03
CHAPTER

Transportation

This chapter discusses existing and future 2030 transportation system conditions, service characteristics, performance, and transportation-related effects for each of the Project's alternatives. Transportation effects include project benefits as well as impacts on traffic (e.g., automobiles and trucks), parking, pedestrians, and bicycles. The analysis includes station area and system-level transportation-related effects for the Build Alternatives and makes comparisons to the No Build Alternative for the planning horizon year 2030.

The analysis is organized into five main sections:

- Existing (2007) conditions and performance
- Future (2030) No Build conditions and performance, with comparisons made to existing conditions
- Future (2030) Build Alternative conditions and performance, with comparisons made to 2030 No Build conditions (including transit-user benefits)
- Construction-related effects, including the effects of construction phasing
- Cumulative transportation system effects, including the effects of the planned extensions

The following transportation-related effects are addressed:

- Transit service, including changes in transit travel times
- Transit ridership, including changes in the transit share of total travel for each alternative
- Bus, pedestrian, and bicycle access in station areas
- Traffic (direct effects from the placement of support columns, station locations, etc.)
- Traffic on adjacent parallel or intersecting roadways
- Traffic related to park-and-rides, kiss-and-rides (passenger drop off), local bus access, and a fixed guideway maintenance and storage facility
- Parking, including potential spillover parking on neighborhood streets near proposed transit stations and the loss of on- and off-street parking

For additional information and references, including more detail about the planned extensions to West Kapolei, UH Mānoa, and Waikīkī, see the *Honolulu High-Capacity Transit Corridor Project Transportation Technical Report* (RTD 2008a).

3.1 Methodology

This section identifies the methodology used to estimate the potential transportation-related effects of the alternatives identified and discussed in Chapter 2, Alternatives Considered.

3.1.1 Analytical Tools and Data Sources

The primary quantitative method for evaluating the alternatives is a travel demand forecasting model used by the Oʻahu Metropolitan Planning Organization (OʻahuMPO) for the *Oʻahu Regional Transportation Plan 2030* (ORTP) (OʻahuMPO 2007). The OʻahuMPO model is based on "best practices" for urban travel models in the U.S. This modeling approach has proven effective in estimating ridership levels in other areas such as Los Angeles County, Salt Lake City, and the Denver region in the last 10 years.

The O`ahuMPO travel demand forecasting model was used to predict future traffic conditions and transit ridership.

The OʻahuMPO model uses the "sequential" approach to travel forecasting, in which travel is assumed to be the product of a sequence of individual decisions:

- The number of trips that a household will make—*trip generation*
- The destinations of these trips—*trip distribution*
- The form of transportation that will be used for travel—*mode choice*
- The paths on the transportation network that the trips will take—*network assignment*

The OʻahuMPO's existing model was reviewed, enhanced, recalibrated, and validated consistent with current Federal Transit Administration (FTA) guidelines. For the purpose of this Project, the model was refined and augmented to better represent transit alternatives in the study corridor. Concurrently, a new on-board transit survey was completed, and the latest socioeconomic information was incorporated. Finally, the mode choice component of the travel demand forecasting model was recalibrated and validated using data from the new on-board survey.

Additional detail on methodology, input, and model coding is documented in the *Honolulu High-Capacity Transit Corridor Project Travel Forecasting Methodology Report* (RTD 2008t).

3.1.2 Approach to Estimating Transportation Effects

Using the model and other information sources, existing transportation system conditions and performance were analyzed. Future 2030 No Build conditions and performance were then analyzed and compared to existing conditions. Finally, future 2030 Build Alternatives conditions and performance were analyzed and compared to future No Build conditions and performance.

The model was used to generate existing and future traffic volume forecasts, parking demand information, and transit ridership statistics. Model results include the following:

- Trip volumes by purpose
- Trip volumes by mode (e.g., automobile, bus, fixed guideway, walk)
- Trip time
- Changes in vehicle miles traveled (VMT)
- Changes in vehicle hours traveled (VHT)
- Changes in vehicle hours of delay (VHD)

Results include travel time changes by alternative for transit. Information from the model also includes transit-system user benefits and time savings.

Traffic Level-of-Service Definitions for Highways and Arterial Roadways

Level-of-Service	Definition
A	**EXCELLENT.** Completely free-flow conditions. Vehicle operation is virtually unaffected by the presence of other vehicles. Minor disruptions are easily absorbed without causing significant delays.
B	**VERY GOOD.** Reasonably unimpeded flow; the presence of other vehicles begins to be noticeable. Disruptions are still easily absorbed, although local deterioration in LOS will be more obvious.
C	**GOOD.** The ability to maneuver and select an operating speed is clearly affected by the presence of other vehicles. Minor disruptions may be expected to cause serious local deterioration in service, and queues may form behind any significant traffic disruption.
D	**FAIR.** Conditions border on unstable flow. Speed and the ability to maneuver are severely restricted due to traffic congestion. Only the most minor disruptions can be absorbed without the formation of extensive queues and deterioration of service to LOS F.
E	**POOR.** Conditions become unstable. Represents operation at or near capacity. Any disruption, no matter how minor, will cause queues to form and service to deteriorate to LOS F.
F	**FAILURE.** Represents forced or breakdown flow. Operation within queues is unstable and characterized by short spurts of movement followed by stoppages.

Effects on traffic at 215 intersections were estimated using procedures outlined in the *Highway Capacity Manual* (TRB 2000) of the Transportation Research Board. The analysis identified existing operating conditions at intersections and projected conditions under the future No Build and Build Alternatives in areas that would be affected by the fixed guideway system.

Traffic effects were determined by comparing changes in level-of-service (LOS) under the No Build Alternative with the Build Alternatives in 2030. An effect was considered to exist when the Project would cause any of the following conditions during either the a.m. or p.m. peak hours:

- LOS declines from D or better to E or F
- LOS declines from E to F
- The No Build Alternative LOS is E or F and the average vehicle delay increases

Where appropriate, measures to lessen or mitigate the Project's effects are identified. For more detail on the methods used to analyze transportation effects, see the Transportation Technical Report (RTD 2008a).

3.2 Existing Conditions and Performance

This section discusses existing transportation conditions in the study corridor. The discussion includes existing travel patterns and the conditions and performance of public transit, streets and highways, freight movement, parking, and the bicycle and pedestrian network. Unless otherwise noted,

Information presented in this section primarily involves islandwide travel conditions and performance. Islandwide data reflect traffic and conditions for the study corridor since this corridor dominates in terms of total transportation demand. For example, 83 percent of both islandwide daily and peak-period work-related transit trips originate within the study corridor. The study corridor also attracts 90 percent of total islandwide daily transit trips and 94 percent of peak-period work-related transit trips.

the source for information presented in this section is the O'ahuMPO travel demand forecasting model (O'ahuMPO 2007).

3.2.1 Existing Travel Patterns

Daily Person Trips

More than 3.2 million person trips are made on a daily (average weekday) basis on O'ahu. As shown in Table 3-1, 86 percent of these trips are made by residents. Of this total, 34 percent originate or end at work. The remaining 14 percent of total daily trips are made by visitors, trucks, and ground access by air passengers.

Mode of Travel

O'ahu has a relatively high number of transit and bicycle or walking trips compared to other U.S. cities. Of the approximately 2.8 million daily person trips made by residents, 6 percent are by transit and 12 percent are by bicycle and walking. Of the approximately 364,000 daily trips made by visitors, 5 percent are by transit and 45 percent are by bicycle and walking (Table 3-2).

Major destinations for weekday bus riders include Downtown (18 percent) and the Mō'ili'ili-Ala Moana area (13 percent). The Downtown area contains the region's highest concentration of jobs. The Mō'ili'ili-Ala Moana area contains a high number of jobs and the State's largest shopping complex.

Approximately 50 percent of peak-period work trips on a bus originating from home come from the Waikīkī, Mō'ili'ili-Ala Moana, Palama-Liliha, Waipahu-Waikele, and Kaimukī-Wai'alae areas. These areas are all within the study corridor and are densely populated with relatively high concentrations of transit-dependent households and activity centers.

Table 3-1 Person Trips by Trip Purpose—2007

Trip Purpose	2007	
	Daily Person Trips	Percentage of Total Daily Trips
Trips by Residents		
To and from work	932,600	29%
While at work	173,100	5%
To and from school/university	287,900	9%
To and from shopping/other	994,800	31%
Do not end at work or home	401,600	12%
Total Trips by Residents	**2,790,000**	**86%**
Other Trips		
Trips by truck	44,700	1%
Ground access trips by air passengers	60,000	2%
Trips by visitors	364,400	11%
Total Daily Trips (All)	**3,259,100**	**100%**

Numbers are rounded to nearest hundred.

Table 3-2 Daily Trips by Mode—2007

Trips by Mode	2007	
	Daily Trips by Mode	Percentage of Total Daily Trips
Residents		
Automobile–private	2,291,400	82%
Transit	165,900	6%
Bicycle and walk	332,700	12%
Total Daily Trips by Residents	**2,790,000**	**100%**
Visitors		
Automobile–private	116,400	32%
Transit	17,600	5%
Taxi	9,300	3%
Tour bus	56,000	15%
Bicycle and walk	165,100	45%
Total Daily Trips by Visitors	**364,400**	**100%**

Numbers are rounded to nearest hundred.

Vehicle Occupancy

Average vehicle occupancy (AVO) data were last collected by the Hawai'i Department of Transportation (HDOT) in 1998. The four monitoring stations in the study corridor are Moanalua Freeway at Moanalua Stream Bridge, Kalaniana'ole Highway, Pali Highway at Tunnel No. 1, and Likelike Highway. During the a.m. peak commute period (5:30 to 9:00 a.m.), traffic using Moanalua Freeway at Moanalua Stream Bridge had the highest AVO in the study corridor (1.28 persons per vehicle). Traffic on Pali Highway at Tunnel No. 1 experienced the highest peak-hour AVO in the study corridor at 1.31 persons per vehicle.

Vehicle Miles Traveled, Vehicle Hours Traveled, and Vehicle Hours of Delay

Travel conditions can be described in terms of VMT, VHT, and VHD. VMT is computed by multiplying the number of trips using a roadway by the facility's total length in miles. VHT is derived by multiplying the number of trips using a roadway by the travel time for each travel period. VHD is calculated by finding the difference between the congested VHT and the VHT that would be expected under free-flow conditions.

Table 3-3 summarizes islandwide total daily VMT, VHT, and VHD by facility type on the classified street and highway system. Most delays in the system occur on freeways and highways. (Section 3.2.3 provides a description of facility types.)

