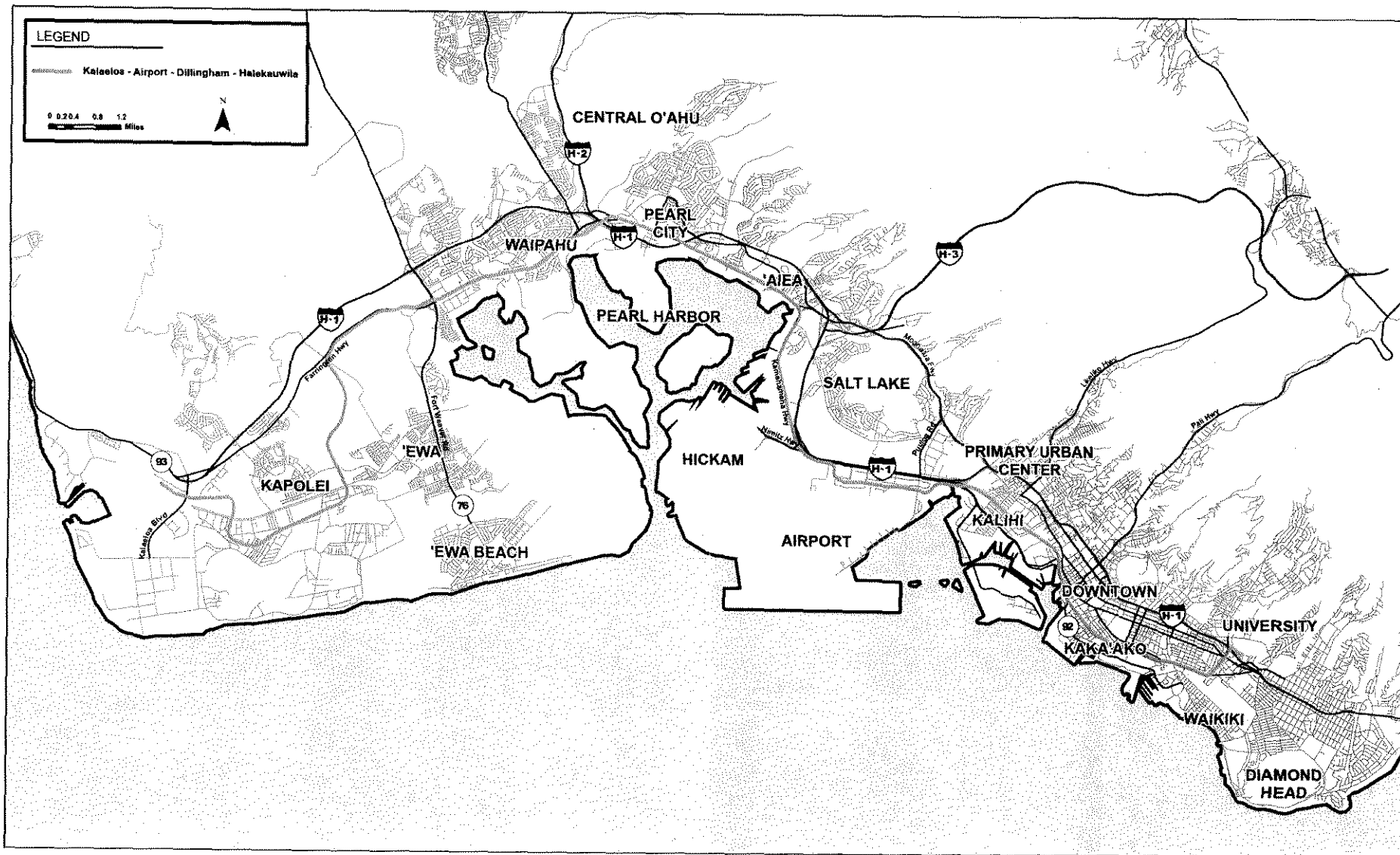
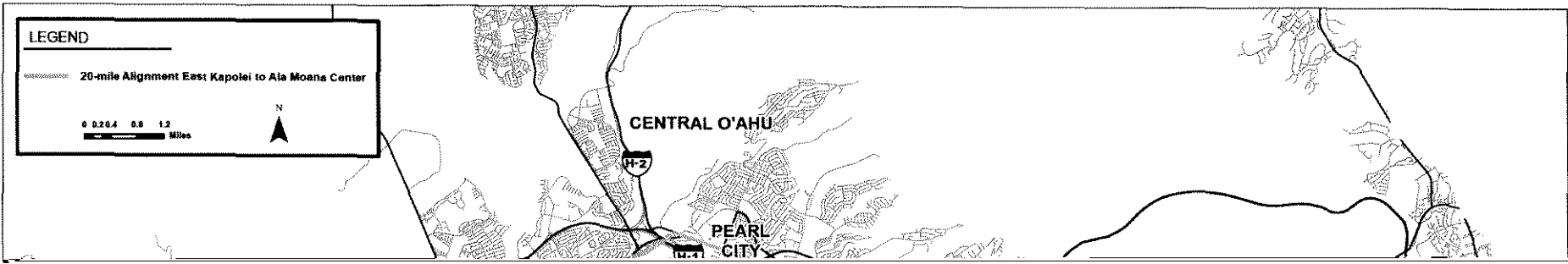


Figure 2-8. Kalaheo - Airport - Dillingham - Halekauwila Combination (Twenty-eight-mile Alignment)



## Schedule

Projects developed through the FTA New Starts process progress through many stages from system planning to operation of the project. The Honolulu High-Capacity Transit Corridor Project is currently in the Alternatives Analysis phase, which includes defining and evaluating specific alternatives to address the purpose of and needs for the project discussed in Chapter 1. The anticipated project development schedule for completion of the 20-mile Alignment is shown in Figure 2-10.

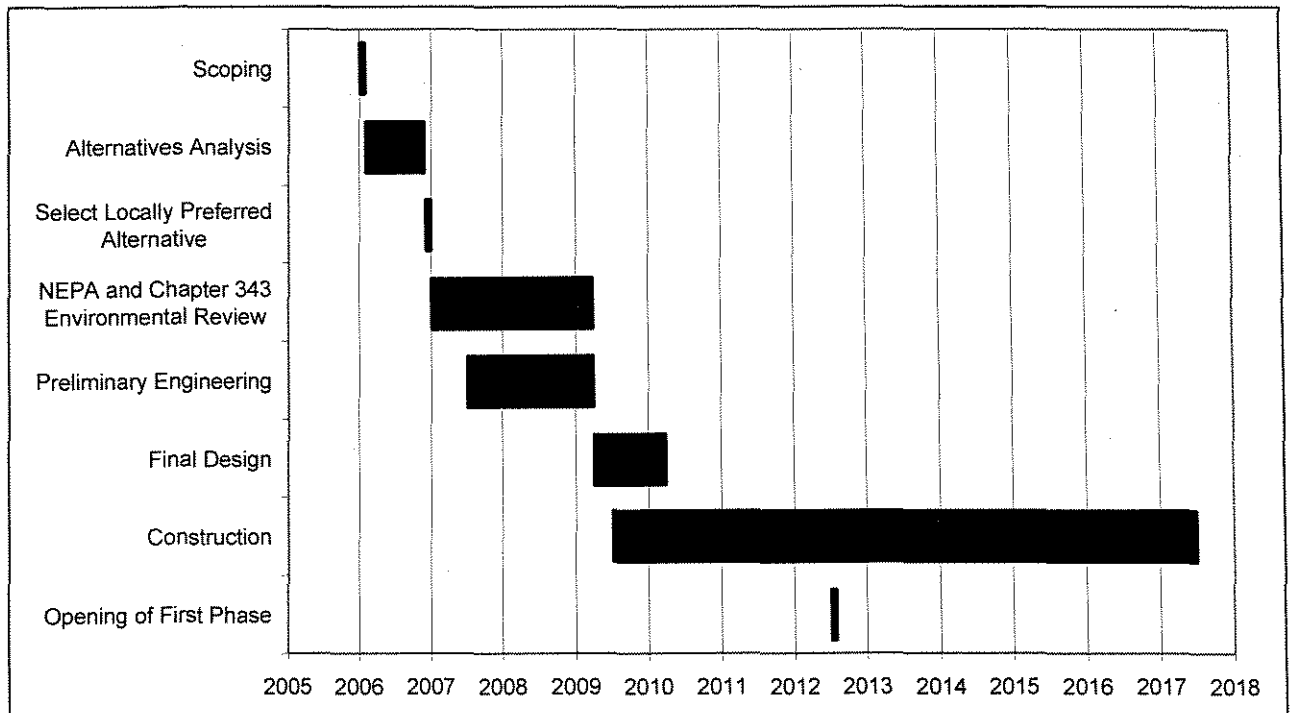


Figure 2-10. Project Schedule



## **Chapter 3      Transportation Benefits and Impacts**

This chapter discusses, for each of the alternatives, the 2030 transportation system conditions; the service characteristics; performance; and transportation impacts. The chapter first presents the projected future travel demand patterns in comparison with



**Table 3-1. Year 2030 Daily Compared to Existing Daily Trips by Transportation Analysis Area, All Modes**

Transportation Analysis Area	2005 Daily Trips, All Purposes				2030 Daily Trips, All Purposes					
	Origin		Destination		Origin			Destination		
	Trips <sup>1</sup>	% of Total	Trips <sup>1</sup>	% of Total	Trips <sup>1</sup>	% of Total	Change from 2005	Trips <sup>1</sup>	% of Total	Change from 2005
1* Downtown	97,000	3.6	224,000	8.3	138,000	4.0	41,000	255,000	7.4	31,000
2* Kaka'ako	60,000	2.2	125,000	4.6	142,000	4.1	82,000	166,000	4.8	41,000
3* Punchbowl-Sheridan-Date	156,000	5.8	184,000	6.8	200,000	5.8	44,000	229,000	6.7	45,000
4* Waikīkī	87,000	3.2	143,000	5.3	100,000	2.9	13,000	160,000	4.7	17,000
5* Kāhala-Pālolo	167,000	6.2	146,000	5.4	182,000	5.3	15,000	172,000	5.0	26,000
6* Pauoa-Kalihi	158,000	5.9	113,000	4.2	171,000	5.0	13,000	136,000	4.0	23,000
7* Iwilei-Māpunapuna-Airport	108,000	4.0	195,000	7.2	126,000	3.7	18,000	216,000	6.3	21,000
8* Hickam-Pearl Harbor	65,000	2.4	155,000	5.7	69,000	2.0	4,000	168,000	4.9	13,000
9* Moanalua-Hālawa	168,000	6.2	211,000	7.8	173,000	5.0	5,000	231,000	6.7	20,000
10* 'Aiea-Pearl City	237,000	8.8	180,000	6.7	257,000	7.5	20,000	232,000	6.7	52,000
11* Honouliuli-'Ewa Beach	119,000	4.4	57,000	2.1	236,000	6.9	117,000	106,000	3.1	49,000
12* Kapolei-Ko 'Olina-Kalaeloa	50,000	1.9	72,000	2.7	210,000	6.1	160,000	252,000	7.3	180,000
13* Makakilo-Makaīwa	35,000	1.3	11,000	0.4	60,000	1.8	25,000	19,000	0.6	8,000
14* Waipahu-Waikele-Kunia	143,000	5.3	110,000	4.1	171,000	5.0	28,000	156,000	4.5	46,000
15* Waiawa-Koa Ridge	36,000	1.3	27,000	1.0	113,000	3.3	77,000	71,000	2.1	44,000
16 Mililani-Melemanu-Kīpapa Wahiawā-Whitmore-	150,000	5.6	88,000	3.3	162,000	4.7	12,000	110,000	3.2	22,000
17 Schofield	95,000	3.5	100,000	3.7	100,000	2.9	5,000	114,000	3.3	14,000
18 East Honolulu	131,000	4.9	60,000	2.2	139,000	4.0	8,000	67,000	2.0	7,000
19 Kāne'ohe-Kahalu'u-Kualoa	145,000	5.4	91,000	3.4	150,000	4.4	5,000	101,000	2.9	10,000
20 Kailua-Mokapu-Waimānalo	165,000	6.1	134,000	5.0	169,000	4.9	4,000	146,000	4.3	12,000
21 Ko'olauloa	36,000	1.3	37,000	1.4	43,000	1.3	7,000	45,000	1.3	8,000
22 North Shore	49,000	1.8	31,000	1.1	55,000	1.6	6,000	35,000	1.0	4,000
23 Wai'anae Coast	98,000	3.6	66,000	2.4	118,000	3.4	20,000	83,000	2.4	17,000
24* Mānoa-Tantalus	117,000	4.3	66,000	2.4	129,000	3.8	12,000	83,000	2.4	17,000
25* University	23,000	0.9	73,000	2.7	25,000	0.7	2,000	82,000	2.4	9,000
<b>Total<sup>2</sup></b>	<b>2,698,000</b>	<b>100</b>	<b>2,698,000</b>	<b>100</b>	<b>3,436,100</b>	<b>100</b>	<b>738,100</b>	<b>3,436,100</b>	<b>100</b>	<b>738,100</b>

\*Transportation Analysis Area is within the Study Corridor.

<sup>1</sup>Values include resident trips only.

<sup>2</sup>Values may not add exactly to the total because of rounding.

**Table 3-2. Year 2030 Compared to Existing Peak-Period Work Trips by Transportation Analysis Area, All Modes**

Transportation Analysis Area	2005 Peak-Period Home-Based Work Trips				2030 Peak-Period Home-Based Work Trips					
	Origin		Destination		Origin			Destination		
	Trips <sup>1</sup>	% of Total	Trips <sup>1</sup>	% of Total	Trips <sup>1</sup>	% of Total	Change from 2005	Trips <sup>1</sup>	% of Total	Change from 2005
1* Downtown	10,000	1.9	69,000	13.2	17,000	2.7	7,000	76,000	12.0	7,000
2* Kaka'ako	6,000	1.1	28,000	5.4	24,000	3.8	18,000	34,000	5.3	6,000
3* Punchbowl-Sheridan-Date	28,000	5.4	38,000	7.3	35,000	5.5	7,000	45,000	7.1	7,000
4* Waikīkī	16,000	3.1	47,000	9.0	17,000	2.7	1,000	51,000	8.1	4,000
5* Kāhala-Pālolo	34,000	6.5	19,000	3.6	34,000	5.4	0	22,000	3.5	3,000
6* Pauoa-Kalihi	34,000	6.5	17,000	3.3	35,000	5.5	1,000	19,000	3.0	2,000
7* Iwilei-Māpunapuna-Airport	13,000	2.5	38,000	7.3	15,000	2.4	2,000	42,000	6.7	4,000
8* Hickam-Pearl Harbor	5,000	1.0	39,000	7.5	5,000	0.8	0	42,000	6.7	3,000
9* Moanalua-Hālawā	29,000	5.5	43,000	8.2	27,000	4.3	-2,000	45,000	7.1	2,000
10* 'Aiea-Pearl City	48,000	9.2	23,000	4.4	47,000	7.4	-1,000	30,000	4.7	7,000
11* Honouliuli-'Ewa Beach	28,000	5.4	7,000	1.3	52,000	8.2	24,000	14,000	2.1	7,000
12* Kapolei-Ko 'Olina-Kalaehoa	8,000	1.5	16,000	3.1	34,000	5.4	26,000	48,000	7.7	32,000
13* Makakilo-Makaīwa	9,000	1.7	1,000	0.2	14,000	2.2	5,000	3,000	0.5	2,000
14* Waipahu-Waikele-Kunia	28,000	5.4	13,000	2.5	31,000	4.9	3,000	21,000	3.3	8,000
15* Waiawa-Koa Ridge	8,000	1.5	6,000	1.1	24,000	3.8	16,000	13,000	2.1	7,000
16 Mililani-Melemanu-Kīpapa	33,000	6.3	11,000	2.1	33,000	5.2	0	14,000	2.2	3,000
17 Wahiawā-Whitmore-Schofield	18,000	3.4	24,000	4.6	17,000	2.8	-1,000	26,000	4.0	2,000
18 East Honolulu	32,000	6.1	7,000	1.3	32,000	5.0	0	7,000	1.1	0
19 Kāne'ohe-Kahalu'u-Kualoa	32,000	6.1	12,000	2.3	32,000	5.0	0	13,000	2.0	1,000
20 Kailua-Mokapu-Waimānalo	34,000	6.5	25,000	4.8	33,000	5.1	-1,000	26,000	4.1	1,000
21 Ko'olaupoko	7,000	1.3	6,000	1.1	8,000	1.2	1,000	6,000	1.0	0
22 North Shore	11,000	2.1	4,000	0.8	11,000	1.8	0	4,000	0.7	0
23 Wai'anae Coast	21,000	4.0	8,000	1.5	24,000	3.8	3,000	9,000	1.4	1,000
24* Mānoa-Tantalus	29,000	5.5	7,000	1.3	30,000	4.8	1,000	9,000	1.5	2,000
25* University	2,000	0.4	13,000	2.5	2,000	0.3	0	14,000	2.2	1,000
<b>Total<sup>2</sup></b>	<b>523,000</b>	<b>100</b>	<b>523,000</b>	<b>100</b>	<b>632,200</b>	<b>100</b>	<b>109,200</b>	<b>632,200</b>	<b>100</b>	<b>109,200</b>

\* Transportation Analysis Area is within the Study Corridor.

<sup>1</sup>Values include resident trips only.

<sup>2</sup>Values may not add exactly to the total because of rounding.

The home-based work data illustrate patterns similar to daily trips and provides additional evidence of increasing employment opportunities outside the Primary Urban Center with a shift to the Leeward areas. Honouliuli-'Ewa Beach and Kapolei-Ko 'Olina-Kalaeloa are projected to post the largest increases in origin trips, and Kapolei-Ko 'Olina-Kalaeloa the largest increase in destination trips. The Downtown area remains the single highest destination for peak-period home-based work trips.

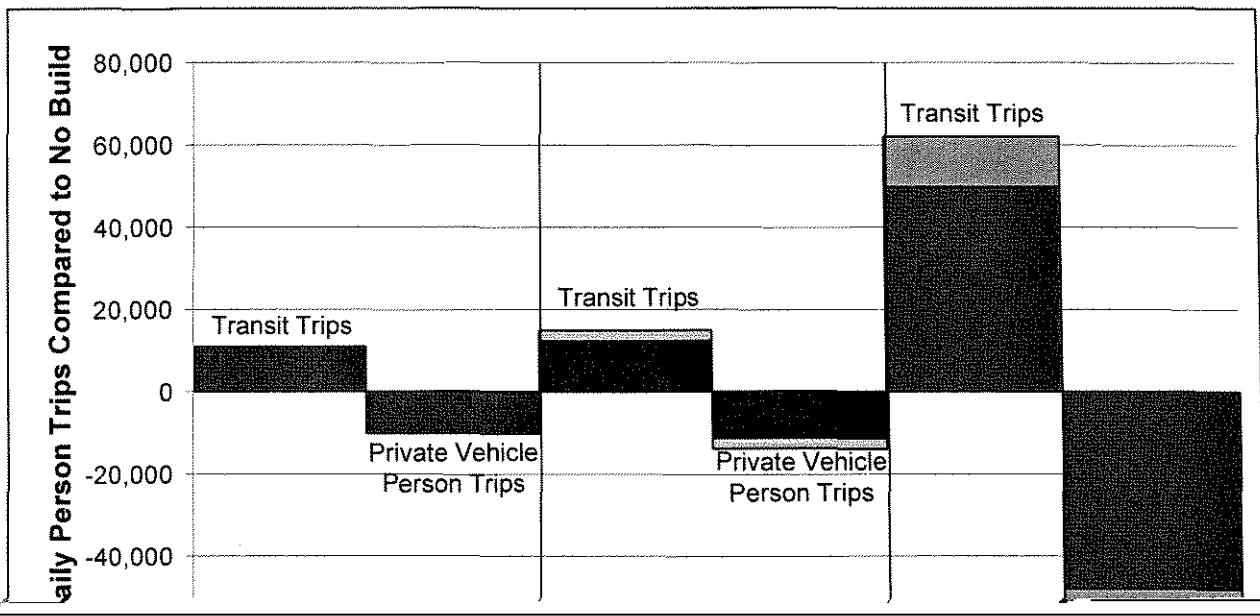
### Systemwide Travel by Mode

Figure 3-1 compares the alternatives estimated average weekday trips by mode to the No Build Alternative for year 2030. Table 3-4 shows the estimated transit mode share of home-based work trips. These trips are typically more representative of peak travel periods. The following sub-sections discuss the results for each alternative. Figure 3-1 compares the changes from the No Build Alternative in daily transit trips and private vehicle trips for the TSM, Managed Lane, and Fixed Guideway Alternatives.

**Table 3-3. Total Daily Person Trips by Mode**

Alternative	Transit Trips	Vehicle Trips	Bicycle/Walk Trips	Total Trips <sup>1</sup>
<b>2005 Existing Conditions</b>				
Existing Conditions	178,400	2,370,000	450,100	2,998,500
% Mode Share	5.9%	79.0%	15.0%	100%
<b>Alternative 1: 2030 No Build</b>				
No Build Alternative	232,100	3,022,100	547,300	3,801,500
% Mode Share	6.1%	79.5%	14.4%	100%
<b>Alternative 2: 2030 Transportation System Management</b>				
TSM Alternative	243,100	3,011,900	546,600	3,801,600
% Mode Share	6.4%	79.2%	14.4%	100%
<b>Alternative 3: 2030 Managed Lane</b>				
Two-direction Option	247,000	3,008,200	546,500	3,801,700
% Mode Share	6.5%	79.1%	14.4%	100%
Reversible Option	244,400	3,010,700	546,700	3,801,800
% Mode Share	6.4%	79.2%	14.4%	100%
<b>Alternative 4: 2030 Fixed Guideway</b>				
Kalaeloa - Salt Lake - North King - Hotel	293,600	2,962,100	546,300	3,802,000
% Mode Share	7.7%	77.9%	14.4%	100%
Kamokila - Airport - Dillingham - King with a Waikiki Branch	287,800	2,968,700	546,500	3,803,000
% Mode Share	7.6%	78.1%	14.4%	100%
Kalaeloa - Airport - Dillingham - Halekauwila	294,100	2,962,500	546,000	3,802,600
% Mode Share	7.7%	77.9%	14.4%	100%
20-mile Alignment East Kapolei to Ala Moana Center	281,900	2,974,100	546,200	3,802,200
% Mode Share	7.4%	78.2%	14.4%	100%

<sup>1</sup>Includes resident transit trips, visitor transit, resident vehicle, and non-motorized trips.



### **Alternative 1: No Build**

As compared to year 2005, total systemwide daily person trips are projected to increase by about 27 percent for the No Build Alternative in 2030, keeping pace with the projected growth in population between 2005 and 2030. Transit mode share for total daily trips as well as home-based work trips (Table 3-4) is expected to increase slightly over the current mode share. The enhancement of the HOV and zipper-lane systems provides some additional benefits, and hence, attractiveness, to the transit mode.

### **Alternative 2: Transportation System Management (TSM)**

As shown in Table 3-3 and Table 3-4, the TSM Alternative, as a result of its enhanced bus service, results in a slightly higher transit mode share, at 6.4 percent (daily trips) and 12.1% (home-based work trips), than the No Build Alternative. Private vehicle trips and non-motorized trips are projected to decrease slightly in comparison to the No Build Alternative as more people are attracted to transit (Figure 3-1).

### **Alternative 3: Managed Lane**

Both Managed Lane Alternative options, as shown in Table 3-3 and Table 3-4, are expected to result in a slightly higher transit mode share for daily trips (6.4 to 6.5 percent) as well as for home-based work trips (12.3 to 12.6 percent) than either the No Build or TSM Alternatives. The projected increase in transit trips and decrease in private vehicle trips is similar to that of the TSM Alternative (Figure 3-1).

### **Alternative 4: Fixed Guideway**

All of the Fixed Guideway Alternative options are expected to experience significantly higher systemwide daily transit ridership and mode share in comparison with all of the other alternatives, as shown in Table 3-3. The three alignment combination options are expected to result in transit mode shares of 7.6 to 7.7 percent for daily trips and up to 16.2% for home-based work trips (Table 3-4). The Fixed Guideway options also see an increase in total daily transit trips over the No Build Alternative by 55,700 to 62,000 trips (Figure 3-1). The vast majority of these trips are drawn away from the highway mode as automobile travel is expected to decrease by 53,400 to 60,000 trips. Of the three combination options, the Kalaeloa - Airport - Dillingham - Halekauwila combination is projected to experience the highest transit ridership with 294,100 trips. The 20-mile Alignment is expected to result in a transit mode share of 7.4 percent and an increase over the No Build Alternative of more than 46,000 transit trips (Figure 3-1). The transit mode share for home-based work trips for the 20-mile Alignment, 15.2 percent, is comparable with those of the Full-corridor Alignments. Similar to the Full-corridor Alignments, the bulk of these trips are expected to be drawn from the highway mode as automobile travel is projected to decrease by 44,600 trips in comparison to the No Build Alternative, by 33,000 as compared to the TSM Alternative, and by 28,000 to 29,000 trips as compared to the Managed Lane Alternative options.

## Transit

This section presents data for transit performance for each alternative. Characteristics of transit service, transit ridership, and user benefits have been identified as the major performance indicators of transit.

### *Transit Service*

#### **Description of Service Plan**

Significant characteristics of the proposed bus transit service plan for each of the alternatives are discussed in this section. Table 2.1 compares bus fleet size requirements

for the proposed plans for each of the alternatives with year 2005 requirements.

#### ***Alternative 1: No Build***

In anticipation of increased roadway congestion and slower overall bus transit speeds, the No Build Alternative's transit component would include an increase in fleet size to allow service frequencies to remain close to what they are today. It would also include new bus

- Ka Uka Road/H-2 - 1,000 parking stalls
- Aloha Stadium - 1,300 parking stalls.

The park-and-ride facilities would be located to intercept vehicles prior to the major choke points of the freeway system, such as occurs at the Waiawa Interchange of H-1

with H-2. The location for Central O'ahu residents would be near Ka Uka Boulevard and H-2. Residents would drive to the park-and-ride facility to access buses for their trip to town. Buses during the peak travel period would depart approximately every five minutes.

Wai'anae Coast and West Kapolei residents would be able to use the Kapolei Parkway and Hanua Street park-and-ride facility.

### *Alternative 3: Managed Lane*

The bus network would be structured to support access to the managed lane via bus transfers at park-and-ride locations as well as by the addition of express bus routes using the Managed Lane viaduct. The two design variations for the Managed Lane Alternative offer a limited number of access points in order to maintain free-flowing lane operations. Bus operations for the managed lane facility would be staged from park-and-ride facilities to serve Central and Leeward O'ahu residents. As in the TSM Alternative, new park-and-ride lots would be located at the following sites:

- Kapolei Parkway/Hanua Street - 1,200 parking stalls
- UH West O'ahu off of North-South Road - 1,700 parking stalls
- Ka Uka Road/H-2 - 1,000 parking stalls
- Aloha Stadium - 1,300 parking stalls.

The park-and-ride planned at the intermediate access point at Aloha Stadium would be within the stadium's parking lot adjacent to the managed lane's on- and off-ramps. The lot would be integrated with the managed lane access ramps so transit riders could access the bus system via this intermediate access point.

The enhanced bus system would include an increase in fleet size (Table 2-1). Based on the redesigned bus network for the Managed Lane Alternative, it is estimated that 321 new buses beyond the existing fleet would need to be added for the two-direction Managed Lane facility and 381 new buses would need to be added for the reversible Managed Lane facility to provide a sufficient fleet to perform operations as planned. These additional buses would create a fleet size of 846 buses for the two-direction facility and 906 buses for the reversible facility. In addition, the normal schedule of bus replacement every 12 years would be executed.

All supporting maintenance facilities and services included in the TSM Alternative are also included in the Managed Lane Alternative. In addition, the Managed Lane Alternative includes additional express bus services dedicated to utilize the managed lane.

*Alternative 4: Fixed Guideway*

Multiple alignment options through most sections of the corridor were analyzed for the Fixed Guideway Alternative. As a result of these analyses, three Full-corridor Alignment combinations were selected for thorough analysis and presentation in this report along with

with one 20-mile Alignment option.

Most of the changes to the transit network for the Fixed Guideway Alternative result from adjustments to provide access to the fixed guideway stations. The fixed guideway system allows many of the existing and planned future express long-haul routes to be shortened or rerouted where the fixed guideway provides improved service. Local buses and community circulators would provide increased service frequency and would include stops at nearby fixed guideway stations to provide access to the fixed guideway system. The reduced requirement for long-haul express buses and the increased frequency of the local and community circulator buses create a large improvement in the overall performance of the bus transit network while not requiring a significant number of new



within the Aloha Stadium parking lot adjacent to the fixed guideway station. For the Kalaeloa - Salt Lake - North King - Hotel combination, the lot would be located at Salt Lake Boulevard and Kahuapa'ani Street. The proposed size of the facilities as indicated in Table 3-5 reflects the expected demand for their use as determined by the travel demand forecasting model.

**Table 3-5. Park-and-Ride Lot Locations and Size for the Fixed Guideway Alternative Alignment Combinations**

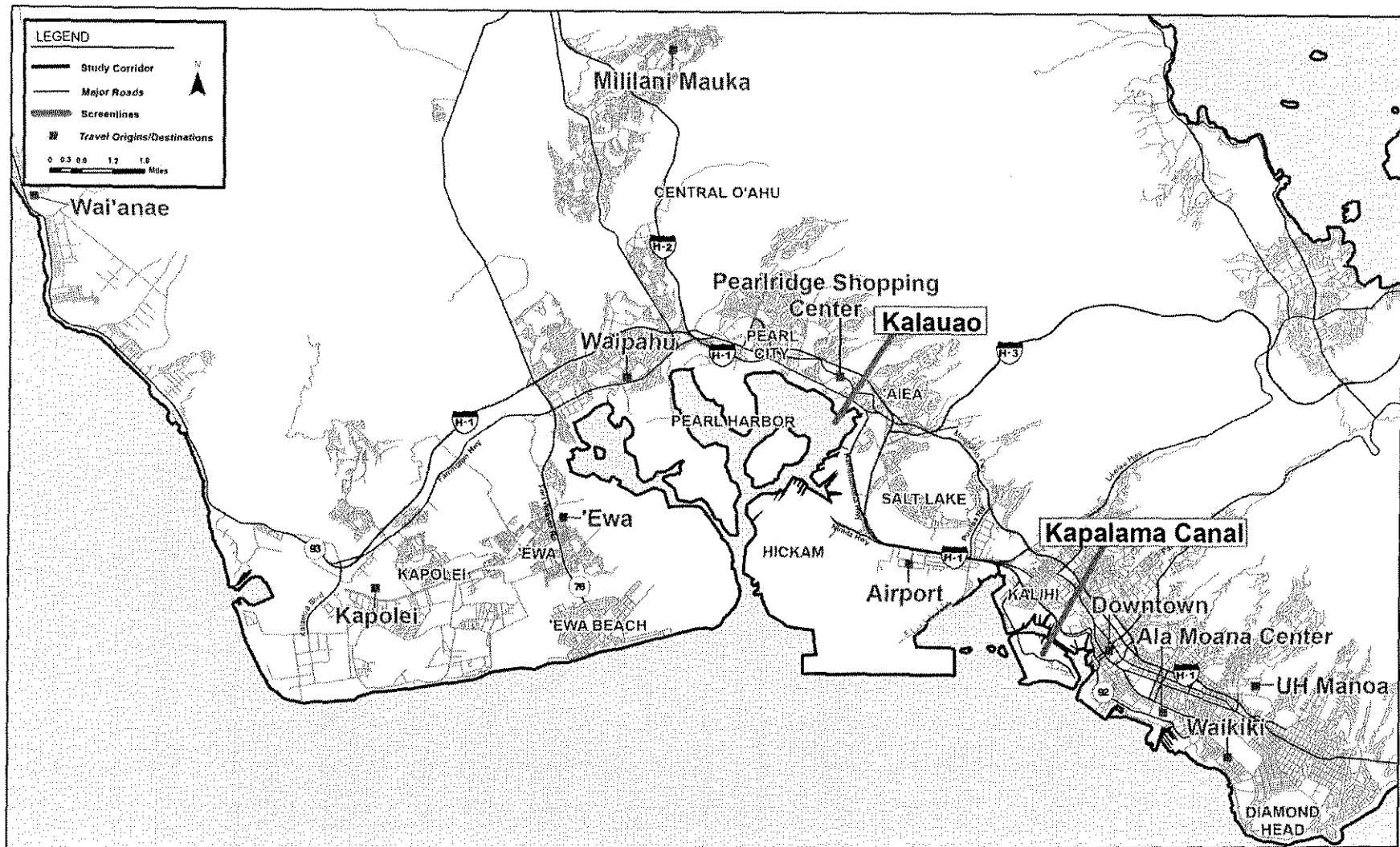
Park-and-Ride Location	Kalaeloa - Salt Lake - North King - Hotel	Kamokila - Airport - Dillingham - King with a Waikiki Branch	Kalaeloa - Airport - Dillingham - Halekauwila	20-mile Alignment East Kapolei to Ala Moana Center
Kapolei Parkway /Hanua Street	1,200 stalls	1,200 stalls	1,200 stalls	n/a
Saratoga Avenue/Renton Road/North-South Road	1,650 stalls	1,650 stalls	1,650 stalls	n/a
UH West O'ahu at North-South Road, south of Farrington Highway	1,700 stalls	n/a	2,100 stalls	1,700 stalls
UH West O'ahu at Farrington Highway and Kapolei Golf Course Road	n/a	1,700 stalls	n/a	n/a
Ka Uka Boulevard and H-2 Freeway	1,000 stalls	1,000 stalls	1,000 stalls	1,000 stalls
Pearl Highlands (Kamehameha Highway/Kuala Street)	1,500 stalls	1,500 stalls	1,500 stalls	1,500 stalls
Aloha Stadium	n/a	1,300 stalls	1,500 stalls	1,500 stalls
Salt Lake Boulevard/ Kahuapa'ani Street	1,300 stalls	n/a	n/a	n/a