Reverse Commute

Currently, commuter-related trips are dominated by the demand to travel to the Downtown Transportation Analysis Area (TAA) in the a.m. peak period (6:00 to 8:00 a.m.) and away from Downtown in the p.m. peak period (3:00 to 5:00 p.m.). (A TAA is a geographic area used for transportation planning purposes.) Downtown-bound (Koko Head) traffic volumes through Waipahu and 'Aiea during the a.m. two-hour peak period are more than twice the volume traveling in the 'Ewa direction. This pattern is attributable to the dominance of Downtown and nearby areas as employment centers. Newly emerging employment centers in the 'Ewa-Kapolei area are expected to generate more reverse commuting in the future.

With 108 routes and 3,800 bus stops, 95 percent of O`ahu's urban residents can walk to a bus stop in 10 minutes or less

Captive versus Choice Riders

The on-board transit survey conducted in December 2005 and January 2006 provided information on captive and choice bus riders. In general, captive (transit-dependent) riders do not

Table 3-3 Vehicle Miles Traveled, Vehicle Hours Traveled, and Vehicle Hours of Delay—2007

Facility Type	Daily VMT		Daily VHT		Daily VHD	
Freeway	5,410,000	47%	120,000	36%	31,000	42%
Highway	1,306,000	11%	25,000	7%	4,000	5%
Arterial	3,345,000	29%	114,000	34%	18,000	24%
Collector	1,281,000	11%	53,000	16%	10,000	14%
Local	239,000	2%	22,000	7%	11,000	15%
Total	**11,581,000**	**100%**	**334,000**	**100%**	**74,000**	**100%**

Source: O'ahuMPO Travel Demand Forecasting Model.

have access to a personal vehicle to make the trip. Choice riders have a vehicle available to make the trip but use transit instead. The survey indicated that 65 percent of bus riders were captive. The remaining share consisted of 29 percent who could have used a personal vehicle and 6 percent who did not answer the question.

3.2.2 Existing Conditions and Performance: Transit

Transit in Honolulu consists of a fixed-route bus transit service known as TheBus, ferry service known as TheBoat, and paratransit service known as TheHandi-Van. The transit service coverage area is approximately 277 square miles, and 95 percent of the urban population lives within one-quarter mile of a bus stop.

System Characteristics

TheBus System

TheBus system currently consists of 108 routes that serve approximately 3,800 bus stops. Of the 108 routes, 99 are fixed routes, 4 are deviation routes operated by the paratransit division, and 5 are feeder routes for TheBoat. Most of the TheBus routes serve the study corridor. The Transportation Technical Report (RTD 2008a) includes a route map of the existing system.

Bus route categories include Rapid Bus, Urban Trunk, Urban Feeder, Suburban Trunk, Community Circulators, Community Access, and Peak Express. The characteristics of each service type are summarized below:

- **Rapid Bus** includes CityExpress! and CountryExpress! routes that provide limited-stop service in both directions. Service is provided early morning through late evening on weekdays. CityExpress! Routes A and B provide 15-minute service and CountryExpress! routes typically provide 30-minute service.
- **Urban Trunk** routes provide frequent, direct service connecting neighborhoods within the Primary Urban Center (PUC) along major ʻEwa/Koko Head corridors. Urban Trunk routes typically provide service every 15 minutes or less and include Routes 1, 2, 3, and 13.
- **Urban Feeder** routes connect the mauka/makai neighborhoods within the urban center. The routes serving the hills and valleys of Honolulu connect residential areas to the Urban Trunk and Rapid Bus routes and provide service to major destinations such as Downtown, the University of Hawaiʻi (UH) at Mānoa, and Waikīkī. These routes typically provide service every 30 minutes or less and include Routes 4, 5, 6, 7, and 8.
- **Suburban Trunk** routes provide service through late evenings and connect outlying communities to the urban center. These routes stop at all local bus stops every day. Suburban Trunk routes typically provide 30-minute service. Examples include Routes 40, 42, 52, 55, and 56.
- **Community Circulators** provide local transit access within their communities. They provide timed connections with other Community Circulators and Suburban Trunk routes at neighborhood hubs or transit centers. Routes with higher demand provide 30-minute service, and lower-demand routes provide 60-minute service. Some routes offer intermittent or peak-only service. Community Circulator service includes Routes 231-236 and 401-403.
- **Community Access** operates on a regular schedule using TheHandi-Van vehicles. Curb-to-curb service is provided to registered TheHandi-Van customers who give 24-hour advance notice and are located within one-quarter mile of the service route. TheHandi-Van service can be used to connect to transit hubs through route deviation. These routes operate every 60 minutes, and time is included in the schedule for possible route deviations. Examples include Routes 501, 503, and 504.

- **Peak Express** routes serve predominantly home-to-work trips by connecting neighborhoods to employment centers. Service is provided during peak periods and in the peak direction. Examples include Routes 81, 85, and 93. Feeder service to TheBoat is a subset of Peak Express. Examples include Routes F11, F12, and F13.

Most bus routes operate seven days a week, including holidays. Passenger amenities include approximately 980 passenger shelters and 2,400 benches. The Transportation Technical Report (RTD 2008a) provides detailed information on the system, including schedules and routes.

TheHandi-Van Service

TheHandi-Van is the City's paratransit service for persons who are eligible according to the Americans with Disabilities Act of 1990 or for persons certified by the City. The service area, days, and hours of operation are the same as TheBus. Trips must be reserved 24 hours in advance.

TheBoat Service

In September 2007, the City began offering a commuter ferry service between West Oʻahu (Kalaeloa Harbor) and Downtown Honolulu (Aloha Tower Marketplace). TheBoat service operates each weekday, with three trips in the morning and three trips in the evening.

To complement TheBoat, local shuttle bus service connects ferry terminals with several locations in West Oʻahu and Downtown Honolulu, as well as UH Mānoa and Waikīkī.

Fleet

TheBus fleet consists of 540 buses. This includes 72 vehicles that are 60-foot articulated buses, of which 10 are hybrid; 431 vehicles that are 40-foot buses; and 37 vehicles less than 40 feet long. TheHandi-Van vehicle fleet contains 129 vehicles. TheBoat service is provided by two 149-passenger vessels chartered by the City. The vessels are passenger-only and do not accommodate vehicles.

Fare Structure

Fare structures for the TheBus and TheBoat are the same and are established by the City Council. Current fares were set in 2003. Table 3-4 provides information on the current breakdown of ridership by fare type. At 41 percent of total ridership, monthly adult pass holders predominate, followed by senior/disabled riders at 27 percent. Considering the various discounts available, the average fare paid is $0.77 per person trip. For TheHandi-Van, every cardholder and companion must pay a fare of $2.00 per person per trip.

Transit Facilities

Existing transit facilities include maintenance and storage facilities, park-and-ride lots, transit centers, major transfer points, and two dedicated bus-only roadways (Hotel Street between River and Alakea

Table 3-4 TheBus and TheBoat Fare Structure—2007

Fare Category	Current Fare	Percentage of Riders by Fare
Adult	$2.00	12%
Youth	$1.00	5%
Senior/Disabled	$1.00	27%
Transfer (1 per trip)	$0.00	7%
Monthly Adult Pass	$40.00	41%
Monthly Youth Pass	$20.00	6%
Monthly Senior/Disabled Pass	$5.00	(included with Senior/Disabled)
Annual Adult Pass	$440.00	(included with Monthly Adult Pass)
Annual Youth Pass	$220.00	(included with Monthly Youth Pass)
Annual Senior/Disabled Pass	$30.00	(included with Senior/Disabled)

Percentages do not add up to 100% because the table does not include minor fare categories such as Visitor Pass.

Source: 2007 City and County of Honolulu records.

Streets and Kūhiō/Kalākaua Avenue between Ena Road and Kuamoʻo Street).

There are two maintenance and storage facilities: the Kalihi-Middle Street facility and the Pearl City bus facility. Five park-and-ride lots are served by TheBus with a total capacity of 529 spaces. These lots are in Hawaiʻi Kai, Mililani Mauka, Royal Kunia, Wahiawā, and Haleʻiwa. The six transit centers are in Alapaʻi, Hawaiʻi Kai, Kapolei, Mililani, Waiʻanae, and Waipahu. There are also major transfer points, such as Ala Moana Center.

Transit inefficiency consumed $11.5 million in additional operating budget expenses in 2006.

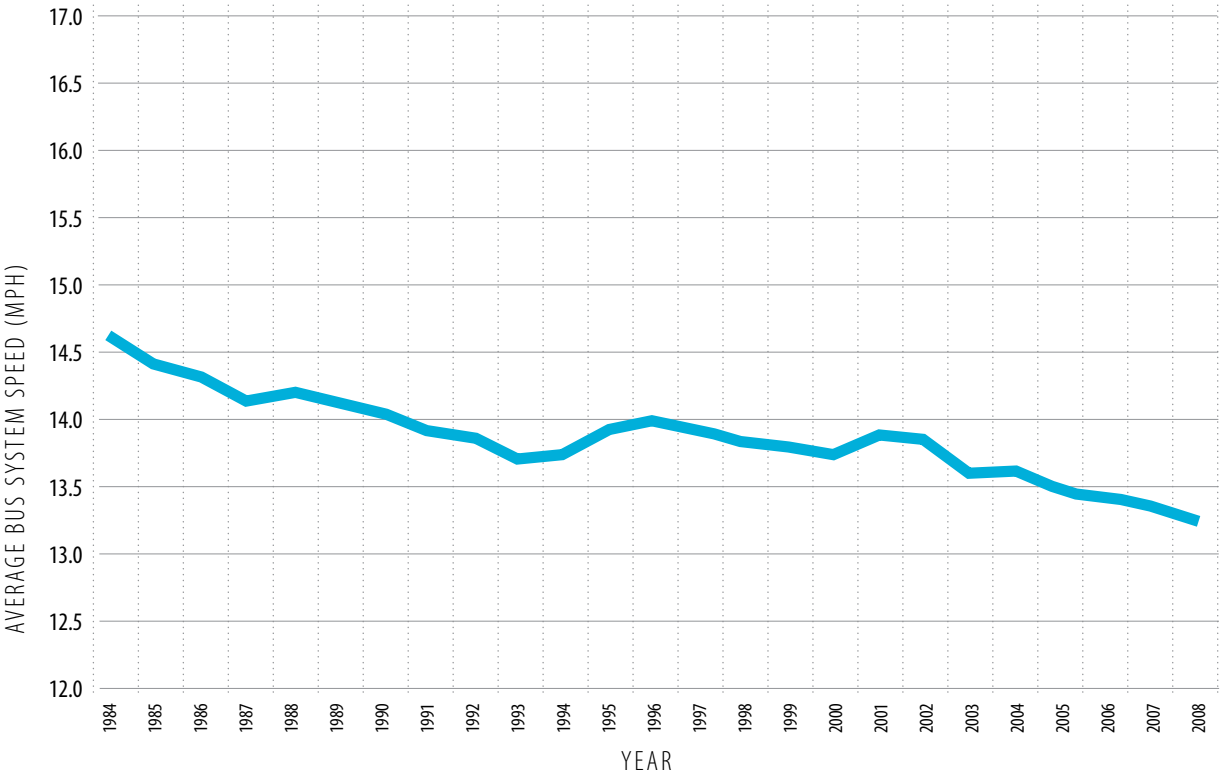
System Performance

This section examines existing transit system performance characteristics.