The supporting bus system would represent a 12 to 15 percent decrease in required fleet size as compared to the No Build Alternative, but would be similar to or a slight increase over the current bus fleet size (Table 2-1). This is in major contrast to both the TSM and

**Table 3-6. A.M. Peak-hour Transit Travel Times by Alternative (in minutes)**

Alternative	Travel origin and destination									
	From Wai'anae To Downtown	From Kapolei To Downtown	From Ewa To Downtown	From Waipahu To Downtown	From Mililani Mauka To Downtown	From Pearlridge Center To Downtown	From Downtown To Ala Moana Center	From Downtown To Waikiki	From Downtown To UH Mānoa	From Airport To Waikiki
<b>2005 Existing Conditions</b>										
Walk to Transit	87	65	68	53	90	46	18	32	31	70
Drive to Transit*	N/A	N/A	N/A	N/A	67	N/A	N/A	N/A	N/A	N/A
Auto Travel Time	81	58	60	45	60	33	17	23	21	36
<b>Alternative 1: 2030 No Build</b>										
Walk to Transit	79	68	67	69	78	51	18	34	41	72
Drive to Transit	N/A	N/A	N/A	N/A	67	N/A	N/A	N/A	N/A	N/A
Auto Travel Time	83	62	70	53	60	35	17	24	22	38
<b>Alternative 2: 2030 Transportation System Management</b>										
Walk to Transit	79	67	67	57	61	46	15	33	31	72
Drive to Transit	68	57	59	N/A	57	41	N/A	N/A	N/A	N/A
<b>Alternative 3: 2030 Managed Lane</b>										
<b>Two-direction Option</b>										
Walk to Transit	87	70	70	52	61	40	19	33	35	68
Drive to Transit	74	63	65	N/A	53	N/A	N/A	N/A	N/A	N/A
<b>Reversible Option</b>										
Walk to Transit	89	72	72	56	66	41	20	33	35	69
Drive to Transit	75	65	67	N/A	58	N/A	N/A	N/A	N/A	N/A
<b>Alternative 4: 2030 Fixed Guideway</b>										
<b>Kalaeloa - Salt Lake - North King - Hotel</b>										
Walk to Transit	79	51	59	34	55	29	13	28	24	63
Drive to Transit	63	43	45	32	38	29	N/A	N/A	N/A	N/A
<b>Kamokila - Airport - Dillingham - King with a Waikiki Branch</b>										
Walk to Transit	79	54	72	39	59	33	15	21	28	31
Drive to Transit	63	47	49	36	43	31	N/A	N/A	N/A	N/A
<b>Kalaeloa - Airport - Dillingham - Halekauwila</b>										
Walk to Transit	85	55	66	41	61	35	17	40	28	42
Drive to Transit	70	49	51	39	45	33	N/A	N/A	N/A	N/A
<b>20-mile Alignment East Kapolei to Ala Moana Center</b>										
Walk to Transit	85	65	63	41	61	35	17	33	31	42
Drive to Transit	66	49	50	39	45	33	N/A	N/A	N/A	N/A

\* A drive to transit trip indicates a trip where the transit user drove to a park-and-ride lot to access transit.



**Figure 3-2. Locations of Origins and Destinations for Selected Travel Time Routes and Screenlines**

***Alternative 1: No Build***

As shown in Table 3-6, auto travel times for the No Build Alternative are either the same or longer than existing conditions between all origins and destinations selected, despite the fact that the “No Build” Alternative includes \$3 billion of roadway improvements that are included in the ORTP. However, the No Build Alternative also results in longer travel times for transit trips for many of the selected pairs. Some transit travel times, such as from Wai’anae to Downtown and from Mililani Mauka to Downtown, are projected to improve in the 2030 No Build Alternative. This is because these trips are able to take advantage of the extended HOV lanes on H-1; the improved operations of the zipper lane, which is assumed to be limited to three or more occupant vehicles by the year 2030; and/or the proposed Nimitz Flyover facility, which will give priority to HOVs and transit vehicles. Additionally, the transit travel time from Mililani Mauka to Downtown improves because it is assumed that bus service will be extended farther into the neighborhood, hence shortening walk access time.

***Alternative 2: Transportation System Management (TSM)***

Transit travel times for the year 2030 TSM Alternative are expected to generally improve over the No Build Alternative (Table 3-6). In most cases, the savings are due to the higher frequency of service and the shorter wait times for riders. Some locations experience larger travel time benefits due to new express routes added for this alternative. The TSM Alternative also has a number of additional park-and-ride lots, and travel times would improve for those riders using these lots.

In general, travel time benefits are moderate at best for the TSM Alternative as compared to the No Build. Table 3-6 shows that even by optimizing the bus system, only a

pronounced with the Reversible Option as compared to the Two-direction Option because it accommodates a higher volume of traffic in the peak direction and thus experiences greater congestion. Additionally, areas that are not directly served by the managed lane, such as from the Airport to Waikīkī, would not experience much change from the No Build or TSM Alternative projections. Hence, although the Managed Lane Alternative would provide some travel-time improvement for certain areas, it has significant limitations with regard to improving travel times or transit service for a broader customer base.

***Alternative 4: Fixed Guideway***

In general, the four Fixed Guideway options provide the fastest transit travel times of all the alternatives and are often either as fast as, or faster than, projected auto travel times for

## Transit Ridership

Table 3-7 and Figure 3-3 present daily transit ridership for year 2005 as well as estimated transit ridership for each of the year 2030 alternatives, and Table 3-8 shows estimated a.m. peak two-hour ridership. The ridership numbers are presented in terms of bus or fixed guideway trips, as well as in terms of total boardings. Note that the number of transit vehicle boardings is higher than the number of total trips because of transfers.

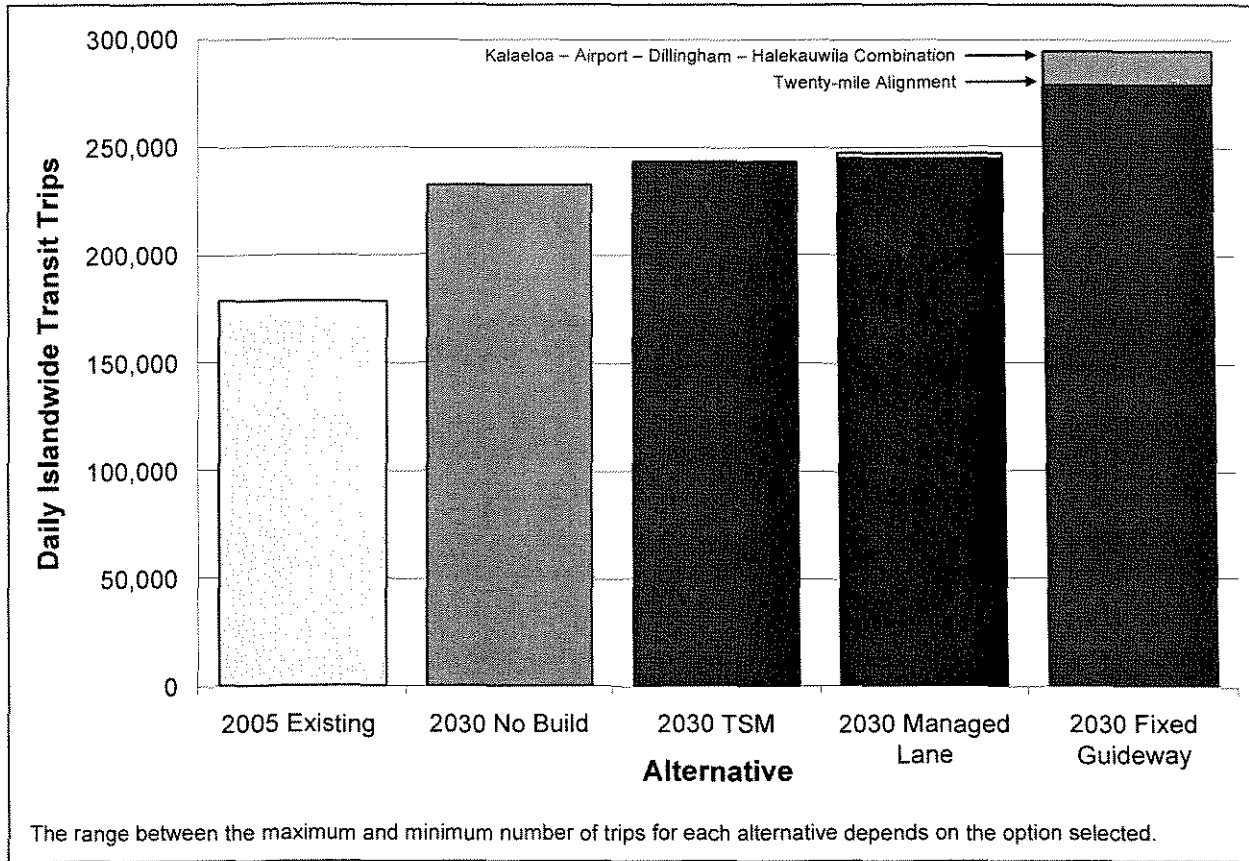
**Table 3-7. Daily Transit Ridership**

Alternative	Fixed Guideway Trips	Total Transit Trips	Total Transit Boardings
<b>2005 Existing Conditions</b>			
Existing Conditions	NA	178,400	243,100
<b>Alternative 1: No Build</b>			
No Build Alternative	NA	232,100	330,600
% Change from Existing Conditions	--	30%	36%
<b>Alternative 2: Transportation System Management</b>			
TSM Alternative	NA	243,100	354,200
% Change from No Build Alternative	--	4.7%	7.1%
<b>Alternative 3: Managed Lane</b>			
Two-direction Option	NA	247,000	363,700
% Change from No Build Alternative	--	6.4%	10%
Reversible Option	NA	244,400	363,700
% Change from No Build Alternative	--	5.3%	10%
<b>Alternative 4: Fixed Guideway</b>			
Kalaeloa - Salt Lake - North King - Hotel	128,500	293,600	468,800
% Change from No Build Alternative	--	27%	42%
Kamokila - Airport - Dillingham - King with a Waikiki Branch	122,500	287,800	449,300
% Change from No Build Alternative	--	24%	36%
Kalaeloa - Airport - Dillingham - Halekauwila	123,700	294,100	468,300
% Change from No Build Alternative	--	27%	42%
20-mile Alignment East Kapolei to Ala Moana Center	95,000	281,900	455,300
% Change from No Build Alternative	--	21%	38%

### **Alternative 1: No Build**

The No Build Alternative is forecast to have the lowest ridership of any of the alternatives, as shown in Table 3-7 and Table 3-8. The No Build Alternative is expected to keep pace with population growth and increase over the 2005 existing conditions by 30 percent. Transit boardings are projected to increase at a slightly higher pace, primarily reflecting additional transfers in the system (about 4.5% more) that would result from route restructuring to focus on transit hubs throughout the network. The majority of the a.m. peak-period transit trips are relatively short and stay within the same community area they originate in, or else terminate in the adjacent community area. This suggests

that transit for the No Build Alternative is not conducive to longer trips because of the slow travel times experienced as a result of the congested roadway network.



**Figure 3-3. Islandwide Daily Transit Trips for All Alternatives**

**Table 3-8. A.M. Peak Two-hour Transit Ridership**

Alternative	Transit Trips	% Change from No Build
<b>2005 Existing Conditions</b>		
Existing Conditions	29,110	N/A
<b>Alternative 1: 2030 No Build</b>		
No Build Alternative	37,970	N/A
<b>Alternative 2: 2030 Transportation System Management</b>		
TSM Alternative	40,220	5.9%
<b>Alternative 3: 2030 Managed Lane</b>		
Two-direction Option	41,220	8.6%
Reversible Option	40,600	6.9%
<b>Alternative 4: 2030 Fixed Guideway</b>		
Kalaeloa - Salt Lake - North King - Hotel	50,730	34%
Kamokila - Airport - Dillingham - King with a Waikīkī Branch	49,280	30%
Kalaeloa - Airport - Dillingham - Halekauwila	50,600	33%
20-mile Alignment East Kapolei to Ala Moana Center	48,110	27%

*Alternative 2: Transportation System Management (TSM)*

Transit ridership for the TSM Alternative is expected to increase over the No Build Alternative by 4.7 percent in terms of transit trips and by 7.1 percent in terms of



large increase in transit trips from all areas to Kapolei - Ko 'Olina - Kalaeloa, which illustrates that the fixed guideway would support the increase in commute trips within the corridor destined for West O'ahu.

The greatest impact of the transit system on the overall transportation network is during the peak commuter travel periods. It is during this period that attracting more travelers to transit will pay the largest dividends in terms of increased system mobility. In comparison to the non-Fixed Guideway alternatives, the Fixed Guideway Alternative combinations show the largest increase in total a.m. peak-period transit trips over the No Build Alternative by a significant margin (Table 3-8). The Full-corridor Alignments show increases ranging from 11,310 to 12,760 transit trips, which are 30 to 34 percent increases. The 20-mile Alignment option is also expected to attract a significant number of a.m. peak-period trips (10,140) over the No Build Alternative, representing a 27 percent increase.

Table 3-9 shows projected daily fixed guideway boardings by station for each of the Fixed Guideway alignment options, as well as the 20-mile Alignment. Stations expected to experience a relatively high level of boardings include the terminus stations, those stations with major park-and-ride facilities, and those stations with major bus interface activity. Of the three full-corridor alignments, all have comparable projected boardings in the Kapolei, 'Ewa, Waipahu, Pearl City and 'Aiea areas. The Kalaeloa - Airport - Dillingham - Halekauwila alignment is projected to have higher ridership through the Salt Lake, Airport and Kalihi areas; while the Kalaeloa - Salt Lake - North King - Hotel alignment is expected to have the highest ridership through the Downtown and Kaka'ako areas. The latter result is due primarily to the Hotel Street alignment being more central to many Downtown destinations in comparison to the Nimitz - Halekauwila alignment, as well as its having more proposed stations through Downtown.

## Roadway Traffic

### *Systemwide Travel Statistics*

This section describes the expected future islandwide roadway travel conditions resulting from each of the study alternatives. Measures assessed include systemwide vehicle miles traveled (VMT), vehicle hours traveled (VHT), and vehicle hours of delay (VHD). Results are presented in Table 3-10. The change in systemwide vehicle hours of delay is also shown graphically in Figure 3-4. VMT and VHT are indicators of how much people are using their private automobiles for travel. Lower values for these measures indicate a more efficient and environmentally friendly transportation system. VHD is a measure that reflects the amount of congestion present in the system. Lower VHD values indicate less congestion on the transportation network.

**Table 3-9. Year 2030 Fixed Guideway Forecast Daily Boardings<sup>1</sup>**

Station	Combination Alignment			20-mile Alignment East Kapolei to Ala Moana Center
	Kalaeloa - Salt Lake - North King - Hotel	Kamokila - Airport - Dillingham - King with a Waikiki Branch	Kalaeloa - Airport - Dillingham - Halekauwila	
Kapolei Parkway & Hanua Street	6,740	6,670	6,730	N/A <sup>2</sup>
Kamokila Blvd. & Wākea Street	N/A	4,410	N/A	N/A
Kapolei Pkwy & Wākea Street	3,530	N/A	3,210	N/A
Saratoga Avenue & Wākea Street	640	N/A	630	N/A
Farrington Hwy at UH West O'ahu	N/A	5,660	N/A	N/A
Saratoga Avenue & Fort Barrette Road	640	N/A	620	N/A
Kapolei Pkwy & North-South Road	4,510	N/A	5,430	5,860
North-South Road between Kapolei Parkway & Farrington Highway	1,580	N/A	1,730	N/A
Farrington Hwy & North-South Road	8,390	1,550	5,540	7,650
Farrington Hwy between North-South Road & Fort Weaver Road	1,110	3,350	1,750	3,610
Farrington Highway & Leokū Street	4,070	3,460	4,550	4,970
Farrington Hwy & Mokuola Street	2,990	3,610	2,990	2,710
Leeward Community College	1,530	1,380	1,490	1,500
Kamehameha Hwy & Kuala Street	9,600	9,800	9,540	9,200
Kamehameha Highway & Kaonohi Street	7,390	6,610	6,880	6,140
Aloha Stadium	N/A	4,340	4,390	4,400
Salt Lake Boulevard & Kahuapa'ani Street	9,230	N/A	N/A	N/A
Salt Lake Blvd. & Ala Inoi Place	4,540	N/A	N/A	N/A
Kamehameha Hwy & Radford Drive	N/A	5,230	5,800	5,330
Honolulu International Airport	N/A	3,710	3,870	3,830
Aolele Street & Lagoon Drive	N/A	3,420	3,010	1,990
Middle Street Transit Center	N/A	3,360	3,180	3,630
N. King Street & Owen Street	3,530	N/A	N/A	N/A
N. King Street & Waiakamilo Road	2,580	N/A	N/A	N/A
N. King Street at Liliha Street	4,750	N/A	N/A	N/A
Dillingham Blvd. & Mokauea Street	N/A	2,980	3,030	2,720
Dillingham Blvd. & Kōkea Street	N/A	2,540	2,340	1,970
Ka'aahi Street	N/A	3,480	4,370	3,390
King Street & Bethel Street	N/A	7,350	N/A	N/A
King Street & Punchbowl Street	N/A	6,330	N/A	N/A
Hotel Street & Kekaulike Street	1,000	N/A	N/A	N/A
Hotel Street & Nu'uaniu Avenue	3,270	N/A	N/A	N/A
Hotel Street & Fort Street Mall	9,150	N/A	N/A	N/A
Honolulu Hale	2,210	N/A	N/A	N/A
Nimitz Highway & Kekaulike Street	N/A	N/A	2,390	1,650
Nimitz Highway & Fort Street Mall	N/A	N/A	5,800	3,670
Waimanu Street & Cummins Street	N/A	3,190	N/A	N/A
Kawaiaha'o Street & Cooke Street	4,190	N/A	N/A	N/A
Halekauwila Street & South Street	N/A	N/A	3,870	5,700
Halekauwila Street & Ward Avenue	N/A	N/A	2,910	2,240
Ala Moana Center	5,140	5,200	9,780	12,990
Kapi'olani Blvd. & McCully Street	11,360	1,110	4,450	N/A
University Avenue & Date Street	3,580	2,460	3,010	N/A
University Avenue & S. King Street	4,280	3,240	4,200	N/A
UH Lower Campus	6,930	5,490	6,180	N/A
<b>Waikiki Branch</b>				
Convention Center from Kalākaua Avenue	N/A	2,630	N/A	N/A
Kūhiō Avenue & Kālainmoku Street	N/A	4,220	N/A	N/A
Kūhiō Avenue & Lili'uokalani Avenue	N/A	5,760	N/A	N/A
<b>Total Daily Boardings<sup>1</sup></b>	<b>128,460</b>	<b>122,540</b>	<b>123,670</b>	<b>94,970</b>

<sup>1</sup>Boardings are a count of individual passengers entering a transit vehicle.

<sup>2</sup>N/A = Not applicable, as this station would not exist for this alternative.

**Table 3-10. Systemwide Daily Travel Statistics by Alternative**

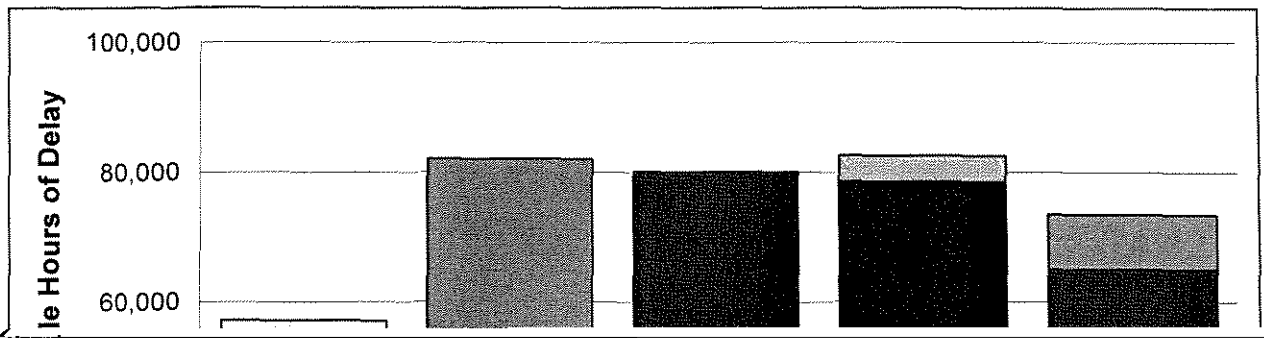
Alternative	Vehicle Miles Traveled	Vehicle Hours Traveled	Vehicle Hours of Delay
<b>2005 Existing Conditions</b>			
Existing Conditions	11,206,000	305,000	57,000
<b>Alternative 1: 2030 No Build</b>			
No Build Alternative	13,971,000	395,000	82,000
% Change from Existing Conditions	25%	30%	44%
<b>Alternative 2: 2030 Transportation System Management</b>			
TSM Alternative	13,874,000	390,000	80,000
% Change from No Build Alternative	-0.7%	-1.3%	-2.4%
<b>Alternative 3: 2030 Managed Lane</b>			
Two-direction Option	14,002,000	384,000	78,500
% Change from No Build Alternative	0.2%	-2.8%	-4.3%
Reversible Option	14,034,000	397,000	82,500
% Change from No Build Alternative	0.5%	0.5%	0.6%
<b>Alternative 4: 2030 Fixed Guideway</b>			
Kalaeloa - Salt Lake - North King - Hotel	13,464,000	365,000	65,000
% Change from No Build Alternative	-3.6%	-7.6%	-21%
Kamokila - Airport - Dillingham - King with a Waikiki Branch	13,512,000	367,000	65,000
% Change from No Build Alternative	-3.3%	-7.1%	-21%
Kalaeloa - Airport - Dillingham - Halekauwila	13,500,000	367,000	67,000
% Change from No Build Alternative	-3.4%	-7.1%	-18%
20-mile Alignment East Kapolei to Ala Moana Center	13,539,000	376,000	73,500
% Change from No Build Alternative	-3.1%	-4.8%	-11%

**Alternative 1: No Build**

Table 3-10 shows that all three systemwide travel measures are expected to increase significantly between 2005 and the 2030 No Build Alternative. However, while VMT and VHT are expected to increase by an amount approximating expected population growth between 2005 and 2030 (i.e., 25 percent and 30 percent, respectively), VHD is projected to increase at a substantially higher rate of nearly 44 percent. This is because much of the roadway system is currently operating at or over capacity for many hours of the day, and it only takes a small increase in additional traffic to create a large amount of additional congestion and delay under these conditions.

**Alternative 2: Transportation System Management (TSM)**

The TSM Alternative is expected to result in a minimal decrease in the three systemwide travel measures as compared to the No Build Alternative (Table 3-10), indicating that it would have only a slight impact islandwide on how much people use their private automobiles and how much congestion is experienced.



The 20-mile Alignment option shows similar results as the Full-corridor Alignments, although to a lesser degree. This option is projected to reduce VMT by 3.1 percent, VHT by 4.8 percent, and VHD by 11 percent in comparison to the No Build Alternative.

### **Traffic Volumes and Level-of-Service**

This section discusses projected roadway network operations for each of the alternatives as indicated by the level of peak-hour traffic volumes and corresponding operational level-of-service (LOS) in the study corridor. For the purpose of this discussion, traffic volumes are grouped together by screenlines (Figure 3-2). Screenlines are imaginary lines drawn across the road network. LOS is a grading scale from A through F for roadway operation; LOS A represents the best condition and LOS F represents more vehicles attempting to use a roadway than the capacity is able to accommodate. Existing traffic volumes were extracted from historical State files at points where the lines intersect the road network and totaled for all of the individual facilities that cross each screenline. Year 2030 volumes were developed through the use of the travel demand forecasting model.

Table 3-11 shows a.m. and p.m. peak-hour volumes for existing conditions (year 2003) and all of the year 2030 alternatives for two key screenlines in the study corridor: Kalauao Stream in Pearl City and the Kapālama Drainage Canal just ‘Ewa of Downtown. The locations of these two screenlines are shown in Figure 3-2. Table 3-12 and Table 3-13 present estimated LOS for these two screenlines and the individual roadways comprising them for the a.m. and p.m. peak hours, respectively, in the peak traffic direction.

#### **Alternative 1: No Build**

Both the Kalauao Stream and Kapālama Canal screenlines experience high volumes and significant congestion under existing conditions. The existing screenline is estimated at LOS F in the a.m. peak hour for Koko Head direction travel across both screenlines, with the H-1 general purpose lanes operating at LOS F as well (Table 3-12). Screenline operations are estimated to be LOS E (i.e., at capacity) in the p.m. peak hour in the ‘Ewa-bound direction (Table 3-13), but LOS F for general purpose traffic on H-1 itself. These conditions are expected to worsen considerably under the 2030 No Build Alternative as peak-hour volumes are projected to increase by 25 to 48 percent at the Kalauao Stream screenline and by 11 to 21 percent at the Kapālama Canal, resulting in extreme LOS F conditions with a V/C ratio of 1.54 at the Kalauao Stream screenline and 1.12 at the Kapālama Canal (note that this latter screenline is still projected to be at LOS F despite the addition of a traffic lane in the peak direction as proposed in the ORTP).

#### **Alternative 2: Transportation System Management (TSM)**

As shown in Table 3-11, the TSM Alternative results in only a small decrease (zero to 6%) in peak-hour volumes across the two key corridor screenlines as compared to the No Build Alternative. Consequently, projected peak-hour peak-direction LOS at these two screenlines is projected to remain at LOS F.

**Table 3-11. Selected Screenline Peak-hour Volumes by Alternative**

Alternative	Screenline			
	Kalauao Stream		Kapālama Canal	
	A.M.	P.M.	A.M.	P.M.
<b>Existing Conditions (2003)</b>				
'Ewa Bound	7,640	15,340	11,370	14,510
Koko Head Bound	18,870	8,970	15,040	12,660
Total	26,510	24,310	26,410	27,170
<b>Alternative 1: 2030 No Build</b>				
'Ewa Bound	9,580	20,270	13,390	16,130
% Change from Existing Conditions	25%	32%	18%	11%
Koko Head Bound	28,020	11,470	18,190	14,540
% Change from Existing Conditions	48%	28%	21%	15%
Total	37,600	31,740	31,580	30,670
% Change from Existing Conditions	42%	31%	20%	13%
<b>Alternative 2: 2030 Transportation System Management</b>				
'Ewa Bound	9,530	20,090	13,340	16,030
% Change from No Build	-1%	-1%	0%	-3%
Koko Head Bound	27,690	11,400	18,070	14,480
% Change from No Build	-1%	-1%	-6%	0%
Total	37,220	31,490	31,410	30,510
% Change from No Build	-1%	-1%	-4%	-2%
<b>Alternative 3: 2030 Managed Lane</b>				
<b>Two-direction Option</b>				
'Ewa Bound	10,620	19,890	15,400	16,210
% Change from No Build	11%	-2%	15%	-2%
Koko Head Bound	28,800	11,230	20,110	14,740
% Change from No Build	3%	-2%	5%	1%
Total	39,420	31,120	35,510	30,950
% Change from No Build	5%	-2%	9%	0%
<b>Reversible Option</b>				
'Ewa Bound	10,570	19,860	15,520	16,190
% Change from No Build	10%	-2%	16%	-2%
Koko Head Bound	28,730	12,260	20,540	14,190
% Change from No Build	3%	7%	7%	-2%
Total	39,300	32,120	36,060	30,380
% Change from No Build	5%	1%	11%	-2%

**Table 3-11. Selected Screenline Peak-hour Volumes by Alternative (continued)**

Alternative	Screenline			
	Kalauao Stream		Kapālama Canal	
	A.M.	P.M.	A.M.	P.M.
<b>Alternative 4: 2030 Fixed Guideway</b>				
<b>Kalaeloa - Salt Lake - North King - Hotel</b>				
'Ewa Bound	9,090	18,930	13,040	15,320
% Change from No Build	-5%	-7%	-3%	-7%
Koko Head Bound	25,810	10,970	16,860	14,080
% Change from No Build	-8%	-4%	-12%	-3%
Total	34,900	29,900	29,900	29,400
% Change from No Build	-7%	-6%	-8%	-5%
<b>Kamokila - Airport - Dillingham - King with a Waikī Branch</b>				
'Ewa Bound	9,100	18,970	12,990	15,390
% Change from No Build	-5%	-6%	-3%	-7%
Koko Head Bound	25,950	11,000	17,000	14,110
% Change from No Build	-7%	-4%	-11%	-3%
Total	35,050	29,970	29,990	29,500
% Change from No Build	-7%	-6%	-8%	-5%
<b>Kalaeloa - Airport - Dillingham - Halekauwila</b>				
'Ewa Bound	9,090	18,960	12,980	15,500
% Change from No Build	-5%	-6%	-3%	-6%
Koko Head Bound	25,930	10,990	17,000	14,040
% Change from No Build	-7%	-4%	-11%	-3%
Total	35,020	29,950	29,980	29,540
% Change from No Build	-7%	-6%	-8%	-5%
<b>20-mile Alignment East Kapolei to Ala Moana Center</b>				
'Ewa Bound	9,100	19,090	12,960	15,280
% Change from No Build	-5%	-6%	-3%	-7%
Koko Head Bound	26,100	11,000	17,070	14,170
% Change from No Build	-7%	-4%	-11%	-3%
Total	35,200	30,090	30,030	29,450
% Change from No Build	-6%	-5%	-8%	-5%

Table 3-12. A.M. Peak-hour Screenline Volumes and Level of Service (LOS)

SCREENLINE / FACILITY	Existing Conditions (2003)				2030 Facility Capacity (vph)	2030 No Build Alternative			2030 TSM Alternative			2030 Managed Lane Alternative						2030 Fixed Guideway Alternative											
	Facility Capacity (vph)	Observed Volume (vph)	Volume/Capacity Ratio	Level of Service		Forecast Volume (vph)	Volume/Capacity Ratio	Level of Service	Forecast Volume (vph)	Volume/Capacity Ratio	Level of Service	Two-direction Option			Reversible Option			Kalaeloa - Salt Lake - North King - Hotel			Kamokila - Airport - Dillingham - King with a Waikiki Branch			Kalaeloa - Airport - Dillingham - Halekauwila			20-mile Alignment East Kapolei to Ala Moana Center		
												Forecast Volume (vph)	Volume/Capacity Ratio	Level of Service	Forecast Volume (vph)	Volume/Capacity Ratio	Level of Service	Forecast Volume (vph)	Volume/Capacity Ratio	Level of Service	Forecast Volume (vph)	Volume/Capacity Ratio	Level of Service	Forecast Volume (vph)	Volume/Capacity Ratio	Level of Service	Forecast Volume (vph)	Volume/Capacity Ratio	Level of Service
Kalaualo Stream Koko Head bound	9,500	10,960	1.15	F	9,500	18,049	1.90	F	17,897	1.88	F	18,327	1.93	F	18,419	1.94	F	17,322	1.82	F	17,414	1.83	F	17,198	1.81	F	17,209	1.81	F
H-1 Fwy	1,900	1,600	0.84	D	1,900	3,014	1.59	F	2,959	1.56	F	2,882	1.52	F	2,769	1.46	F	2,756	1.45	F	2,701	1.42	F	2,698	1.53	F	2,740	1.44	F
H-1 Fwy (HOV) <sup>1</sup>	1,900	1,700	0.89	D	1,900	2,444	1.29	F	2,396	1.26	F	1,677	0.88	D	NA	NA	NA	2,120	1.12	F	2,154	1.13	F	2,147	1.13	F	2,241	1.18	F





### **Alternative 3: Managed Lane**

The two Managed Lane Alternative options are expected to increase the volume of peak-hour vehicles across the two key corridor screenlines in the a.m. peak hour and have a minimal impact in reducing the volume in the p.m. peak hour (Table 3-11) as compared to the No Build Alternative. As such, the peak-hour peak-direction LOS for the two screenlines is projected to remain at LOS F under this alternative for general purpose traffic except at the Kapālama Canal screenline in the p.m. peak hour which is projected to improve to LOS E. The managed lanes themselves are projected to be operating at levels of service ranging from LOS B to LOS D in the a.m. peak hour, and LOS A during the p.m. peak hour. The Two-direction Option is projected to result in a large decrease in both the a.m. and p.m. peak hour HOV volumes in the Zipper Lane due to a shift of this traffic to the managed lane. Both managed lane options are expected to result in lower volumes in the median HOV lane in the p.m. peak hour as compared to the No Build Alternative; hence improving HOV lane operations.