Transit Speed

TheBus operates in mixed traffic, without signal priority; therefore, buses are caught in the same congestion as general-purpose traffic. With increasing traffic congestion over the last 20 years, scheduled trip times for bus routes have been lengthened to reflect the additional time each bus trip takes. Average operating speeds for TheBus over time are shown in Figure 3-1.

As a result of longer bus travel times, approximately 111,700 additional revenue hours of bus service were needed in 2006 to deliver the same amount of service TheBus provided in 1984. This inefficiency consumed about $11.5 million in



Source: DTS reported National Transit Database (and formerly Section 15) reports: Annual Vehicle Revenue Miles and Annual Vehicle Revenue Hours.

Figure 3-1 TheBus Annual Average Operating Speed in Miles per Hour—1984–2007

additional annual operating budget expenses in 2006 (in 2006 dollars).

Temporary improvement to TheBus system's operating speeds was achieved by introducing new service concepts and restructuring the bus network in 2001. This improvement, known as the "hub-and-spoke" network, created new transit centers ("hubs") and new types of bus routes ("spokes") using rider-friendly features. For example, at a single facility riders can access routes that serve a variety of destinations. However, worsening roadway congestion further eroded average transit speeds and by 2006, a record low average speed of 13.4 miles per hour (mph) was recorded.

Figure 1-11 (in Chapter 1, Background, Purpose and Need) depicts the total time required to complete one scheduled afternoon peak-period trip for each of five selected routes (40, 42, 52, 55, and 62) in different years starting in 1992. These five routes travel through at least part of the study corridor and are considered Suburban Trunks. Routes 40 and 42 travel from the Mākaha Beach and ʻEwa Beach areas to Ala Moana Center and Waikīkī. Routes 52 and 55 jointly form the "Circle Island" route, which travels from Ala Moana Center through Downtown, Mililani, Wahiawā, Haleʻiwa, and Kāneʻohe and returns to Ala Moana Center. Route 62 also travels from Wahiawā to Honolulu (Figure 1-12). All five routes have had time added to their schedules due to congestion.

Using national standards for reliability, transit service on O`ahu has been gradually getting worse and now rates an "F" on a scale of "A" (best) to "F" (worst).

Route 52 is perhaps most illustrative of this schedule issue. This route was changed in 1999 to operate on Interstate Routes H-1 and H-2 (the H-1 and H-2 Freeways) instead of on Kamehameha Highway. This resulted in a drop from 135 to 121 scheduled minutes to operate the entire trip. This time was adequate from 2002 to 2004, but congestion caught up to this change. Time was added back into the schedule in 2005. In 2008, it is now scheduled to make a trip in 153 minutes—32 more minutes for the same distance than just four years ago—and more buses have been added to maintain the same service frequency.

Transit Ridership

Systemwide

TheBus system serves more than 80 percent of Oʻahu's developed areas and has about 251,400 boardings on an average weekday (2007 data). Of those boardings, approximately 10 percent are made by visitors. In fiscal year (FY) 2007 (July 2006 through June 2007), annual boardings were approximately 72 million.

Selected Routes in the Study Corridor

Most of TheBus routes, as well as most transit ridership in Oʻahu, occur within the study corridor. Routes 40, 42, 52, 55, and 62 are among the Suburban Trunk routes that travel through the study corridor and are part of the system's backbone. Average weekday boardings are shown in Table 3-5. These routes represent almost 20 percent of total islandwide daily boardings.

Table 3-5 Average Weekday Boardings on Selected Routes in the Study Corridor—2008

Route	Average Weekday Boardings
40	10,600
42	9,300
52	5,700
55	3,300
62	4,900

Transit Reliability

On-time performance is a measure of reliability and is based on the following service standard: a bus is considered to be late if it arrives at a route

timepoint (a location along each route that has an identified schedule time) more than five minutes after the scheduled time. This standard has been used by the City's bus management services contractor to monitor service.

Figure 3-2 includes systemwide schedule adherence results for TheBus for weekdays in a typical month in each year since 1998. During four of the last six years, more than 30 percent of bus trips ran late. According to the LOS standards identified in the Transportation Research Board's *Transit Capacity and Quality of Service Manual* (TRB 2003), the extent of late trips indicated a grade of "F" on a scale of "A" (best) to "F" (worst).

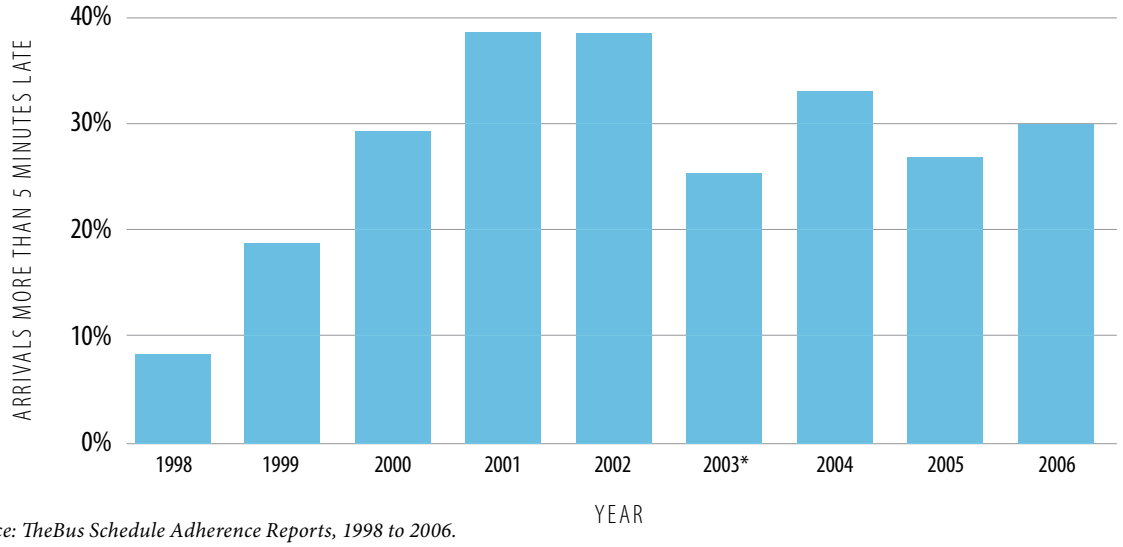
Buses are sometimes so far behind schedule that the trip does not reach its final destination. The bus operator is instructed to abandon the trip, off-load all passengers, and turn back so the next scheduled assignment for the operator and vehicle can be initiated on time. Figure 3-3 includes the total annual service incidents involving "turnbacks" from 1998 to 2007. The low number of turnbacks in 2003 reflects a work stoppage due to a 34-day bus operator strike.

Transit Effectiveness/Load Factors

For a city of its size, Honolulu has a very effective bus system, as measured by bus passenger trips per revenue hour (also known as *load factor*). As shown in Table 3-6, TheBus is the only one of the largest 20 bus operations in the U.S. that operates in a region without rail transit or a separated transit guideway system. Only three transit agencies (New York, San Francisco, and Los Angeles) have bus systems with higher service effectiveness than Honolulu.

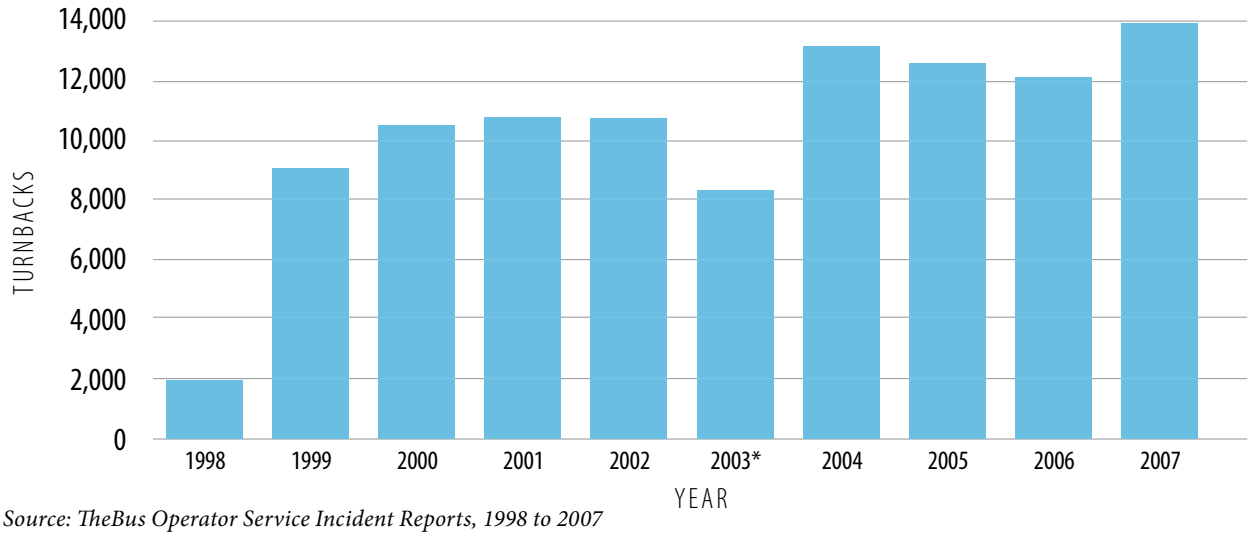
TheBus has maintained steady level-of-service effectiveness, as measured by bus passenger boardings per vehicle revenue hour. TheBus system's performance is consistently above the same service-effectiveness average for the nation among all transit modes.