### **Alternative 4: Fixed Guideway**

Table 3-11 shows that all of the Fixed Guideway Alternative options, including the 20-mile Alignment, are expected to reduce the number of vehicles crossing these two key screenlines in the peak hours by anywhere from 3 to 12 percent as compared to the No Build Alternative. While this amount of volume decrease is significant and would reduce the V/C ratios and hence the degree of congestion, due to the very high volumes anticipated for the corridor this reduction would not result in an improvement in the overall LOS in the a.m. peak hour. However, in the p.m. peak hour, LOS is projected to improve to LOS E at the Kapālama Canal screenline for three of the four fixed guideway options.

## **Measures Taken to Minimize Uncertainties Associated with Transportation Analysis**

Potential risks associated with the transportation analysis have been identified and a

number of measures to minimize them have been taken. The primary risk relates to the accuracy of the ridership forecasts. The level of projected ridership is key to whether a proposed project is viable from both a financial and political perspective. A commonly considered risk is that the projected levels of ridership will not be attained in reality. Factors that can influence this include the robustness of the travel demand forecasting process and the accuracy of the data input into the model, particularly the projections of

revision of the model and the resulting forecast methodology have been reviewed and approved by FTA.

- A comprehensive on-board transit survey was undertaken covering the entire TheBus system to obtain the most up-to-date information regarding how many people are currently using transit on O'ahu, who they are, and why they use it. This information is critical in assessing future transit use on the island.
- The population and employment forecasts are official OMPO projections. These forecasts were reviewed and updated specifically for this project to make certain that the most recent knowledge regarding development on the island is incorporated into the model.

After taking these steps, the biggest single risk that could affect the accuracy of the ridership forecasts is the accuracy of the population and employment projections. External factors, such as a downturn in the economy, could affect whether the island will develop as planned.

## Conclusions Regarding Transportation

Table 3-14 summarizes and compares the results for key measures for each of the alternatives analyzed in this chapter. The results can be summarized as follows.

The only alternative that is expected to significantly affect transit mode share and attract additional transit riders is the Fixed Guideway Alternative. Of the Fixed Guideway options, the Kalaeloa - Airport - Dillingham - Halekauwila alignment option is projected to attract the highest systemwide transit ridership.

*Exceeds to serving existing and future transit markets, the Fixed Guideway Alternative*

congestion somewhat along the managed lane facility itself, but it creates additional congestion because of the volume of traffic increase wanting to access it; hence, very little positive change in systemwide vehicle hours of delay is projected. In addition, while all other alternatives have a minimal to negligible impact on peak-period traffic volumes in the corridor (in fact the managed lane options are expected to increase vehicle peak-hour volumes in the corridor), the Fixed Guideway Alternative is projected to reduce peak traffic volumes up to 12 percent in some areas. Most importantly, however, the Fixed Guideway Alternative provides a mobility option that the other alternatives do not, in that it gives users the opportunity to bypass the congestion that will occur on roadways throughout the study corridor.

**Table 3-14. Summary of Transportation Effects**

Alternative	Measure				
	Transit Mode Share (Table 3-3 and Table 3-4)	Transit Ridership (Table 3-7)	Ability to Serve Transit Markets	Transit Travel Times (Table 3-6)	Roadway Impacts (Table 3-10 to Table 3-13)
<b>Alternative 1: 2030 No Build</b>					
No Build Alternative	Little change from existing	Keeps pace with projected population growth	Primarily attracts/serves shorter trips and transit-dependent trips. Does not serve increased commute to West O'ahu well	Transit travel times increase over existing, although HOV facility improvements reduce some travel times to the Leeward side.	Significant increase in peak-hour volumes over existing (11 to 48%). Key corridor screenlines at LOS F. 44% increase over existing VHD.
<b>Alternative 2: 2030 TSM</b>					
TSM Alternative	Small increase over No Build	Small increase (4.7%) over No Build	Primarily attracts/serves shorter trips and transit-dependent trips. Does not serve increased commute to West O'ahu well	Some improvement in times over the No Build due to increased bus frequency.	Negligible change in key screenline peak-hour volumes. Screenlines at LOS F. Slight decrease in VHD (2.4%) from No Build.
<b>Alternative 3: 2030 Managed Lane</b>					
Two-direction Option	Small increase over No Build	Small increase (6.4%) over No Build	While serving slightly longer trips in comparison to No Build and TSM, both options still primarily attract/ serve shorter trips and transit-dependent trips.  The Reversible Option does not serve increased commute to West O'ahu well	Selected areas well served by managed lanes experience improved times, other areas stay the same or experience increased times.	Peak-hour corridor volumes increase for a.m. peak hour as compared to No Build. Key screenlines at LOS E or F. Slight VHD decrease (4.3%) from No Build for Two-Direction, negligible change for Reversible. Diversion of HOV traffic to the managed lanes results in some improvement in HOV and Zipper Lane operations.
Reversible Option	Small increase over No Build	Small increase (5.3 %) over No Build			
<b>Alternative 4: 2030 Fixed Guideway</b>					
Kalaeloa - Salt Lake - North King - Hotel	Substantial increase over No Build, especially for work trips	Substantial increase (27%) over No Build	Serves both long and short trips. Provides mobility around corridor "pinch points." Accommodates increased commute to West O'ahu	Transit travel times between most key corridor locations improve. Travel time reliability is greatly improved due to use of separate right-of-way from the roadway system.	Peak hour volumes decrease up to 12% in both peak periods, both directions. While volume reduction will provide some relief (particularly for the shoulder peak), peak-hour peak-direction conditions will still be at LOS E or F for key corridor screenlines. However, substantial decrease in VHD (18-21%) from No Build for Full-corridor Alignments, significant decrease (9%) for 20-mile Alignment East Kapolei to Ala Moana Center.
Kamokila - Airport - Dillingham - King with a Waikiki Branch	Substantial increase over No Build, especially for work trips	Substantial increase (24%) over No Build			
Kalaeloa - Airport - Dillingham - Halekauwila	Substantial increase over No Build, especially for work trips	Substantial increase (27%) over No Build			
20-mile Alignment East Kapolei to Ala Moana Center	Substantial increase over No Build, especially for work trips	Substantial increase (21%) over No Build			

**Chapter 4**

**Environmental Consequences**

alignment would cause a substantially greater number of noise impacts than any other alignment within the study corridor. In Section V, the Hotel Street/Kawaiaha'o Street/Kapi'olani Boulevard alignment would require more residential property acquisitions and have a greater potential to disturb cultural practices and burials than any other alignment.

**Table 4-1. Numbers of Parcels Affected (Full or Partial Acquisitions)**

Alternative	Parcels of All Types <sup>1</sup>	Residential Parcels	Commercial/Office Parcels
<b>Alternative 1: No Build</b>			
No Build Alternative	0	0	0
<b>Alternative 2: Transportation System Management</b>			
TSM Alternative	None identified		
<b>Alternative 3: Managed Lane</b>			
Two-Direction Option	49	2	30
Reversible Option	44	2	29
<b>Alternative 4: Fixed Guideway (Full-corridor Alignments by section)</b>			
<b>I. Kapolei to Fort Weaver Road</b>			
Kamokila Blvd./Farrington Hwy.	22	0	3
Kapolei Pwy./North-South Rd.	19	0	0
Saratoga Ave./North-South Rd.	35	0	0
Geiger Rd./Fort Weaver Rd.	28	0	4
<b>II. Fort Weaver Road to Aloha Stadium</b>			
Farrington Hwy./Kamehameha Hwy.	14	2	4
<b>III. Aloha Stadium to Middle Street</b>			
Salt Lake Blvd.	24	1	12
Mauka of the Airport Viaduct	33	0	20
Makai of the Airport Viaduct	49	0	37
Aolele St.	15	0	1
<b>IV. Middle Street to Iwilei</b>			
North King St.	37	2	6
Dillingham Blvd.	39	1	22
<b>V. Iwilei to UH Mānoa</b>			
Beretania St./South King St.	36	3	22
Hotel St./Kawaiaha'o St./Kapi'olani Blvd.	83	11	58
King St./Waimanu St./Kapi'olani Blvd.	36	9	62
Nimitz Hwy./Queen St./Kapi'olani Blvd.	63	8	47
Nimitz Hwy./Halekauwila St./Kapi'olani Blvd.	77	9	51
Waikikī Branch	16	1	10
<b>Total for 20-mile Alignment East Kapolei to Ala Moana Center</b>	<b>139</b>	<b>7</b>	<b>72</b>

<sup>1</sup>Parcels of all types is greater than the sum of the other columns because it also includes parcels with governmental or utility company ownership that are not currently transportation right-of-way.

Land use effects could be substantial within one-half mile of certain station locations along the four alignment options being considered for the Fixed Guideway Alternative. This radius is within walking distance to a station, and the new transit service would increase mobility and accessibility. These changes would affect land values and increase

Transit-oriented development includes the following elements:

- Moderate to higher density uses
- Within easy walk to and from the station
- Mix of uses
- Pedestrian-oriented
- New construction or redevelopment
- Generates transit ridership.



#### **Section IV. Middle Street to Iwilei**

The North King Street alignment would serve more residents than the Dillingham alignment; however, it would serve fewer jobs. The Dillingham alignment would require more parcel acquisitions; however, fewer would be residential parcels (Table 4-1). More noise impacts would occur with the North King Street alignment. Thirty-three potentially historic properties are located along the North King Street alignment compared to 12 along Dillingham Boulevard.

#### **Section V. Iwilei to UH Mānoa**

The Beretania Street/South King Street alignment would serve the fewest residents and jobs. The Hotel Street/Kawaiaha‘o Street/Kapi‘olani Boulevard alignment would require acquisition of the greatest number of residential parcels of any alignment within the study corridor (Table 4-1). Noise impacts would be greater along the Waikīkī Branch than at any other alignment in Section V, but would be fewer than with the Salt Lake Boulevard or North King Street alignments in other sections. Noise impacts also would occur along the South King Street and Queen Street alignments. A greater number of cultural practices could be affected and the greatest number of burials compared to any alignment within the study corridor could be disturbed by the Hotel Street/Kawaiaha‘o Street/Kapi‘olani Boulevard alignment.

### **Uncertainties Associated with Environmental Resources**

Project risks related to environmental resources may affect costs, schedule, and possibly alignment or design options. Encountering unanticipated contaminated sites could require soil or groundwater cleanup that would slow the project schedule and increase the project cost. Encountering a threatened or endangered species, such as *Abutilon menziesii* in Section I of the Fixed Guideway Alternative, would require development and implementation of a habitat conservation plan, affecting the project schedule. The Honolulu High-Capacity Transit Corridor Project would attempt to work within or append to the plan that already has been developed by HDOT.

Any use of parklands or historic resources would require compliance with Section 4(f) of the U.S. Department of Transportation Act of 1966. This would require engineering evaluation to determine if avoidance is possible, which could increase the cost of the alternative or create other environmental impacts.

Encountering burials or archeological resources during construction can cause construction delays. This risk may be reduced by avoiding cut-and-cover tunneling, minimizing ground disturbance, and conducting sub-surface investigation of areas where resources are likely to be encountered.

Visual impacts and noise are issues of frequent concern to the public. While there are no legal regulations beyond the National Environmental Policy Act pertaining to addressing these issues, how they are addressed may affect overall public sentiment related to the project. Design decisions to minimize noise and to match the project to the visual character of its surroundings can be effective in garnering community support.

## **Chapter 5**

## **Financial Feasibility Analysis**

This chapter compares relative costs among the alternatives and evaluates their financial feasibility. The details of the financial information will continue to be refined once the LPA is selected and as it advances through planning and development. Project cost

All construction and capital costs are expressed in 2006 dollars (dollar value as of fourth-quarter 2006). Unit costs were developed from HDOT cost data or other historical

~~cost data from other systems throughout the country. When cost data from other systems~~

**Table 5-2. Capital Cost Estimates of the Fixed Guideway Alternative Alignments**

<b>Section and Alignment</b>	<b>Capital Cost (millions of 2006 dollars)<sup>1</sup></b>
Cost common to all alignments	480
<b>I. Kapolei to Fort Weaver Road</b>	
Kamokila Boulevard/Farrington Highway	670
Kapolei Parkway/North-South Road	790
Saratoga Avenue/North-South Road	820
Geiger Road/Fort Weaver Road	850
<b>II. Fort Weaver Road to Aloha Stadium</b>	
Farrington Highway/Kamehameha Highway	990
<b>III. Aloha Stadium to Middle Street</b>	
Salt Lake Boulevard	580
Mauka of the Airport Viaduct	680
Makai of the Airport Viaduct	820
Aolele Street	690
<b>IV. Middle Street to Iwilei</b>	
North King Street	450 <sup>2</sup>
Dillingham Boulevard	400
<b>V. Iwilei to UH Mānoa</b>	
Beretania Street/South King Street	1,340 <sup>3</sup>
Hotel Street/Kawaiaha'o Street/Kapi'olani Boulevard	1,480 <sup>4</sup>
King Street/Waimanu Street/Kapi'olani Boulevard	1,900
Nimitz Highway/Queen Street /Kapi'olani Boulevard	1,150
Nimitz Highway/Halekauwila Street/Kapi'olani Boulevard	1,230 <sup>5</sup>
Waikīkī Branch	350

<sup>1</sup> Finance charges are not included.

<sup>2</sup> Connecting from Salt Lake Boulevard to North King Street would reduce this value to \$400 million.

<sup>3</sup> Connecting from North King Street to Beretania Street would reduce this value to \$1.12 billion.

<sup>4</sup> Connecting from North King Street to Hotel Street would reduce this value to \$1.45 billion.

<sup>5</sup> Connecting from North King Street to Nimitz Highway would increase this value to \$1.24 billion.

## Operating and Maintenance Costs

### Estimation Methods

Detailed bus budgetary and operating data were obtained from O'ahu Transit Services for FY 04-05, and the associated unit costs were developed for that year. These costs were escalated to standardize bus costs in 2006 dollars.

Unit costs for the fixed guideway operation and maintenance (O&M) cost model were developed using data from FTA's National Transit Database by assigning driving variables to line item object class expenses. Sacramento's Regional Transit District light rail system was determined to be representative of the fixed guideway service, and 2003 to 2004 light rail cost data from that system were used to develop fixed guideway unit costs. The costs were escalated to standardize fixed guideway costs in 2006 dollars and further adjusted upward to account for higher costs in Honolulu, as compared to the Sacramento area.

Peak operating fleet sizes were determined from the operating plans for each alternative. The total fixed guideway fleet size is based on limiting the average annual vehicle

mileage to 80,000, and is calculated by dividing the annual revenue vehicle miles by this number.

**Transit Operating and Maintenance Cost Estimates by Alternative**

Table 5-3 presents estimated year 2030 transit operating and maintenance costs for each alternative in 2006 dollars. Operating costs in 2030 for the No Build Alternative are estimated to be approximately \$192 million. This compares to current operating costs for the existing bus system of about \$132 million. The increase would result from expansion of the bus system, including the use of more articulated vehicles, to continue to meet current service levels with increased demand and roadway congestion.

**Table 5-3. Estimated Year 2030 Annual Transit Operating and Maintenance Costs (millions 2006 dollars)**

Alternative	Bus O&M Cost	Fixed Guideway O&M Cost	Total O&M Cost
<b>Alternative 1: No Build</b>			
No Build Alternative	191.9	-	191.9
<b>Alternative 2: Transportation System Management</b>			
TSM Alternative	234.2	-	234.2
<b>Alternative 3: Managed Lane</b>			
Two-Direction Option	250.9	-	250.9
Reversible Option	261.1	-	261.1
<b>Alternative 4: Fixed Guideway</b>			
Kalaeloa - Salt Lake - North King - Hotel	169.3	78.9	248.2
Kamokila - Airport - Dillingham - King with a Waikiki Branch	168.7	79.9	248.6
Kalaeloa - Airport - Dillingham - Halekauwila	173.0	83.1	256.1
20-mile Alignment East Kapolei to Ala Moana Center	189.2	61.4	250.6

The estimated operating costs for the TSM Alternative would be approximately \$42 million greater than for the No Build Alternative, reflecting the higher level of bus service. Transit operating costs for the Managed Lane Alternative would range between approximately \$251 and \$261 million as a result of additional buses that would be put in service under that alternative.

Estimated operating costs for the Fixed Guideway Alternative would range between

## **Proposed Funding Sources**

### ***Sources of Project Capital***

Funding sources for capital investments include a State General Excise and Use Tax (GET) surcharge, City general obligation bonds, and FTA funds. In addition, other potential sources are discussed in a later section of this chapter.

#### **General Excise and Use Tax Surcharge**

A 0.5 percent surcharge on the GET will be levied on transactions generated in the City and County of Honolulu from January 1, 2007 to December 31, 2022. The State Council on Revenues' May 2006 forecast of GET revenues from Fiscal Years 2006-2007 to 2012-2013 was used in conjunction with a baseline historical trend in developing a forecast for this revenue source. Table 5-4 presents the estimated annual GET surcharge revenues for three scenarios, net of a 10 percent reduction from the State for tax collection and administration purposes. The "Trend Forecast" is a statistical projection based on historical GET collections for O'ahu. The second scenario, "Council on Revenues 1," is based on the Council on Revenues' GET forecast through June 30, 2013, with a growth stabilized to historical levels through 2022. The "Council on Revenues 2" scenario is the Council on Revenues' GET forecast through June 30, 2013, with sustained growth at the 2007 to 2013 levels through 2022.

The State legislation establishing the GET surcharge limits the expenditure of monies collected to operating or capital costs of a locally preferred alternative for a mass transit project. The funds cannot be used to build or repair public roads or highways, bicycle paths, or support public transportation systems existing as of July 2005. Accordingly, under current law, the GET surcharge can be expended on the Fixed Guideway Alternative but cannot be used for existing transit services for the No Build and TSM Alternatives or to construct the Managed Lane Alternative.

#### **City General Obligation Bonds**

The City issues general obligation bonds to construct bus facilities and to purchase equipment and rolling stock. General obligation bonds are direct obligations of the City for which its full faith and credit are pledged. This source can be used by all alternatives, but expenditures are subject to appropriation by the Honolulu City Council.

#### **FTA Section 5309 New Starts Program (49 U.S.C. Section 5309)**

The New Starts program provides funds for construction of new fixed guideway systems or extensions to existing fixed guideway systems costing at least \$250 million. A fixed guideway refers to any transit facility that uses exclusive or controlled rights-of-way or rails, entirely or in part.

Eligible purposes for these funds include light rail line, rapid rail (heavy rail), commuter rail, automated fixed guideway system (such as a "people mover"), a busway/HOV facility, or an extension of any of these. Also, New Starts projects can involve the development of transit corridors and markets to support the eventual construction of fixed

guideway systems, including the construction of park-and-ride lots and the purchase of land to protect rights-of-way.

**Table 5-4. GET Surcharge Revenues for Three Growth Scenarios 2007-2022**

Calendar Year	Trend Forecast		Council on Revenues 1		Council on Revenues 2	
	Net Revenues (2006 \$ M)	Net Revenues (YOE <sup>1</sup> \$ M)	Net Revenues (2006 \$ M)	Net Revenues (YOE \$ M)	Net Revenues (2006 \$ M)	Net Revenues (YOE \$ M)
2007	154	162	164	172	164	172
2008	155	169	170	185	170	185
2009	156	175	175	196	175	196
2010	157	181	178	206	178	206
2011	158	188	181	216	181	216
2012	159	195	185	227	185	227
2013	161	203	187	236	190	240
2014	162	211	189	246	195	253
2015	164	220	191	256	200	267
2016	166	229	193	267	205	283
2017	168	239	195	278	210	299
2018	170	249	198	289	215	316
2019	172	259	200	301	221	333
2020	173	269	202	314	227	352
2021	175	280	204	327	233	372
2022	177	292	206	340	239	393
<b>TOTAL</b>	<b>2,626</b>	<b>3,520</b>	<b>3,018</b>	<b>4,056</b>	<b>3,185</b>	<b>4,310</b>

<sup>1</sup>YOE = year of expenditure

Only the Fixed Guideway Alternative would be eligible for New Starts funding. The No Build and TSM Alternatives would not be eligible because they do not entail construction of a fixed guideway facility. The Managed Lane Alternative would not be eligible for New Starts funding because of use by toll-paying single-occupancy vehicles, which are excluded from the statutory definition of “fixed guideway” (49 USC Section 5302).

Projects become candidates for funding under this program by successfully completing the appropriate steps in FTA’s major capital investment planning and project development process. Projects must also meet certain project justification and financial commitment criteria specified in law and regulation. Funding allocation recommendations are made by FTA in an annual report to Congress. For this report, a funding level between \$800 million and \$1,200 million in YOE dollars was assumed to be reasonable and plausible.

**Sources for System Capital Replacement and Operating and Maintenance (O&M) Expenses**

Establishing that the initial capital expenses of a particular alternative can be funded does not necessarily imply that the long-term operating and maintenance and capital replacement expenses also can be funded. The feasibility of sustaining the investment in an alternative during and after the implementation period was also assessed.

Honolulu currently receives the following sources of Federal funding for transit:

- Section 5307 Urbanized Area Formula Program
- Section 5309 Capital Investment Grants and Loans - Rail and Fixed Guideway Modernization Program
- Section 5309 Bus and Bus Facilities Discretionary Funds.

#### **FTA Urbanized Area Formula Program (49 USC Section 5307)**

FTA Section 5307 funds are apportioned on the basis of legislative formulae. For areas of 50,000 to 199,999 in population, the formula is based on population and population density. For areas with populations of 200,000 and more, the formula is based on a combination of bus revenue vehicle miles, bus passenger miles, fixed guideway revenue vehicle miles, and fixed guideway route miles, as well as population and population density. The City is the designated recipient for Section 5307 funds apportioned to the Honolulu urbanized area and to the Kailua-Kāneʻohe urbanized area.

Activities eligible for Section 5307 funds include planning, engineering design, and



Eligible purposes include: acquisition of buses for fleet and service expansion; bus maintenance and administrative facilities; transfer facilities; bus malls; transportation centers; intermodal terminals; park-and-ride stations; acquisition of replacement vehicles; bus rebuilds; bus preventative maintenance; passenger amenities such as passenger shelters and bus stop signs; accessory and miscellaneous equipment such as mobile radio units; supervisory vehicles; fareboxes; and computers, shop and garage equipment. The bus-related elements of all the alternatives are eligible for Bus Capital funds, if so allocated by Congress.

The discretionary nature of this program makes the level of funding difficult to predict, as it is subject to Congressional earmarking. Future allocations were forecast using the City's historical 10-year growth rate in bus and bus capital funding of 4.8 percent.

### ***Rail and Fixed Guideway Modernization (FGM) Program***

A fixed guideway refers to any transit service that uses exclusive or controlled rights-of-way or rails, entirely or in part. The term includes that portion of motor bus service operated on exclusive or controlled rights-of-way and HOV lanes.

Eligible purposes include capital projects to modernize or improve fixed guideway systems (e.g., purchase and rehabilitation of rolling stock, track, line equipment, structures, signals and communications, power equipment and substations, passenger stations and terminals, security equipment and systems, maintenance facilities and equipment, operational support equipment, including computer hardware and software, system extensions, and preventative maintenance). All alternatives would be eligible for FGM funds.

FGM funds are apportioned using a formula containing seven tiers, and the City's apportionment is based on bus service operating on the Fort Street Transit Mall and HOV lanes. FGM apportionment amounts for 2007 to 2009 reflect FTA's estimates. For 2010 to 2022, the apportionment amounts are assumed to grow at an annual rate of 2.1%, consistent with the Congressional Budget Office forecast of the Highway Trust Fund revenues through 2016, extended through 2022. As with the Section 5307 formula funds, the implementation of an alternative would lead to an increase in the formula apportionment amount due to the improved level of service.

### **Growth in Federal Funding Due to Project Implementation**

Each of the four alternatives studied in the AA would have some incremental effect on the amount of funding that Honolulu receives from these sources. In the case of the Section 5307 Urbanized Area Formula program and the Section 5309 Fixed Guideway Modernization program, an expansion of the parameters considered in the calculation of funding would result in increased assistance for Honolulu, subject to a growing national authorization for these programs. In the case of the Section 5309 Bus Discretionary

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program, added buses or bus-related improvements do not necessarily correspond to increases in the FTA contribution. Table 5-5 shows the 2007 and 2030 FTA revenue expectations for each alternative.

**Table 5-5. Expected FTA Revenues by Alternative in 2007 and 2030 (in millions of year of expenditure dollars)**

Year	Source	Alternative				
		No Build	TSM	Managed Lane	20-mile Alignment East Kapolei to Ala Moana Center	Full-corridor Alignments
FY 2007	5307	26	26	26	26	26
	5309 FGM	1	1	1	1	1
	5309 Bus	8	8	8	8	8
	<b>TOTAL</b>	<b>35</b>	<b>35</b>	<b>35</b>	<b>35</b>	<b>35</b>
FY 2030	5307	58	60	59	79	101
	5309 FGM	2	2	2	35	48
	5309 Bus	23	23	23	23	23
	<b>TOTAL</b>	<b>83</b>	<b>85</b>	<b>84</b>	<b>137</b>	<b>172</b>

**City and County Revenue Sources**

The City's contribution to transit O&M is funded using local revenues from the General and Highway Funds. During the 1994 to 2005 period, revenues from these two local sources total a combined \$8.4 billion, of which \$920 million (11 percent) has gone to transit. During this period, the General Fund and Highway Fund grew at a real annual rate (net of inflation) of 0.65%. This growth rate is assumed to continue through the analysis period.

The City provides the local match to federal funds for capital replacement and expansion from the Highway Improvement Bond Fund.

**Additional Sources**

The discussion above focuses on sources that are the most likely to have the largest impact on the feasibility of the project alternatives. However, other sources for both project capital and ongoing expenses can be sought as additional revenues, if needed. These additional sources include, on the project capital side, additional local taxes not yet passed for transit use, private real-estate-related sources, such as Tax Increment Financing, Benefit Assessment Districts, and Developer Mitigation Fees, as well as bonding against future user fees for the Managed Lane Alternative. On the ongoing funding side, increases in fares and other user fees and increases in local taxes could be

Honolulu currently issues General Obligation (GO) debt for the benefit of transit. Though GO debt capacity for this use is currently constrained by current obligations, given affordability guidelines, it is reasonable to assume that the capacity for future GO debt would increase if GET surcharge revenues are received, thereby enabling GO bonding for the project. Another option would be the issuance of revenue bonds backed only by future GET surcharge collections.

## **Assessment of Financial Feasibility of the Alternatives**

### ***Financial Feasibility of Major Capital Investment***

#### **No Build and TSM Alternatives**

The No Build and TSM Alternatives correspond essentially to an improvement in bus service. Therefore, their relative capital cost is not differentiated from the ongoing bus replacement, and expansion capital cost and financial feasibility will be determined in the context of ongoing systemwide capital needs discussed below.

#### **Managed Lane Alternative**

The Managed Lane Alternative is not eligible for GET surcharge revenues. Therefore, the financial feasibility of the capital investment has to be assessed using existing local funding in the form of GO Bonds, as well as toll revenues from users of the managed lane facility. Since the Reversible Option is the lesser cost option and its transportation performance is similar to that of the Two-Direction Option, the financial feasibility analysis for the Managed Lane Alternative focuses on the Reversible Option.

The Managed Lane Alternative generates revenue from tolls paid by vehicles using the facility. The toll rates would be set at such a level as to manage vehicular demand to maintain operating conditions at a speed of 50 mph or better. For year 2030, peak period toll rates are estimated to be \$6.40 for the Reversible Option, in 2006 dollars. In off-peak times, the toll rates are estimated to be \$2.85 for the Reversible Option, in 2006 dollars. On an average weekday in 2030, 14,660 toll-paying vehicles are estimated to use the facility in the peak period; 940 vehicles in the off-peak period. This is estimated to yield approximately \$29 million in annual toll revenue, in 2006 dollars. The cost of operating and maintaining the toll facilities is estimated to be \$7.6 million, for net revenues of \$21.4 million, in 2006 dollars, and \$43.4 in YOE dollars.

Table 5-6 shows sources and uses of funds for the financing of the Reversible Option. The alternative has an estimated capital cost of \$2.57 billion in 2006 dollars. In Year of Expenditure dollars, the estimated amount is \$3.27 billion. Since no toll revenues would be obtained until after the managed lane facility is in operation, the City would need to issue bonds with the net toll revenues as a first pledge, along with other City tax revenues. That decision would have cost and policy implications that go beyond the scope of the present study. The City's debt policy and affordability guidelines imply a stringent limit on annual debt service, and preliminary analysis of outstanding debt as of August 2005 suggests that there is only a limited amount of room left for incremental

rating downgrade, incurring a higher interest cost not only for the project itself, but for any other city project funded by GO Bonds.

**Table 5-6. Sources and Uses of Funds for the Managed Lane Reversible Option**

	2006\$ M	YOE <sup>1</sup> \$ M
Net Toll Revenues	664	1,524
Other Sources	3,020	5,220
Total Revenues	3,684	6,744
Capital Costs	2,572	3,267
Financing Costs	1,112	3,477
Total Costs	3,684	6,744

<sup>1</sup>YOE - year of expenditure  
Amounts may not add up due to rounding.

Assuming that the full cost of the Managed Lane - Reversible Option is financed with 30-year bonds with an interest rate of 5.5%, principal and interest payments over the term of the loan period would total approximately \$6.74 billion in YOE dollars. The debt service payment, in FY 2030, would be approximately \$225 million in YOE dollars. Estimated net toll revenues in 2030 would be approximately \$43 million in YOE dollars, leaving a balance of over \$180 million to be paid from other City sources. Over the life of the loans, through 2047, net toll revenues are anticipated to pay for approximately 23 percent (\$1,524 million) of the total debt service, and the remaining 77 percent (\$5,220 million) would be paid from the General Fund or Highway Fund.

### **Fixed Guideway Alternative**

The financial feasibility of two Fixed Guideway alignments has been explored: the lowest cost Full-corridor Alignment, the Kalaeloa - Airport - Dillingham - Halekauwila alignment, and the 20-mile Alignment East Kapolei to Ala Moana Center.

The financial feasibility analysis assumed that debt financing would be limited to meeting the needs of the peak years of project construction when yearly costs would exceed revenues available from the GET surcharge and federal sources. A generic limited-duration loan debt structure was modeled with interest rate assumptions based on a tax-exempt coupon equivalent to six percent. The six percent interest rate is based on four percent insured tax-exempt security as of October 2, 2006, plus 100 basis points accounting for future increases in interest rates and 100 basis points for other fees. For the alternative that is eligible for GET surcharge revenues, funds at the beginning of the project, when in excess of project costs, are entered into a trust or savings account.

Table 5-7 and Table 5-8 show sources and uses of funds for the financing of the Full-corridor Alignment and the 20-mile Alignment, assuming the different GET surcharge revenue scenarios, described previously. Table 5-7 shows that for all three scenarios GET surcharge revenues and \$1.2 Billion (YOE \$) in New Starts funds would be insufficient to fund the Full-corridor Alignment project. Other sources of revenue would be needed, in addition. Table 5-8 shows that for both Council on Revenues scenarios, GET surcharge revenues and New Starts funds of less than \$1.2 Billion would be sufficient to fund the 20-mile Alignment project. Additional revenue would be needed in the case of the Trend Forecast scenario.

**Table 5-7. Sources and Uses of Funds - Full-corridor Alignment**

	Trend Forecast		Council on Revenues 1		Council on Revenues 2	
	2006 \$M	YOE <sup>1</sup> \$M	2006 \$M	YOE \$M	2006 \$M	YOE \$M
Total Net GET Surcharge Revenues	2,626	3,520	3,018	4,056	3,185	4,310
New Starts Funds	933	1,200	934	1,200	934	1,200
Other Sources	1,234	1,586	860	1,106	717	922
Total Revenues	4,793	6,306	4,812	6,362	4,836	6,432
Fixed Guideway Capital Cost	4,621	5,943	4,621	5,943	4,621	5,943
Net Interest Costs	172	363	191	418	216	488
Total Cost	4,793	6,306	4,812	6,362	4,836	6,432

<sup>1</sup>YOE - year of expenditure  
Amounts may not add up due to rounding.

**Table 5-8. Sources and Uses of Funds - 20-mile Alignment**

	Trend Forecast		Council on Revenues 1		Council on Revenues 2	
	2006 \$M	YOE <sup>1</sup> \$M	2006 \$M	YOE \$M	2006 \$M	YOE \$M
Total Net GET Surcharge Revenues	2,626	3,520	3,018	4,056	3,185	4,310
New Starts Funds	948	1,200	802	1,015	662	837
Other Sources	223	282	0	0	0	0
Total Revenues	3,797	5,002	3,820	5,071	3,847	5,147
Fixed Guideway Capital Cost	3,605	4,559	3,605	4,559	3,605	4,559
Net Interest Costs	192	443	216	511	243	587
Total Cost	3,797	5,002	3,820	5,071	3,847	5,147

<sup>1</sup>YOE - year of expenditure  
Amounts may not add up due to rounding.