In Honolulu, passenger boardings per vehicle revenue hour averaged 41.0 to 45.3 from 2001 to 2006, while the range for the nation was between



Source: TheBus Schedule Adherence Reports, 1998 to 2006.
* Affected by a 34-day bus operator strike.

Figure 3-2 TheBus Systemwide Schedule Adherence (Percent of Weekday Systemwide Arrivals more than Five Minutes Late)



Source: TheBus Operator Service Incident Reports, 1998 to 2007
* Affected by a 34-day bus operator strike.

Figure 3-3 TheBus Systemwide Annual Service Incidents Involving Turnbacks

37.3 and 40.4 during the same period. This is notable because the national rate includes the highest-capacity transit operations in the largest metropolitan areas.

Cost-effectiveness is measured by comparing service inputs (total operating expense) and service consumption (total passenger boardings). Between 2001 and 2006, the national average operating expense per passenger boarding increased from $2.39 to $3.09. TheBus experienced a commensurate increase in operating expense per passenger boarding of $1.60 to $2.25 over the same period, but TheBus expense has been consistently about 30 percent lower than the national average.

O`ahu has some of the highest transit ridership per vehicle revenue hour of service anywhere in the United States, making Honolulu a very transit-oriented city.

Access to Transit

Currently, access to transit service is dominated by walking and by transferring from other bus routes. Ninety-five percent of the urban population lives within one-quarter mile of a bus line. There are currently more park-and-ride spaces than demand.

Transfers

A major feature of O‘ahu’s existing transit service is reliance on transit centers and transfer locations as major focal points. The network of transit centers and the hub-and-spoke nature of the bus route system result in a high number of bus transfers. The current (2007) transfer rate is 37 percent, with an average of 1.4 bus rides or segments per transit trip.

3.2.3 Existing Conditions and Performance: Streets and Highways

Freeways, highways, and streets are the basic transportation network elements responsible for the movement of people and goods on O‘ahu. This network is used by all types of vehicles, public and private transit services, bicycles, and pedestrians. O‘ahu’s roadway system is maintained by HDOT and the City and County of Honolulu Department of Facility Maintenance.

System Characteristics

The State highway system includes all freeways and major highways connecting various parts of

Table 3-6 Ranked Bus Passenger Vehicle Trips per Revenue Hour for the 20 Largest U.S. Bus Operations—2005

Transit Agency		Urbanized Area	Annual Bus Passenger Trips	Annual Bus Vehicle Revenue Hours	Bus Passenger Vehicle Trips per Revenue Hour	Transportation Modes Provided by Agency		
Rank	Name	Primary City	(1,000s)	(1,000s)		Bus	Rail	Other
1	MTA-NYC	New York, NY	952,418	12,870	74.0	B, DR	HR	–
2	MUNI	San Francisco, CA	163,149	2,495	65.4	B, TB, DR	LR	CC
3	LACMTA	Los Angeles, CA	377,268	7,482	50.4	B	HR, LR, CR	–
4	TheBus	Honolulu, HI	67,407	1,365	49.4	B, DR	–	–
5	SEPTA	Philadelphia, PA	187,960	3,830	49.1	B, TB, DR	HR, LR, CR	–
6	MBTA	Boston, MA	138,557	2,838	48.8	B, TB, DR	HR, LR, CR	FB
7	NYCDOT	New York, NY	71,347	1,559	45.8	B	–	FB
8	CTA	Chicago, IL	303,244	6,748	44.9	B, DR	HR	–
9	WMATA	Washington, DC	153,392	3,423	44.8	B, DR	HR	–
10	MTA	Baltimore, MD	77,806	1,922	40.5	B, DR	HR, LR, CR	–
11	MARTA	Atlanta, GA	71,066	1,798	39.5	B, DR	HR	–
12	TRI-MET	Portland, OR	68,765	1,873	36.7	B, DR	LR	–
13	OCTA	Santa Ana, CA	67,304	1,838	36.6	B, DR	–	–
14	AC Transit	Oakland, CA	64,601	1,800	35.9	B, DR	–	–
15	King County Metro	Seattle, WA	94,608	2,882	32.8	B, TB, DR	LR	VP
16	Metro Transit	Minneapolis, MN	61,797	2,011	30.7	B	LR	–
17	NJ Transit	New York, NY	156,147	5,184	30.1	B, DR	LR, CR	VP
18	MTA of Harris County	Houston, TX	81,547	2,848	28.6	B, DR	LR	VP
19	RTD	Denver, CO	74,683	2,639	28.3	B, DR	LR	VP
20	Miami Dade Transit	Miami, FL	76,753	2,732	28.1	B, DR	HR, AG	–

Data include all bus and trolleybus trips and exclude all demand response trips.

B = Bus, TB = Trolleybus, DR = Demand Response, HR = Heavy Rail, LR = Light Rail, CR = Commuter Rail, AG = Automated Guideway, FB = Ferry Boat, VP = Van Pool, CC = Cable Car

Source: 2005 Public Transportation Fact Book, APTA, April 2005.

the island and consists of approximately 280 route miles and 940 lane miles.

Interstate freeways on O'ahu are dedicated transportation facilities that are fully grade-separated, access-controlled roadways. Access to the Interstate system is restricted to dedicated ramps, which minimizes disruptions to the flow of traffic. This allows for higher operational speeds and improved capacity compared to surface streets. The study corridor is served primarily by the H-1 Freeway and the Moanalua Freeway. The H-2 Freeway provides access from Central O'ahu, and the H-3 Freeway provides access from the Windward side.

Highways, unlike freeways, are not fully grade-separated and tend to be major surface streets or expressways. Because local traffic can access these facilities at intersections, capacities and operational speeds are reduced.

To maximize the efficiency of the freeway and highway systems, the State and the City employ a variety of Transportation Demand Management (TDM) and Transportation System Management (TSM) strategies to reduce single-occupant motor vehicle trips and make the existing transportation system more efficient.

Examples of TDM measures used on Oʻahu include contraflow operations and special traffic and high-occupancy vehicle (HOV) lanes. TSM measures include carpool and vanpool matching services, bicycle and pedestrian transportation alternatives, and park-and-ride facilities. These measures are overseen by either the City or HDOT. Reversible contraflow lanes operate during specific peak periods on portions of congested corridors, such as Kapiʻolani Boulevard, Ward Avenue, Atkinson Drive, and Waiʻalae Avenue.

HDOT operates HOV lanes on the following facilities during certain times of day: H-1 Freeway, H-2 Freeway, Moanalua Freeway, H-1 Freeway zipper lane and shoulder express lane, and Nimitz Highway. The H-1 zipper lane, H-1 shoulder express lane, and Nimitz Highway are contraflow lanes. Although transit vehicles use these HOV lanes, they still experience delays due to congestion. Once a vehicle exits an HOV lane, it is also subjected to congestion on surrounding roadways.

Performance of the Street and Highway System

For the purpose of this analysis, traffic volumes and other performance statistics were grouped by screenlines, which are imaginary lines drawn across the road network at selected locations to enable comparisons. Eight screenlines were used to describe existing conditions in the study corridor (as illustrated on Figure 3-4 and described in Table 3-7) for the a.m. and p.m. peak travel hours. Traffic count data for 2005 and 2006, the most recent set of counts, were used to analyze existing volume and LOS conditions.

Screenline Volumes and Operating Conditions

The operation of the roadway segments was calculated by comparing traffic volumes on each roadway facility to the saturated volume LOS thresholds for each individual facility. The saturated volume thresholds represent the capacity of a roadway and were developed based on the roadway functional classification and operating characteristics (e.g., number of intersections or interchanges per mile, divided or undivided roadways, number of travel lanes, and one-way or two-way facility).

Table 3-7 summarizes observed volumes and estimated LOS at each screenline for each direction during the a.m. and p.m. peak hours. In general, congested conditions (e.g., LOS E or F) occur during the a.m. and p.m. peak hours at several locations. Specifically, this occurs in the peak direction (i.e., toward Downtown in the morning and away from Downtown in the evening) at screenline locations such as ʻEwa (Screenline B) Koko Head-bound in the a.m. peak hour and Ward Avenue (Screenline G) ʻEwa-bound in the p.m. peak hour. The Kalauao and Kapālama screenlines (Screenlines D and F) Koko Head-bound operate at LOS F in the a.m. peak hour.

Traffic congestion occurs throughout the study corridor during peak travel hours, affecting cars, freight, and buses.

Under congested conditions, vehicle speeds are slow and vehicles back up in queues. As a result, less traffic gets through and any traffic counts conducted under these conditions tend to under-represent the true demand for the facility, making the roadway appear to operate better than it actually does. Table 1-3 (in Chapter 1) shows existing travel speeds at several locations in the a.m. peak hour. This information indicates a consistent LOS F throughout the study corridor and reflects current travel conditions in the corridor.

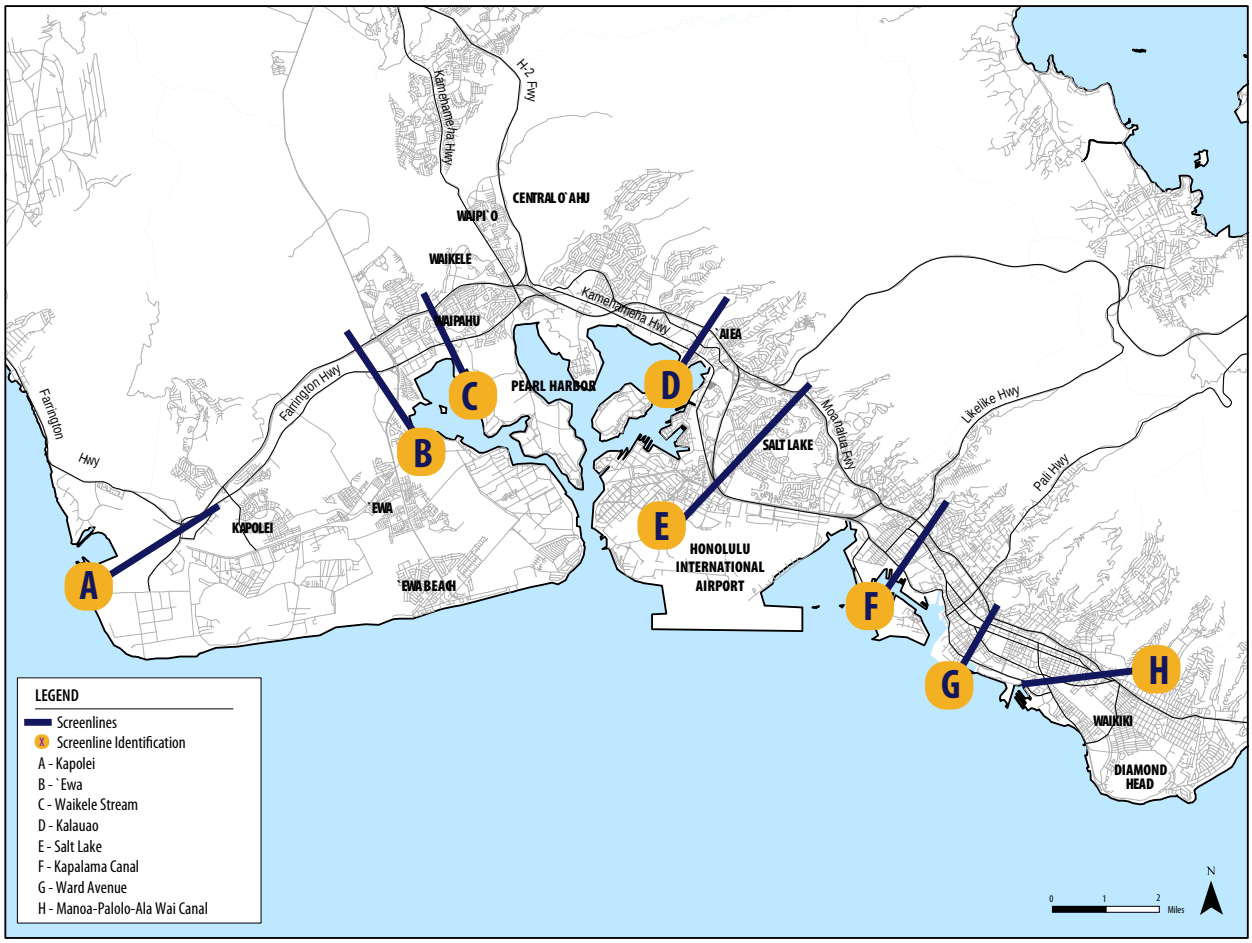


Figure 3-4 Selected Screenline Facilities Locations

Congestion on roadways currently affects overall mobility within the study corridor and affects the ability to add bus service in a cost-effective, reliable manner. This is because buses are using the same congested roadways as automobiles.

Freight Movement

The movement of goods and products is important to O'ahu's economic vitality. Ocean transportation delivers most imported food, building materials, manufactured goods, and energy products. Ocean transportation, shipbuilding and repair, commercial fishing, ocean recreation, and other support industries are the main activities in O'ahu's commercial harbors. The harbors are widely used by a variety of interests, from major cargo carriers to commercial fishermen to charter boat operators with a single vessel. O'ahu's two commercial harbors are Honolulu Harbor and Kalaeloa Barbers Point Harbor. Downtown Honolulu and government offices grew around Honolulu Harbor. A network of highways connects this harbor with outlying areas. Freight also enters O'ahu via Honolulu International Airport, which is located in the study corridor.

Trucks carrying freight enter and exit Honolulu Harbor on Nimitz Highway and use all major highways and freeways on O'ahu. Heavily used freight routes include Nimitz Highway, the H-1 Freeway, and Ala Moana Boulevard. These major roadways are also used by transit vehicles, so delays that automobiles and transit experience along major corridors are also experienced by truck traffic.

Table 3-7 Traffic Volumes and Level-of-Service at Screenlines—Existing Peak Hour

ID[1]	Screenline and Direction	A.M. Peak Hour		P.M. Peak Hour	
		Observed Volume (vph)[2]	LOS	Observed Volume (vph)[2]	LOS
A	Kapolei mauka-bound	1,840	D	2,550	D
	Kapolei makai-bound	2,640	D	1,680	D
B	`Ewa Wai`anae-bound	5,360	C	6,820	E
	`Ewa Koko Head-bound	7,460	E	6,760	D
C	Waikele Stream `Ewa-bound	7,630	D	8,520	E
	Waikele Stream Koko Head-bound	9,170	E	6,000	C
D	Kalauao `Ewa-bound	8,940	D	12,540	D
	Kalauao `Ewa-bound (H-1 Freeway HOV)[3]	n/a	n/a	1,530	D
	Kalauao Koko Head-bound	14,050	F	8,110	D
	Kalauao Koko Head-bound (H-1 Freeway HOV)[3]	1,740	E	1,360	D
	Kalauao Koko Head-bound (H-1 Freeway zipper)	1,510	D	n/a	n/a
E	Salt Lake `Ewa-bound	7,540	C	12,640	D
	Salt Lake `Ewa-bound (H-1 Freeway HOV)[3]	n/a	n/a	1,410	D
	Salt Lake Koko Head-bound	13,270	D	9,680	D
	Salt Lake Koko Head-bound (H-1 Freeway HOV and Moanalua Freeway HOV)[3]	2,640	E	240	A
	Salt Lake Koko Head-bound (H-1 Freeway zipper)[3]	1,510	D	330	A
F	Kapālama Canal `Ewa-bound	11,870	D	15,170	E
	Kapālama Canal Koko Head-bound	18,970	F	14,940	E
G	Ward Avenue `Ewa-bound	13,800	E	12,370	E
	Ward Avenue Koko Head-bound	11,390	E	15,350	D
H	Mānoa-Pālolo/Ala Wai Canal `Ewa-bound	14,940	D	12,780	D
	Mānoa-Pālolo/Ala Wai Canal Koko Head-bound	11,130	D	16,340	E

[1] Shown on Figure 3-4.
[2] Peak-hour traffic count data were obtained from HDOT (2005).
[3] Because separate HOV lane and zipper lane counts are not available at this location, HOV and zipper lane traffic volumes are estimated.

3.2.4 Existing Conditions and Performance: Parking

Parking availability varies widely throughout the study corridor. Parking is relatively accessible in suburban areas such as Pearl City and ʻAiea and at most shopping facilities, residences, and along the street. Parking is notably more limited in Downtown Honolulu, Chinatown, Kakaʻako, and near UH Mānoa.

On- and off-street parking facilities are heavily used in Downtown Honolulu, Waikīkī, and along University Avenue. Off-street parking structures are used by commercial and employment centers and, although they are available to the general public, the cost is relatively high. Inadequate parking supply has been a long-term problem in this portion of the study corridor. Permanent on-street parking is not available on Nimitz Highway,

Kapiʻolani Boulevard, or Kalākaua Avenue, although metered parking is available and heavily used throughout these areas.

Downtown Honolulu parking rates are high. In 2008, the median daily parking rate in Honolulu was $44, nearly $29 more than the national median of $15.42. This rate exceeds those for major urban areas such as Midtown Manhattan ($40) and Chicago ($30). Monthly parking rates are the ninth highest of the 53 U.S. markets surveyed. Honolulu's monthly median parking rate for an unreserved space was $216, more than $60 higher than the national median of $154 (Colliers 2008).

3.2.5 Existing Conditions and Performance: Bicycle and Pedestrian Network

Three primary bikeway types constitute the bicycle infrastructure on the island, as defined by the *Bike Plan Hawaiʻi Master Plan* (HDOT 2003):

- **Shared Roadway—**any street or highway open to both bicycles and motor vehicle travel. Signs may be present designating their status as a preferred bike route. Currently, there are 30.1 miles of shared roadway on Oʻahu.
- **Bike Lane—**a section of roadway designated by striping, signing, and/or pavement markings for the preferential or exclusive use of bicyclists. There are 33.6 miles of bike lanes on Oʻahu.
- **Shared-use Path—**a route that is physically separated from motorized vehicular traffic by an open space or barrier and is located either within the highway right-of-way or has an independent right-of-way. There are 34.3 miles of shared-use paths on Oʻahu.

Although there are approximately 98 miles of bicycle facilities on Oʻahu, topography, safety issues, and an auto-oriented environment have generally limited these facilities in the study corridor. For instance, signs for a shared roadway are located on Farrington Highway. However, high traffic volumes and average vehicle speeds of 35 to 45 mph pose safety concerns for bicyclists using this facility. In the less developed ʻEwa area of the study corridor, bicycle facilities are being constructed in many new subdivisions. Buses are also equipped with bicycle racks.

The quality and extent of Honolulu's pedestrian system varies depending on location. In certain areas, such as Waikīkī, Chinatown, and Downtown, the City has invested heavily in creating a continuous and accessible pedestrian system. Pedestrian linkages are not yet fully developed in the Kapolei area because of the less dense land uses and the highway network. In most other areas, pedestrian facilities exist but are sometimes narrow or not continuous.

3.3 Future Conditions and Effects: No Build Alternative

This section discusses future conditions and estimated effects of the 2030 No Build Alternative. Unless otherwise noted, the source for information presented in this section is the OʻahuMPO travel demand forecasting model (OʻahuMPO 2007).

Even with $3 billion in roadway improvements under the No Build Alternative, traffic delay in 2030 would increase 44 percent compared to today.

The No Build Alternative includes all transportation improvements outlined in the ORTP, except the fixed guideway system. Although the ORTP includes the fixed guideway system, it is not included in the No Build Alternative so that a comparison can be made between "with" and "without" the Project.

The ORTP is the long-range plan for developing Oʻahu's multimodal transportation system. It includes additional roadway, bus, and bicycle and pedestrian projects planned within the

study corridor. These improvements include congestion-relief projects, such as widening Farrington Highway and the H-1 Freeway, extending Kapolei Parkway, constructing HOV and zipper lanes on the H-1 Freeway, and widening and extending North-South Road. Bus improvements are also planned and include service expansion to and within ʻEwa, Kapolei, and Central Oʻahu. Bus transit centers are also planned at various locations islandwide. Roadway elements of the ORTP are further described in Chapter 2. The projects listed above are included in the analysis of the No Build and Build Alternatives.

Plans to expand Oʻahu's bikeway system are also underway and largely driven by the *Bike Plan Hawaiʻi Master Plan* (HDOT 2003) and the *Honolulu Bicycle Master Plan* (DTS 1999). Since publication of these reports, construction has begun on the following:

- 19 miles of shared roadways with 172 miles planned
- 5 miles of bike lanes with 50 miles planned
- 14 miles of shared-use paths with 37 miles planned

3.3.1 No Build Alternative—Future Travel Patterns

Daily Person Trips

As indicated in Table 3-8, total daily person trips are expected to increase by 780,000 trips (24 percent) between 2007 and 2030, with more than 4 million trips in 2030. Of these 4 million trips, almost 3.5 million would be made by residents. The remaining trips are made by visitors, trucks, and ground access by air passengers.