**Cash Flow Table**

An example of financing using a generic limited-duration loan debt structure is presented in Table 5-9. A cash flow table through 2022 is presented for the 20-mile Alignment East Kapolei to Ala Moana Center, with the Council on Revenue 1 revenue scenario. As shown, in 2007 and 2008 funds from the GET surcharge and FTA New Starts are greater than are needed for project expenditures, so the balance is deposited into a savings account. The savings account balance is drawn down over the following three years, 2009 to 2011. The total Transfer from Savings amount, \$320 million, exceeds the

Deposit to Savings amount, \$284 million, reflecting \$36 million in interest earnings. Beginning in 2011, through 2016, loan proceeds of \$1,378 million are used to supplement other revenue sources in completing the project. The loan principal is repaid in the period from 2017 to 2022. Financing costs are paid during the 2012 to 2022 period. These financing costs of \$547 million, less the \$36 million in interest earnings described above, total a net interest cost of \$511, as shown in Table 5-8.

***Financial Feasibility of the Capital Replacement and Operating Needs***

Table 5-5 showed the estimated amount of Federal funds expected from the Section 5307 Urbanized Area Formula program, the Section 5309 Fixed Guideway Modernization

— amount of the Section 5309 Fixed Guideway Modernization program. These funds are 111

**Table 5-9. Fixed Guideway 20-mile Alignment Cash Flow, Council on Revenues Scenario 1**

Transaction	Year and amount in millions of year-of-expenditure dollars																
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
<b>Capital Funding Sources</b>																	
FTA New Starts	4	4	4	91	134	178	165	162	142	81	44	6	-	-	-	-	1,015
GET Surcharge	172	185	196	206	216	227	236	246	256	267	278	289	301	314	327	340	4,056
Transfer from Savings	-	-	118	81	120	-	-	-	-	-	-	-	-	-	-	-	320
Loan Proceeds	-	-	-	-	86	344	314	311	256	68	-	-	-	-	-	-	1,378
<b>Total Sources</b>	<b>176</b>	<b>189</b>	<b>318</b>	<b>378</b>	<b>556</b>	<b>749</b>	<b>715</b>	<b>719</b>	<b>654</b>	<b>416</b>	<b>322</b>	<b>295</b>	<b>301</b>	<b>314</b>	<b>327</b>	<b>340</b>	
<b>Capital Outlays</b>																	
Construction Costs	-	-	249	302	463	629	578	564	487	257	150	-	-	-	-	-	3,680
Soft Costs	40	41	69	76	92	110	106	106	101	81	32	25	-	-	-	-	880
<i>Subtotal</i>	<i>40</i>	<i>41</i>	<i>318</i>	<i>378</i>	<i>555</i>	<i>739</i>	<i>684</i>	<i>670</i>	<i>588</i>	<i>338</i>	<i>185</i>	<i>25</i>					<i>4,560</i>
Deposits to Savings	137	148	-	-	-	-	-	-	-	-	-	-	-	-	-	-	284
Loan Principal Repayment	-	-	-	-	-	-	-	-	-	-	59	195	238	265	294	326	1,378
Financing Costs	-	-	-	-	-	10	30	48	66	78	81	75	63	49	32	15	547
<b>Total Outlays</b>	<b>176</b>	<b>189</b>	<b>318</b>	<b>378</b>	<b>556</b>	<b>749</b>	<b>715</b>	<b>719</b>	<b>654</b>	<b>416</b>	<b>322</b>	<b>295</b>	<b>301</b>	<b>314</b>	<b>327</b>	<b>340</b>	

Note: Amounts may not add up due to rounding.

**Table 5-10. Average Fare Box Recovery Ratio and City Operating Support to Transit**

Alternative	Fare Box Recovery Ratio		City Operating Support to Transit <sup>1</sup>	
	FY 2007	FY 2030	FY 2007	FY 2030
No Build Alternative	29%	28%	11%	13%
TSM Alternative	29%	24%	11%	18%
Managed Lanes Alternative - Reversible Option	29%	22%	11%	21%
Full Length Fixed Guideway Alternative, Kalaeloa - Airport - Dillingham - Halekauwila alignment	29%	29%	11%	14%
20-Mile Fixed Guideway Alignment East Kapolei to Ala Moana Center	29%	28%	11%	15%

<sup>1</sup>Transit operating subsidy as a percentage of total General Fund and Highway Fund revenues.

The final funding source available for O&M expenses are funds from the Highway Fund and General Fund. As shown in Table 5-10, the TSM Alternative and the Managed Lane Alternative would require the largest percentage subsidy from the City's operating budget.

## Risks and Uncertainties

The foregoing analysis has discussed the financial feasibility of implementing the various alternatives, given current cost and revenue estimates. However, uncertainties around key economic and financial factors remain, and the City will have to take the necessary steps in order to mitigate those risks as much as possible.

### **Economic Risk**

Economic risks include such factors as the inflation rate and the vitality of the general economy. An increase in inflation beyond current expectations would result in increased costs for all alternatives, including capital costs, financing costs, and O&M costs. On the other hand, key revenue sources, including the GET surcharge and several of the City's General Fund and Highway Fund revenue sources, would likely experience additional growth with an increase in inflation rates. A downturn in the economy would negatively affect revenues from tax collection on the island but could also result in a slowing in the growth of construction costs.

### **Level of FTA Funds**

The level of FTA funds is subject to annual appropriations and program reauthorizations approximately every six years. The analyses assume that future FTA funding levels will keep the same growth trends as in the recent past. Future reauthorization legislation may



## **Construction Risk**

Scheduling delays, world market conditions, the availability of skilled labor, and unforeseen construction challenges can lead to cost increases that may challenge the financial feasibility of the project. The capital cost estimates include contingencies, both those allocated to specific cost elements and an overall project reserve amount, which add approximately 33% to the cost estimate, in year 2006 dollars. The financial analysis also makes assumptions concerning construction cost inflation. During the 1990s, construction cost escalation consistently trailed the general rate of inflation. In the early 2000s, due to world market conditions and storm impacts, that situation was reversed, with construction costs growing more rapidly than the general rate of inflation. This analysis assumes that construction costs will continue to grow more rapidly than the general rate of inflation through 2008, then will grow at the general rate of inflation.

**Optimum Alternatives**

Several options were evaluated within the Managed Lane and Fixed Guideway Alternatives. Over the course of the analysis presented in Chapter 3 through Chapter 5, the relative merits of the various operational and alignment options became clear. This section compares the various options and selects the optimum Managed Lane and Fixed Guideway option for comparison between all of the alternatives later in this chapter.

**Managed Lane Alternative**

Two options were evaluated for the Managed Lane Alternative: a Reversible Option and a Two-direction Option. The Two-direction Option would allow express buses to use the managed lane roadway in both directions throughout the day; however, the difference in transit benefit would be very small. Travel times in the corridor are similar for both options, with each option showing a one or two minute advantage between some locations. Comparison of environmental impacts between the options shows small trade-offs, but neither option is substantially better than the other.

Project costs are the greatest differentiator between the options. At \$2.5 billion (in 2006 dollars), the Reversible Option would be nearly 30 percent less expensive than the Two-direction Option. The lower cost and similar performance between the two options results in better cost-effectiveness for the Reversible Option (Table 6-1). Because the performance differences between the two options would be small, the Reversible Option would offer a better benefit-to-cost ratio; therefore, it would be the optimum Managed Lane option. The evaluation of the Managed Lane Alternative that appears later in this chapter considers the Reversible Option only.

**Fixed Guideway Alternative**

The various alignment options would provide a range of benefits, impacts, and costs within each corridor section evaluated for the Fixed Guideway Alternative. The alignment options are compared by section below. The comparison results in an

**Table 6-1. Transportation System Costs and Transit User Benefits Compared to No Build**

Measure	No Build Alternative	Managed Lane Alternative						Fixed Guideway Alternative							
		TSM Alternative		Two-Direction Option		Reversible Option		Kalaeloa - Salt Lake - North King - Hotel		Kamokila - Airport - Dillingham - King with a Waikiki Branch		Kalaeloa - Airport - Dillingham - Halekauwila		20-mile Alignment East Kapolei to Ala Moana Center	
		Value	Incremental Change	Value	Incremental Change	Value	Incremental Change	Value	Incremental Change	Value	Incremental Change	Value	Incremental Change	Value	Incremental Change
Annualized Capital Cost (Millions 2006 Dollars)	\$43.52	\$59.80	\$16.28	\$335.14	\$291.62	\$257.87	\$214.35	\$387.31	\$343.79	\$445.73	\$402.21	\$380.66	\$337.14	\$308.23	\$264.71
Year 2030 Systemwide O&M Cost (Millions 2006 Dollars)	\$191.90	\$234.20	\$42.30	\$250.90	\$59.00	\$261.10	\$69.20	\$248.20	\$56.30	\$248.60	\$56.70	\$256.10	\$64.20	\$250.60	\$58.70
Total 2030 Annualized Cost (Millions 2006 Dollars)	\$235.42	\$294.00	\$58.58	\$586.04	\$350.62	\$518.97	\$283.55	\$635.51	\$400.09	\$694.33	\$458.91	\$636.76	\$401.34	\$558.83	\$323.41
Year 2030 Incremental User Benefits (Hours of Benefit)	N/A	N/A	4,325,100	N/A	5,528,500	N/A	5,632,700	N/A	18,770,200	N/A	16,963,900	N/A	18,573,900	N/A	15,153,600
Cost-Effectiveness (Cost per User Benefit)	N/A	N/A	\$13.54	N/A	\$63.42	N/A	\$50.34	N/A	\$21.32	N/A	\$27.05	N/A	\$21.61	N/A	\$21.34

N/A = Not Applicable. Transit user benefits are calculated relative to the performance of the No Build Alternative.

**Section I. Kapolei to Fort Weaver Road**

In Section I, the Saratoga Avenue/North-South Road alignment would be of greatest

benefit to transit riders, allowing walking access to the greatest number of transit riders in

#### **Section IV. Middle Street to Iwilei**

A greater number of transit riders would use the Dillingham alignment compared to the North King Street alignment.

The Dillingham alignment would require more property acquisitions; however, fewer would be residential parcels. More noise impacts would occur and a greater number of potentially historic properties is located along the North King Street alignment.

When connecting to the Section III alignments at Nimitz Highway, the Dillingham alignment would cost less at \$400 million than the North King Street alignment at \$450 million.

The Dillingham alignment would be the best alignment option within Section IV.

#### **Section V. Iwilei to UH Mānoa**

Section V is the most complex area within the study corridor. The Beretania Street/South King Street alignment would serve substantially fewer transit riders than the other alignments.

The Hotel Street/Kawaiaha'o Street/Kapi'olani Boulevard alignment would require acquisition of the greatest number of residential parcels and affect a greater number of cultural practices and the greatest number of burials of any alignment within the study corridor.

The King Street Tunnel alignment is the most expensive alignment within the study corridor at \$1.9 billion. The Queen Street alignment would be least expensive at \$1.15 billion, followed by the Halekuanile Street alignment at 1.02 billion.

The Nimitz Highway/Halekauwila Street/Kapi‘olani Boulevard alignment would be the best alignment option within Section V. The Waikīkī Branch is not included because of the cost that it would add to the project.

### **Twenty-mile Alignment**

As discussed in Chapter 2, the FTA guidance recommends evaluation of one or more options of various lengths within the study corridor to provide intermediate-cost alternatives within an AA.

Several portions of the corridor could be selected within the Kalaeloa - Airport - Dillingham - Halekauwila Alignment; however, the 20-mile Alignment should be able to provide substantial benefit to transit users independent of the remainder of the system under long-range consideration. As indicated by the financial analysis presented in Chapter 5, identified funding sources may be reasonably expected to generate approximately \$3.6 billion to support the project.

The project that would serve as much of the study corridor as practical and provide the greatest user benefit within \$3.6 billion would be the section that begins at one station makai of UH West O‘ahu and continues Koko Head following Farrington Highway/Kamehameha Highway to Aolele Street and Dillingham Boulevard, and then continues elevated following Nimitz Highway to Ala Moana Center.

## **Effectiveness at Meeting Goals and Objectives**

### ***Improve Corridor Mobility***

The No Build and TSM Alternatives would continue to serve the study corridor with bus service. Transit would serve 6.1 percent of daily trips for the No Build Alternative and 6.4 percent of daily trips with the TSM Alternative (Table 3-3). Daily vehicle miles traveled and vehicle hours of delay, a measure of time lost to traffic congestion, would increase substantially compared to today (Table 3-10). During the a.m. peak-period, travel times on transit would remain similar to today or decrease slightly because of increased transit service, while auto travel times would increase in the corridor (Table 3-6). Transit reliability would continue to be affected by roadway conditions.

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The Managed Lane Alternative would provide transit service similar to the TSM Alternative, only with an additional roadway facility for express service in a portion of

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During peak-periods, the transit share would be even higher, with 16.2 percent of home-based work trips served by transit for the Full-corridor Alignment and 15.2 percent with the 20-mile Alignment (Table 3-4). Daily vehicle miles traveled and vehicle hours of delay, a measure of time lost to traffic congestion, would be less than for the No Build Alternative (Table 3-10). Daily vehicle miles traveled would be 3.4 percent less for the Full-corridor Alignment and 3.1 percent less with the 20-mile Alignment. Daily vehicle hours of delay would be 18 percent less for the Full-corridor Alignment and 11 percent less with the 20-mile Alignment; this represents a substantial reduction in traffic congestion compared to the No Build Alternative in 2030. During the a.m. peak-period, travel times on transit would be substantially reduced for several travel routes compared to the No Build Alternative (Table 3-6).

### ***Encourage Patterns of Smart Growth and Economic Development***

The No Build and TSM Alternatives would continue to serve the study corridor with bus service. Neither alternative would provide concentrations of transit service that would serve as a nucleus for transit-oriented development.

The Managed Lane Alternative would provide similar transit service to the TSM Alternative, with an additional roadway facility for express service in a portion of the corridor. It would not further encourage smart growth compared to the TSM Alternative. Daily vehicle miles traveled would be greater for the Managed Lane Alternative than for any other alternative (Table 3-10).

The Fixed Guideway Alternative is the only alternative that would include new stations providing reliable high-capacity transit at locations zoned for new development or suitable for redevelopment. With supportive regulations, substantial transit-oriented development could be served by the Fixed Guideway Alternative. Because the Full-corridor Alignment would better serve Kapolei, it would provide more opportunity for smart growth and transit-oriented economic development than the 20-mile Alignment.

### ***Find Cost-Effective Solutions***

User benefits have been defined by FTA as a measure of transit user time savings calculated in comparison to the TSM Alternative. The Managed Lane Alternative would provide approximately 2 million hours of user benefits annually at an annualized incremental cost compared to the TSM Alternative of approximately \$225 million (Table 3-11).

**Table 6-2. Incremental Cost per Hour of Transportation System User Benefits Compared to TSM Alternative**

Measure	TSM Alternative	Fixed Guideway Alternative					
		Managed Lane Alternative		Full-corridor Alignment		20-mile Alignment East Kapolei to Ala Moana Center	
		Value	Incremental Change compared to TSM	Value	Incremental Change compared to TSM	Value	Incremental Change compared to TSM
Annualized Capital Cost (2006 Dollars)	\$59,797,000	\$257,868,000	\$198,073,000	\$380,658,000	\$320,863,000	\$308,228,000	\$248,433,000
Year 2030 Systemwide O&M Cost (2006 Dollars)	\$234,200,000	\$261,100,000	\$26,900,000	\$256,100,000	\$21,900,000	\$250,600,000	\$16,400,000
Total 2030 Annualized Cost (2006 Dollars)	\$293,997,000	\$518,968,000	\$224,973,000	\$636,758,000	\$342,763,000	\$558,828,000	\$264,833,000
Year 2030 Incremental User Benefits (Hours of Benefit)	N/A	N/A	2,191,900	N/A	15,504,500	N/A	11,638,500
Cost Effectiveness (Cost per Hour of User Benefit)	N/A	N/A	\$102.64	N/A	\$22.11	N/A	\$22.75

N/A = Not Applicable. User benefits are calculated relative to the performance of the TSM Alternative.



**Provide Equitable Solutions**

The No-Build and TSM Alternatives conceptually maintain the status quo, providing transit

### ***Minimize Community and Environmental Impacts***

The No Build and TSM Alternatives would generate no direct environmental impacts; however, they would also not generate any environmental benefits.

The Managed Lane Alternative would require a moderate number of displacements and would affect a moderate number of potentially historic structures, as well as one recreational facility. It would generate the greatest amount of air pollution, require the greatest amount of energy for transportation use, and would result in the largest number of transportation noise impacts. It would provide little community benefit, as it would not provide substantially improved transit access to the corridor.