Table 3-8 Daily Person Trips by Mode—2007 and 2030 No Build Alternative

Trip Type	2007		2030 No Build	
	Number	Percent	Number	Percent
Trips by Residents				
Automobile–private	2,291,400	82%	2,814,600	82%
Transit	165,900	6%	205,700	6%
Bicycle and walk	332,700	12%	432,400	13%
Total Trips by Residents	2,790,000		3,452,700	
Trips by Visitors				
Automobile–private	116,400	32%	160,100	37%
Transit	17,600	5%	19,800	5%
Taxi	9,300	3%	9,700	2%
Tour bus	56,000	15%	77,500	18%
Bicycle and walk	165,100	45%	163,600	38%
Total Trips by Visitors	364,400		430,700	
Other Trips				
Trips by trucks	44,700	43%	51,600	33%
Ground access trips by air passengers	60,000	57%	103,900	67%
Total Other Trips	104,700		155,500	
Total Daily Trips (All)	3,259,100		4,038,900	

Numbers do not equal 100 percent due to rounding.

Mode of Travel

Table 3-8 also provides mode share information for islandwide daily trips in 2007 and under 2030 No Build conditions. For trips made by residents, there would be virtually no change in shares for the identified travel modes: private automobile, transit, and bicycle and walk. For trips made by visitors, the share by private automobile under No Build conditions would increase from 32 to 37 percent. The transit share would be unchanged, and minor changes are estimated for taxi and tour bus. However, the bicycle and walk share would decrease from 45 to 38 percent as more auto-oriented tourist destinations, such as Ko ʻOlina, are developed over time.

Vehicle Miles Traveled, Vehicle Hours Traveled, and Vehicle Hours of Delay

Table 3-9 shows the systemwide VMT, VHT, and VHD in the study corridor for 2007 and the 2030 No Build Alternative. Under 2030 No Build conditions, approximately 13.6 million VMT per day are projected in the transportation system, including major freeways, highways, arterials, and collectors. This would be an increase of approximately 17 percent (or 2 million miles) over 2007 conditions.

Table 3-9 Daily Vehicle Miles Traveled, Vehicle Hours Traveled, and Vehicle Hours of Delay—2007 and 2030 No Build Alternative

Alternative	Daily VMT	Daily VHT	Daily VHD
2007 Existing Conditions	11,581,000	334,000	74,000
2030 No Build	13,583,000	415,000	106,000
% Change from 2007	*17%*	*24%*	*43%*

VHT is expected to increase by 24 percent by 2030 compared to 2007 levels. Delay would increase by 43 percent. VHT and VHD would increase at a higher rate than VMT because as roadway facilities become oversaturated, travel times through the affected sections would increase dramatically.

Reverse Commute Market

Reverse commute trips originate in central areas and are destined to outlying and more suburban locations. Similar to current conditions, the No Build Alternative would have two-way transit service along major travel corridors, thereby providing opportunities for reverse commute bus riders. However, the effectiveness of the service would be compromised by characteristics such as reduced overall bus travel speeds.

Service to Transit-Dependent Households

Bus service under the No Build Alternative would provide access to areas with high concentrations of transit-dependent households. Compared to 2007 conditions, some increases in transit travel times are projected for travel markets involving transit-dependent households. One example is between Pearlridge and Downtown Honolulu. Other travel markets would experience small reductions in transit travel times.

In 2030 under the No Build Alternative, even with ORTP planned improvements, the key measures of transit reliability, accessibility, mobility, and equity would all be worse than today.

3.3.2 Effects on Transit

This section provides information on the effects of the No Build Alternative on transit, including travel times, service reliability, and ridership resulting from anticipated limitations of the roadway network.

Transit Speed

In general, transit travel times during the a.m. two-hour peak period (6:00 to 8:00 a.m.) would be longer under the 2030 No Build Alternative when compared to 2007 due to generally slower transit speeds. Figure 3-5 shows system-level historic transit speeds as well as projected speeds under the No Build Alternative. Table 3-10 shows estimated

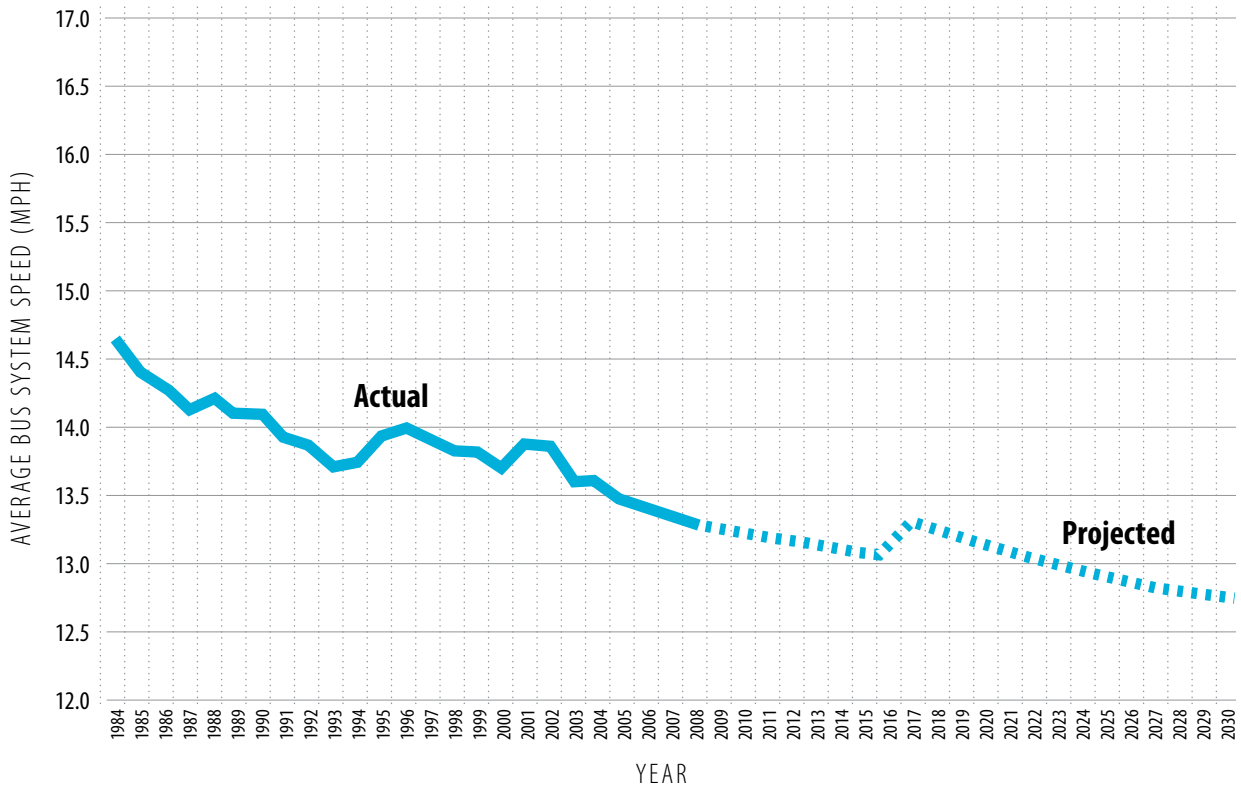


Figure 3-5 TheBus Average Operating Speeds in Miles per Hour—Historic and Projected under 2030 No Build Alternative

Table 3-10 A.M. Peak Period Transit Vehicle Speeds (in miles per hour)

Alternative	Kapolei to Downtown	`Ewa to Downtown	Waipahu to Downtown	Mililani Mauka to Downtown	Pearlridge Center to Downtown	Downtown to Ala Moana Center	Waipahu to Waikīkī
2007 Base Year	19	15	19	20	15	13	17
2030 No Build	19	15	19	18	13	10	17
2030 Salt Lake	29	23	33	30	31	24	25
2030 Airport	28	22	32	30	29	24	25
2030 Airport & Salt Lake	29	23	33	31	31	24	25

changes in transit speeds for several locations in the corridor. Slower speeds are attributable to increased traffic along streets and highways on which buses operate. The temporary increase in transit speeds in 2018 is attributable to planned implementation of extended HOV lanes on the H-1 Freeway and improved transit operations in the zipper lane.

Some transit travel times, such as from Waipahu to Waikīkī and Mililani Mauka to Downtown, are projected to improve under the No Build Alternative. These trips would take advantage of extended HOV lanes on the H-1 Freeway, improved operations of the zipper lane (assumed to be limited to three or more-occupant vehicles in the year 2030), and/or the proposed Nimitz Flyover facility (which would give priority to HOVs and transit vehicles).

Transit Ridership

Transit boardings under the No Build Alternative are expected to keep pace with population growth and increase over 2007 existing conditions by approximately 25 percent (Table 3-11). No major

increases in the transit share of total travel are projected for the No Build Alternative.

Table 3-11 Changes in Total Daily Transit Boardings and Trips—2007 and 2030 No Build Alternative

Alternative	Total Transit Boardings	Total Transit Trips
2007 Existing Conditions	251,000	184,000
2030 No Build	314,000	226,000
% Change from 2007	*25%*	*23%*

Although some increases in bus services would occur under the No Build Alternative, a review of route-specific demand and service levels for 2030 indicates that bus capacity would be exceeded for several routes. In some cases the demand per bus trip would be more than twice the seating capacity.

Adding substantial passenger capacity with more buses is not feasible in some key locations along the system because of roadway capacity constraints. Choke points occur in Downtown Honolulu during the a.m. peak period, especially at the merger of North Beretania, North King, and Liliha Streets, and Dillingham Boulevard. King Street has been used to introduce new service in recent years; however, choke points occur at the Chinatown bus stops and at the Punchbowl Street and King Street stops. Buses often must wait to move into an open and safe boarding position. Continuing to add additional service to King Street without major physical improvements would add to the gridlock in this corridor, deteriorate transit service, and complicate pedestrian and traffic safety issues.

Several routes, including CountryExpress! Routes C, D, and E are projected to be overloaded in 2030. Increasing frequency would require headways at five minutes or less. Further, the downtown street network cannot support the number of buses that would be required to meet projected demand.

Transit Reliability

In addition to the estimated increase in transit travel times, transit reliability under the No Build Alternative would likely worsen compared to existing conditions. This is due to projected increases in congestion and a longer duration of unstable traffic flow expected during the a.m. two-hour peak period. Operating conditions, such as missed trips and bus turnbacks, are expected to worsen. Of particular concern is the reliability of longer-distance service connecting the emerging population centers in West O‘ahu with major destinations such as Downtown.