The Fixed Guideway Alternative would require more displacements and affect more potentially historic structures, as well as three park or recreational facilities. It would result in fewer transportation noise impacts than the Managed Lane Alternative.

Visual impacts for the Fixed Guideway Alternative would be less than those for the Managed Lane Alternative in areas where both alternatives would include structures, but the Fixed Guideway Alternative would extend beyond the area of the Managed Lane Alternative. The visual impacts of the 20-mile Alignment would be less than for the Full-corridor Alignment because the area of effect would be less.

The Fixed Guideway Alternative would generate the least air pollution and require the least energy for transportation. It would provide improved connections between communities, employment, and services in the corridor. The benefits of the Full-corridor Alignment would be somewhat greater than those for the 20-mile Alignment.

### ***Achieve Consistency with Other Planning Efforts***

All alternatives are generally consistent with Local, District, and State plans. The Fixed Guideway Alternative best serves the areas of O'ahu that are designated for future growth and development. The Fixed Guideway Alternative is the only alternative that is consistent with regional transportation system planning defined in the *2030 O'ahu*

service that would serve as a nucleus for transit-oriented development. The Fixed Guideway Alternative would include new stations providing reliable high-capacity transit at locations zoned for new development or suitable for redevelopment. The Full-corridor Alignment would provide the greatest opportunity for smart growth, but considerable opportunities also would occur with the 20-mile Alignment.

The Fixed Guideway Alternative is substantially more cost-effective than the Managed Lane Alternative when the respective cost per transit user benefit relative to the TSM Alternative are compared (Table 6-2).

The Fixed Guideway Alternative best meets the goal of providing equitable solutions. The Full-corridor Alignment would best serve transit-dependent populations, but the 20-mile Alignment would serve the majority of those served by the Full-corridor Alignment.

The No Build and Fixed Guideway Alternatives are financially feasible considering reasonably certain funding sources. The No Build Alternative would continue bus service using existing funding mechanisms. The TSM Alternative would require a limited amount of additional funds, but the source of those funds is not defined. Because the implementing legislation prohibits the GET surcharge from being used to fund existing transit systems, it would not be available to fund the TSM Alternative. The Managed Lane Alternative has no defined funding source. Because it would be open to general purpose vehicles, neither the GET surcharge nor FTA funds could be used for its construction. The toll revenues would cover only 23 percent of the total debt service and the remaining 77 percent would need to come from other sources that are not available at this time. The 20-mile Alignment for the Fixed Guideway Alternative could be funded with a combination of expected GET revenues and FTA New Starts funds. There is more uncertainty in funding of the Full-corridor Alignment. Additional local or FTA funds beyond those that have specifically been identified would be required for completion of the Full-corridor Alignment.

The alternatives range widely in relation to community and environmental impacts. The No Build and TSM Alternatives would have little direct effect on existing resources; however, they also would not offer community or environmental benefits. The Managed Lane Alternative would require acquisition of private property, generate the highest levels of air and water pollution, consume the greatest amount of transportation energy, and create the greatest number of noise impacts. The Fixed Guideway Alternative would require the greatest number of property acquisitions and have the greatest number of utility conflicts, but it would also provide a new safe transportation connection between communities in the corridor. The small amount of on-street parking taken by the Fixed Guideway Alternative would be more than compensated by the resulting reduction in corridor parking demand as a consequence of fewer automobile trips. It would provide the greatest environmental benefits related to air and water pollution and energy consumption.

Table 6-3. Effectiveness of Alternatives at Meeting Goals and Objectives in the Year 2030

Objective	Evaluation Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4: Fixed Guideway	
		No Build Alternative	TSM Alternative	Managed Lane Alternative	Full-corridor Alignment	20-mile Alignment East Kapolei to Ala Moana Center
Reduce corridor travel times	Reduction in transit travel times	-	9% reduction	3% reduction	14% reduction	17% reduction
	Total daily transit travel time savings (person hours)	-	14,000	18,000	60,000	49,000
	Reduction in daily vehicle hours of travel delay	-	2% reduction	1% increase	18% reduction	11% reduction
Improve corridor travel time reliability	Miles of alternative's alignment in exclusive right-of-way	0	0	16 miles	28 miles	20 miles
Provide convenient, attractive and effective transit service within the corridor	Increase in transit mode share	-	5% increase	7% increase	26% increase	21% increase
	Total daily transit trips	232,100	243,100	244,400	294,100	281,900
	Total daily new riders	-	11,900	16,400	60,700	49,000
	Reduction in daily vehicle trips	-	10,200	14,900	59,600	48,000
Provide transit corridor travel times competitive with auto travel times	Comparison of transit with auto travel times	22% increase	12% increase	19% increase	5% increase	2% increase
Maximize the number of persons within convenient access range of transit	Employees within one-half mile of stations	0	0	0	443,800	315,900
	Population within one-half mile of stations	0	0	0	364,400	214,400
Encourage transit-oriented development in existing and new growth areas	Potential for transit-oriented development	○	○	○	●	●
Integrate transit with designated higher density development areas	Degree to which the alternative serves existing and planned higher density developments	○	○	○	●	●
Support economic development of major regional economic centers	Thousands of residents within 30 minutes travel by transit to Downtown Honolulu	215	219	218	235	226
	Thousands of residents within 30 minutes travel by transit to Kapolei	67	82	99	109	98
Provide solutions with benefits commensurate with their costs	Incremental annualized cost per user benefit (compared to TSM Alternative)	N/A	N/A	\$102.64	\$22.11	\$22.75
Provide solutions that meet the project purpose and need while minimizing total costs	Total capital costs (2006 dollars)	0	0	\$2.6 billion	\$4.6 billion	\$3.6 billion
	Annual operation and maintenance costs	\$192 million	\$234 million	\$261 million	\$256 million	\$251 million
	Incremental annualized cost per new rider(compared to TSM)	N/A	N/A	\$562	\$22	\$22
Improve transit operating efficiency	Operating cost per transit passenger mile	\$0.35	\$0.40	\$0.47	\$0.33	\$0.35
Avoid disproportionate impacts on low income and minority population groups	Full or partial acquisitions to low income and minority communities	0	0	17	60	54
Provide effective transit options to transit-dependent communities	Number of transit trips originating from transit-dependent communities	56,000	57,200	58,000	60,300	59,800
The cost of building, operating, and maintaining the alternative is within the range of likely available funding	Degree to which the amount of funding required to build the alternative system is attainable	●	●	○	●	●
	Proposed share of total project costs from sources other than New Starts Section 5309 funds	100%	100%	100%	66%	82%
	Ability to operate and maintain the transit system after it is built	●	●	●	●	●
Construction of the alternative is feasible in terms of constructability and ROW availability	High rating = standard construction/low degree of risk and known available ROW	●	●	●	●	●
	Low rating = unique or difficult construction/high degree of risk and ROW availability uncertain or doubtful					
Minimize impacts on natural and cultural resources	Use of land including natural areas and parklands	0	0	2	3	3
	Proximity to historic resources	0	0	30	82	70

Note: ○ = Lowest benefit or greatest impact, ● = Highest benefit or least impact

Objective	Evaluation Measure	Alternative 1	Alternative 2	Alternative 3	Alternative 4: Fixed Guideway	
		No Build Alternative	TSM Alternative	Managed Lane Alternative	Full-corridor Alignment	20-mile Alignment East Kapolei to Ala Moana Center
Minimize the effect on homes and businesses	Number of full or partial acquisitions of residential or commercial parcels	0	0	31	90	79
Minimize disruption to traffic operations	Degree of physical roadway impacts	●	●	●	○	○
Minimize conflicts with utilities	Degree to which utilities need to be relocated (relocation cost)	0	0	\$220 million	\$530 million	\$460 million
Minimize construction impacts	Daily vehicle miles traveled impacted by construction of the alternative	-	-	670,000	631,000	524,000
	Impact to access to businesses and residences during construction	●	●	○	○	○
	Duration of construction impacts	-	-	6 to 8 years	8 to 10 years	7 to 9 years
Minimize impacts to community and community amenities	Community facilities/resources affected	0	0	0	8	5
	Impacts to parking	○	○	○	●	●
	Number of noise impacts to residences	0	0	260	200	170
	Visual impacts/view corridors affected	●	●	○	○	○
Reduce energy consumption	Reduction in regional transportation-related energy consumption	N/A	●	○	●	●
Achieve consistency with adopted plans	Degree of consistency with adopted plans	○	○	○	●	●

Note: ○ = Lowest benefit or greatest impact, ● = Highest benefit or least impact

All alternatives are generally consistent with Local, District, and State plans. The Fixed Guideway Alternative best serves the areas of O'ahu that are designated for future growth and development. It is also the only alternative that is consistent with regional transportation system planning defined in the *2030 O'ahu Regional Transportation Plan* (OMPO, 2006a).

The general public in Honolulu is very concerned about transportation. In the *Honolulu Advertiser* Hawai'i Poll conducted in June 2006, traffic was identified by most



## **Chapter 7**

## **Coordination and Consultation**

A public and agency involvement process was undertaken to inform the citizens of O'ahu about the Honolulu High-Capacity Transit Corridor Project. The process had two goals: to provide meaningful information throughout the process and to solicit and record the public's views on key issues. Public information materials explained the alternatives considered and how they would affect residents in the corridor and throughout O'ahu. Additionally, the process solicited public and agency input, promoted dialogue, addressed community concerns, and supported completion of the AA to provide information for selection of a Locally Preferred Alternative that would best meet the needs of the citizens of O'ahu.

The public involvement process included the following:

- Informing the public and keeping them up-to-date about project progress

- Collecting and addressing community concerns
- Building on DTS's public participation programs from previous corridor projects
- Planning public involvement efforts in cooperation with City
- Using the news media, community groups, neighborhood associations, and other resources within the corridor and throughout O'ahu.

These goals of the public involvement process were addressed through a multi-media, multi-venue campaign to reach as many O'ahu citizens as possible. Over 200 meetings were held with members of the public while developing the AA. The following list highlights specific efforts:

- Organized project opening to solicit input on the project purpose and need, alternatives





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# PHONOTHEQUE

DVD

Honolulu High Capacity Transit Corridor Project  
Alternatives Analysis DVD

Department of Transportation Services  
City and County of Honolulu  
Mayor Mufi Hannemann

TR1 18:30  
November 1, 2006



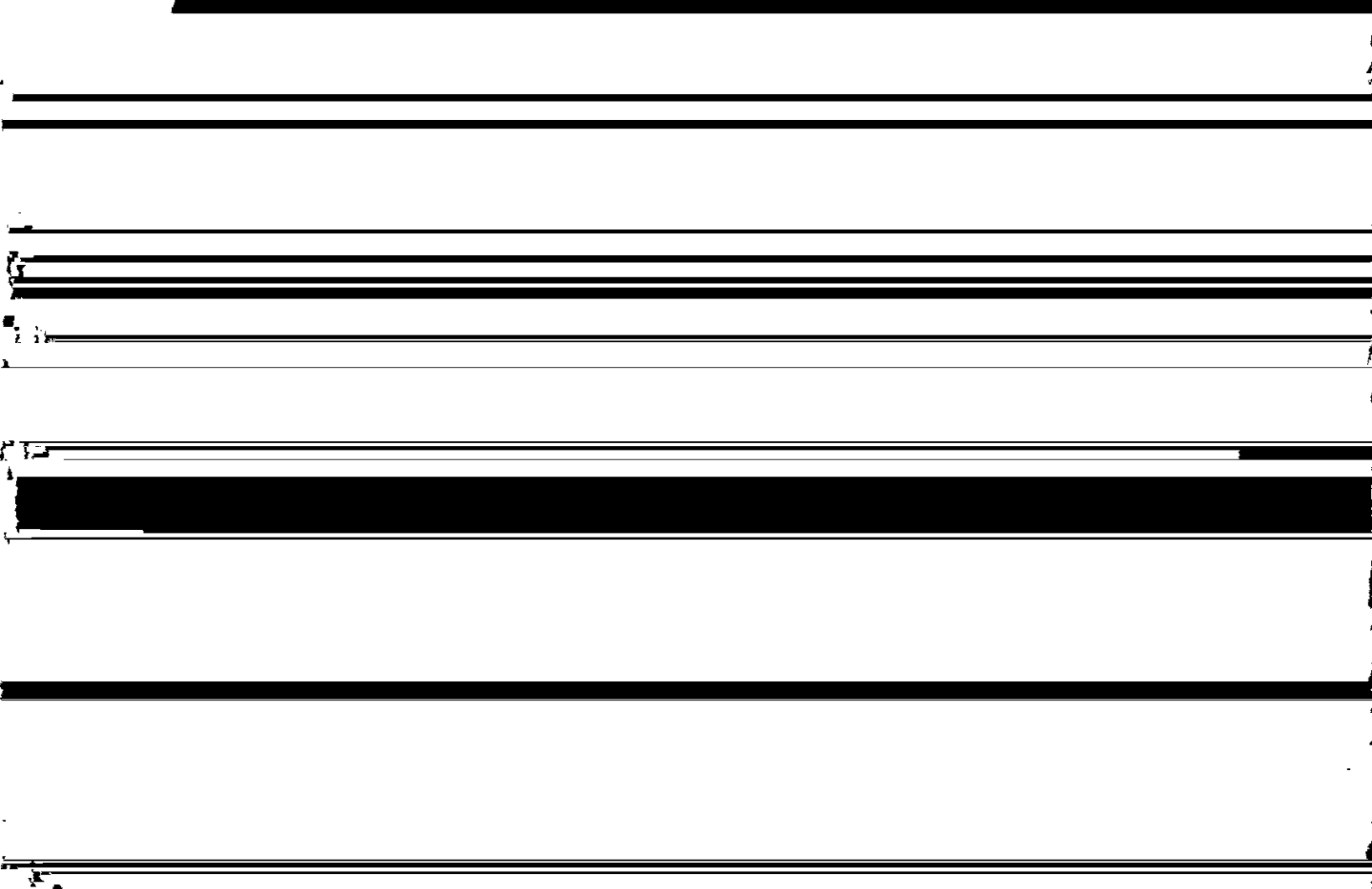
RESOLUTION

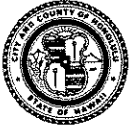
RELATING TO THE SUPPORT OF A FIXED GUIDEWAY RAPID TRANSIT SYSTEM AND TO THE SELECTION OF A LOCALLY PREFERRED ALTERNATIVE (LPA) FOR THE HONOLULU HIGH-CAPACITY TRANSIT CORRIDOR PROJECT

WHEREAS, the Council of the City & County of Honolulu had previously found in Ordinance 05-027 that currently, traffic congestion on Oahu is a major drain on the quality of life for all island residents; and

WHEREAS, by its adoption of Act 247, Session Laws of Hawaii, Regular Session of 2005, codified as Section 46-18.6 of the Hawaii Revised Statutes, the Legislature of the State of Hawaii authorized each county to establish by ordinance a one-half percent surcharge on the state general excise and use tax; and

WHEREAS, the State Legislature decreed that a county with a population greater than five hundred thousand that adopts the county general excise and use tax





## RESOLUTION

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WHEREAS, the City Administration agreed to meet the Council's deadline of November 1, 2006, provided that the Alternatives Analysis would be completed in accordance with the Federal Transit Administration's Guidance of New Starts Policies and Procedures and the Metropolitan Transportation Planning Process, wherein a Draft Environmental Impact Statement is completed after the selection of a locally preferred alternative; and

WHEREAS, the City Administration has presented the Alternative Analysis Report to the Council; and

WHEREAS, the Alternatives Analysis Report concludes that the Fixed Guideway Alternative would most significantly improve transit travel times between key corridor origins and destinations, and is expected to produce the most reliable transit travel times; and

WHEREAS, the Alternatives Analysis Report further concludes that the Kalaeloa – Airport – Dillingham – Halekauwila alignment option is the most effective alignment between Kapolei and the University of Hawaii at Manoa; and

WHEREAS, the Council after receiving public testimony has given due consideration of the alternatives identified in the Alternative Analysis Report; now, therefore

BE IT RESOLVED by the Council of the City and County of Honolulu that it supports and selects the full length fixed guideway alternative between Kapolei and UH at Manoa as the locally preferred alternative; and

BE IT FURTHER RESOLVED that the Council authorizes the City Administration to proceed with planning, engineering, and preparing the Environmental Impact Statement for the locally preferred alternative, and for the first phase of the project; and



**RESOLUTION**

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BE IT FINALLY RESOLVED that the City Clerk is hereby directed to transmit certified copies of this Resolution to the DTS Director.

INTRODUCED BY:

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DATE OF INTRODUCTION:

\_\_\_\_\_  
\_\_\_\_\_

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Honolulu, Hawaii

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Councilmembers