Access to Transit Service

With the No Build Alternative, access to transit services would be generally similar to current characteristics. New transit centers would be built at five locations to allow transfers between TheBus routes. One additional park-and-ride facility would be built at the Middle Street Intermodal Transportation Center.

Transfers

The estimated rate of transfers under the No Build Alternative would be 39 percent (or 1.4 bus rides or segments per transit trip). This rate is close to the 37 percent transfer rate in 2007 (or 1.4 bus rides or segments per transit trip). The transfer rate would reflect that the bus route structure under the No Build Alternative would be generally similar to that in 2007.

Comfort and Convenience

With the No Build Alternative, additional bus service would be provided on some routes. Given the reliance on buses, most of which would continue to operate in mixed traffic, transit riders would be subject to service delays and long trip times for several travel markets. Riders who have to stand would be subject to frequent stop-and-go vehicle movements.

3.3.3 Effects on Streets and Highways

This section discusses the effects of the No Build Alternative on streets and highways and includes future highway volumes and travel times.

Screenline Volumes and Operating Conditions

Under the No Build Alternative, vehicular traffic volumes on major roadway facilities in the study corridor are projected to increase from existing conditions. Due to the high rate of population and employment growth in ʻEwa and Kapolei, daily traffic volumes are expected to increase even more substantially at the ʻEwa end of the study corridor. Growth in traffic volumes at screenlines (Figure 3-4) are projected to be between 35 and 45 percent at Waikele Stream (Screenline C) and the ʻEwa areas (Screenlines A and B) and by more than 75 percent in the developing area of Kapolei. Under 2030 No Build conditions, Kapālama Canal (Screenline F) would be the most traveled, with more than 464,000 daily vehicles crossing it.

Table 3-12 compares existing traffic volumes for the a.m. and p.m. peak hours to those of the No Build Alternative. The greatest percentage increases in traffic volumes would be observed in Kapolei and ʻEwa (Screenlines A, B, and C).

Changes in Transit and Private Vehicle Demand

Figure 3-6 shows the estimated share of home-based work trips on transit in 2007 and under the 2030 No Build Alternative during the a.m. two-hour peak period for selected locations in the corridor. As seen in the figure, there is not much difference between 2007 and 2030. In most cases, any changes in mode share are less than 10 percent.

Table 3-12 Traffic Volumes at Selected Screenlines—2005 and 2030 No Build Alternative

ID[1]	Screenline and Direction	Volume (vph)[2]				% Change from Existing (A.M.)	% Change from Existing (P.M.)
		2005 Conditions		2030 No Build			
		A.M. Peak Hour	P.M. Peak Hour	A.M. Peak Hour	P.M. Peak Hour		
A	Kapolei mauka-bound	1,840	2,550	4,260	4,160	132%	63%
	Kapolei makai-bound	2,640	1,680	5,120	3,010	94%	79%
B	`Ewa Wai`anae-bound	5,360	6,820	8,010	8,700	49%	28%
	`Ewa Koko Head-bound	7,460	6,760	10,010	10,280	34%	52%
C	Waikele Stream `Ewa-bound	7,630	8,520	10,650	11,130	40%	31%
	Waikele Stream Koko Head-bound	9,170	6,000	12,070	8,380	32%	40%
D	Kalauao `Ewa-bound	8,940	14,070	10,250	16,150	15%	15%
	Kalauao Koko Head-bound	17,300	9,470	20,800	10,810	20%	14%
E	Salt Lake `Ewa-bound	7,540	14,050	8,670	15,610	15%	11%
	Salt Lake Koko Head-bound	17,420	10,250	19,520	10,920	12%	7%
F	Kapālama Canal `Ewa-bound	11,870	15,170	13,210	16,710	11%	10%
	Kapālama Canal Koko Head-bound	18,970	14,940	22,140	16,880	17%	13%
G	Ward Avenue `Ewa-bound	13,800	12,370	15,000	13,600	9%	10%
	Ward Avenue Koko Head-bound	11,390	15,350	13,460	17,330	18%	13%
H	Mānoa-Pālolo/Ala Wai Canal `Ewa-bound	14,940	12,780	15,790	13,890	6%	9%
	Mānoa-Pālolo/Ala Wai Canal Koko Head-bound	11,130	16,340	12,720	17,610	14%	8%

[1] Shown on Figure 3-4.
[2] Peak-hour traffic count data were obtained from HDOT (2005). 2030 data were obtained from the travel demand forecasting model.

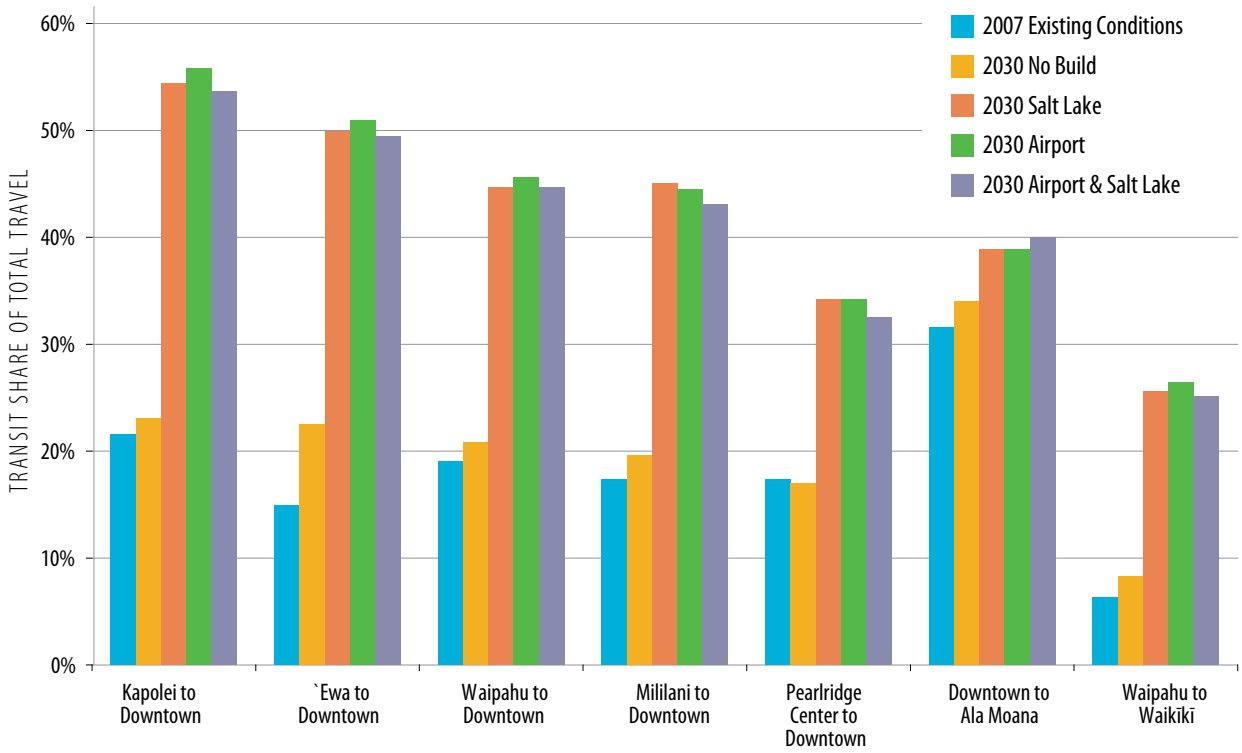


Figure 3-6 Transit Shares of Home-Based Work Trips in A.M. Two-hour Peak Period

3.3.4 Effects on Parking, Bicycle and Pedestrian Network, and Freight Movement

Other than improvements in the ORTP, the No Build Alternative would not directly affect parking, bicycle, pedestrian, or freight movement. However, these facilities would be affected by the continued increase in population, background traffic, and roadway delay that is expected with this alternative.

A single incident can cause major traffic disruptions. In 2006, an accident on the H-1 Freeway at a pedestrian overpass closed the `Ewa-bound lanes for eight hours, resulting in gridlock conditions.

3.4 Future Conditions and Effects: Build Alternatives

This section analyzes the effects of the Build Alternatives and compares them to the No Build Alternative. This assessment of the future transportation effects (year 2030) of the Build Alternatives includes potential phasing of the alternatives, such as phasing of the Airport & Salt Lake Alternative that would include first the section between East Kapolei and Ala Moana Center along Salt Lake Boulevard, followed by the connection from the Middle Street Transit Center to Honolulu International Airport, and finally the connection from the airport to Aloha Stadium. The following issues are examined:

- Travel characteristics
- Transit effects, including changes affecting mobility, reliability, access, and equity
- Transit-user benefits
- Street and highway effects, including operating conditions that would result from the fixed guideway system and physical effects of the guideway's components
- Parking, including the effects of traffic conditions at guideway stations with park-and-ride

access, on- and off-street parking eliminated due to placement of the fixed guideway columns, and spillover parking
- Bicycle and pedestrian movement/access
- Freight movement

3.4.1 Build Alternatives—Future Travel Patterns

Daily Person Trips

Table 3-13 identifies daily person trips for the 2030 No Build and Build Alternatives. Approximately 4 million person trips are projected under each alternative.

Mode of Travel

Under each Build Alternative, the private automobile share would decrease from 82 to 80 percent and the transit share would increase from 6 to 7 percent. Bicycle and walk would remain the same at 13 percent under all alternatives.

For trips made by visitors, mode share would generally remain the same for the No Build and Build Alternatives.

Vehicle Miles Traveled, Vehicle Hours Traveled, and Vehicle Hours of Delay

VMT, VHT, and VHD are projected to decrease under each Build Alternative compared to the No Build Alternative (Table 3-14). Daily VMT would decrease by 4 percent and VHT would decrease by 7 percent for each alternative. VHD would experience the greatest decrease: up to 23 percent, depending on the alternative. This reflects the fact that even moderate decreases in traffic volumes under congested conditions can result in relatively large decreases in travel delay.

Table 3-13 Islandwide Mode Shares—2030 No Build and Build Alternatives

Trip Type	No Build Alternative		Salt Lake Alternative		Airport Alternative		Airport & Salt Lake Alternative	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Trips by Residents								
Automobile–private	2,814,600	82%	2,773,600	80%	2,771,800	80%	2,772,700	80%
Transit	205,700	6%	247,400	7%	249,200	7%	248,200	7%
Bicycle and walk	432,400	13%	431,600	13%	431,600	13%	431,600	13%
Total Trips by Residents	3,452,700		3,452,600		3,452,600		3,452,500	
Trips by Visitors								
Automobile–private	160,100	37%	158,500	37%	158,100	37%	158,100	37%
Transit	19,800	5%	22,900	5%	23,700	6%	23,700	6%
Taxi	9,700	2%	9,600	2%	9,600	2%	9,600	2%
Tour Bus	77,500	18%	76,600	18%	76,400	18%	76,400	18%
Bicycle and walk	163,600	38%	163,600	38%	163,600	38%	163,600	38%
Total Trips by Visitors	430,700		431,200		431,400		431,400	
Other Trips								
Trips by Trucks	51,600	1%	51,600	1%	51,600	1%	51,600	1%
Ground access trips by air passengers	103,900	3%	103,900	3%	103,900	3%	103,900	3%
Total Other Trips	155,500		155,500		155,500		155,500	
Total Daily Trips (All)	4,038,900		4,039,300		4,039,500		4,039,400	

Numbers do not equal 100 percent due to rounding.

Table 3-14 Vehicle Miles Traveled, Vehicle Hours Traveled, and Vehicle Hours of Delay—2030 No Build and Build Alternatives

Alternative	Total			Percent Change from No Build		
	Daily VMT	Daily VHT	Daily VHD	Daily VMT	Daily VHT	Daily VHD
No Build	13,583,000	415,000	106,000	n/a	n/a	n/a
Salt Lake	13,096,000	385,000	84,000	-4%	-7%	-21%
Airport	13,086,000	385,000	82,000	-4%	-7%	-23%
Airport & Salt Lake	13,103,000	386,000	83,000	-4%	-7%	-22%

Under congested conditions, even small reductions in traffic volumes can show large reductions in delay.

Reverse Commute Markets

Improved access to West Oʻahu communities would also address reverse commute markets. Reverse commute trips originate in central areas and are destined to outlying and more suburban locations.

The fixed guideway service provided under the Build Alternatives would support and reinforce land use plans associated with Oʻahu's planned "second city" in Kapolei. With an almost four-fold increase in employment estimated by 2030 for Kapolei, the quick and direct access provided by the fixed guideway system from PUC Development Plan area locations (e.g., Downtown and Kakaʻako) would help address the demand of future reverse commute markets. These markets include existing and planned local government offices and the future UH West Oʻahu campus. Based on transit travel forecasts, about 20 percent of fixed guideway ridership during the a.m. two-hour peak period would be in the ʻEwa-bound direction, which demonstrates that the Project supports the goal of improving access to planned development and a second urban center.

With quick transit access provided to emerging employment centers, the Build Alternatives support enhanced transportation equity. Of the reverse commute transit trips with destinations in ʻEwa and Kapolei during the a.m. two-hour peak period, 54 to 55 percent originate from low-income communities.

Service to Transit-Dependent Households

Under the Build Alternatives, transit travel time benefits would occur for several communities with high concentrations of transit-dependent households (Figure 3-7). The transit-dependent communities are those with higher than average numbers of households without vehicles or residents who are unable to drive. There would be substantial travel time benefits for transit-dependent communities such as Waipahu, West Loch, Waikīkī, Chinatown, and Makakilo.

3.4.2 Effects on Transit

This section describes the effects of the Build Alternatives on various transit factors, including mobility, access, reliability, and equity.

The Build Alternatives would benefit the overall transportation system, enhancing the key measures of transit reliability, accessibility, mobility, and equity.

Transit Speed

Transit riders would experience substantially reduced travel times under the Build Alternatives compared to existing conditions and the No Build Alternative. Shorter travel times reflect faster systemwide transit speeds. Bus speeds have gradually declined over the past several years and would continue to decline under the No Build Alternative as a result of growth in traffic congestion and the lack of exclusive right-of-way

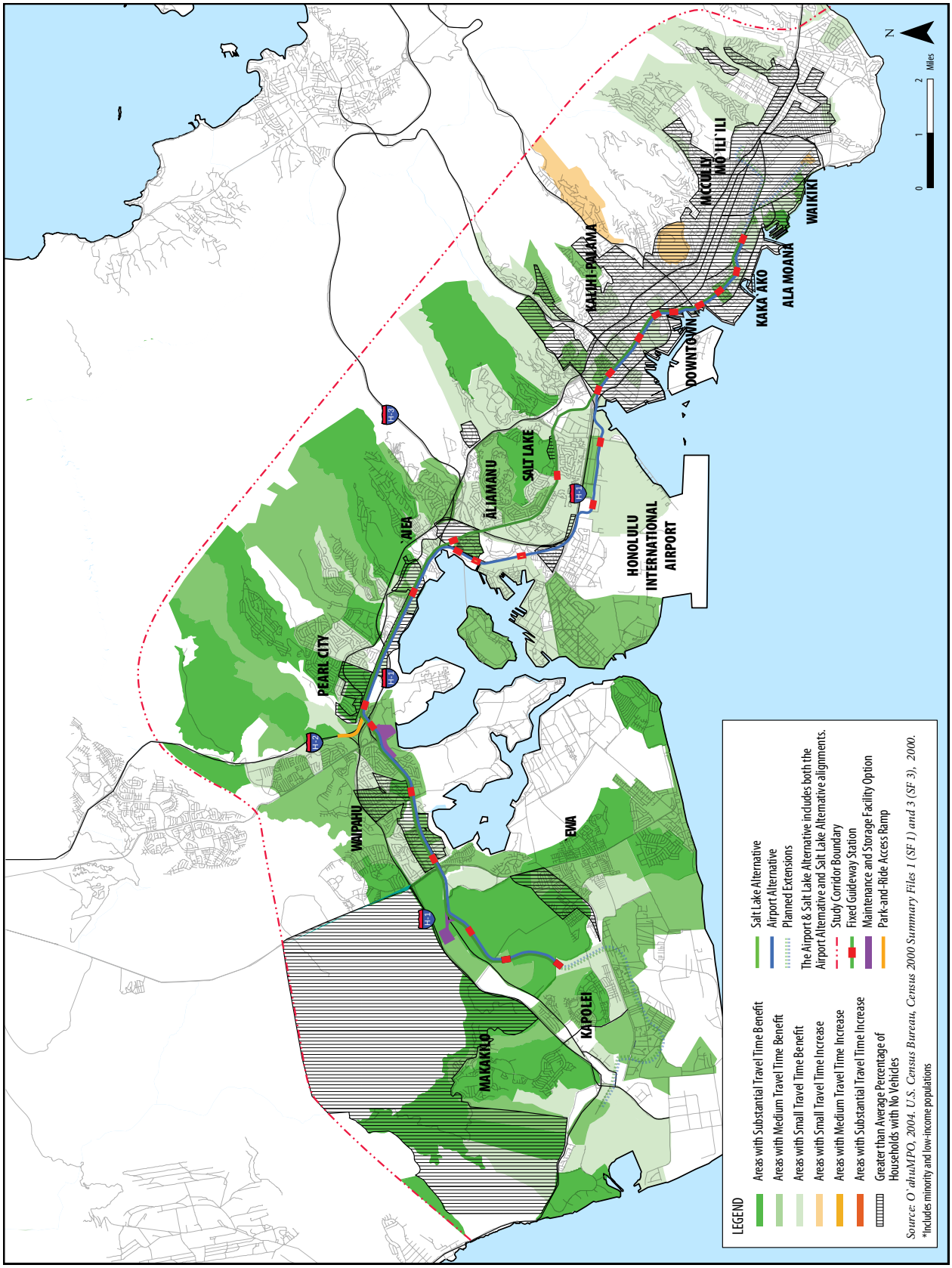


Figure 3-7 Transit Dependent Households

for transit vehicles. However, the fixed guideway operations would provide faster service compared to bus-only operations. Figure 3-8 compares system-level transit speeds for the No Build and Build Alternatives. Table 3-10 lists transit speeds for the No Build and Build Alternatives at selected locations. As a result of the increased transit speeds, major reductions in transit travel times would occur for several major markets, such as between Downtown Honolulu and developing areas in ʻEwa.

Under any of the Build Alternatives, average travel times on transit would improve dramatically, enhancing overall mobility and accessibility. In some cases, transit travel times would be half of what they are today.

Figure 3-9 shows 2007 and 2030 travel times between selected locations. This information represents the time required to complete a trip from origin to destination and assumes that at least a portion of the trip would be made on the fixed guideway system. Travel-time information for 2030 is presented for the No Build Alternative and the Build Alternatives.

As demand increases after the fixed guideway system is fully operational, service would gradually be expanded with more frequent and longer trains. This would cause the overall average transit speed to continue to increase. Trips to and from Mililani and Waikīkī, which are not along the alignment, would also benefit from reduced travel times when using the guideway. Station-to-station travel times are shown in Table 3-15. Since the fixed guideway system would operate independently from traffic, these travel times would be the same at all times of the day, offering certainty and reliability to riders. For example, the travel time between the East Kapolei and UH West Oʻahu Station would only be two minutes. The travel time from East Kapolei to Pearlridge Station would be the sum of the travel times in between, or 18 minutes along a heavily traveled portion of the study corridor.

Transit Ridership

Transit Ridership—Systemwide

Table 3-16 shows projected daily transit ridership for the No Build and Build Alternatives. Ridership numbers are presented in terms of fixed guideway boardings and total transit boardings. Daily transit boardings for the Build Alternatives would increase up to 43 percent over the No Build, depending on the alternative. Service frequency would be lower on the Airport & Salt Lake Alternative, so slightly fewer fixed guideway boardings are projected for this alternative.

Station and Link Volumes

Figure 3-10 shows the number of fixed guideway boardings (passengers getting on) and alightings (passengers getting off) that would occur at each station during the a.m. two-hour peak period in each direction. The Pearl Highlands Station would have the highest number of boardings in the a.m. two-hour peak period, and the Ala Moana Center Station would have the highest number of alightings and total passenger activity (boardings plus alightings).

Figure 3-11 shows the passenger volumes on guideway trains between each station during the a.m. two-hour peak period. The location of the highest link volume would vary by alternative: between Ala Liliko'i and Middle Street for the Salt Lake Alternative, between Aloha Stadium and Pearl Harbor for the Airport Alternative, and between Middle Street and Kalihi for the Airport & Salt Lake Alternative.

The maximum peak direction (Koko Head) volume during the a.m. two-hour peak period would be about 11,950 passengers in 2030. This is below the fixed guideway system's currently planned minimum capacity of 13,000 passengers per direction for a two-hour period. Should higher passenger

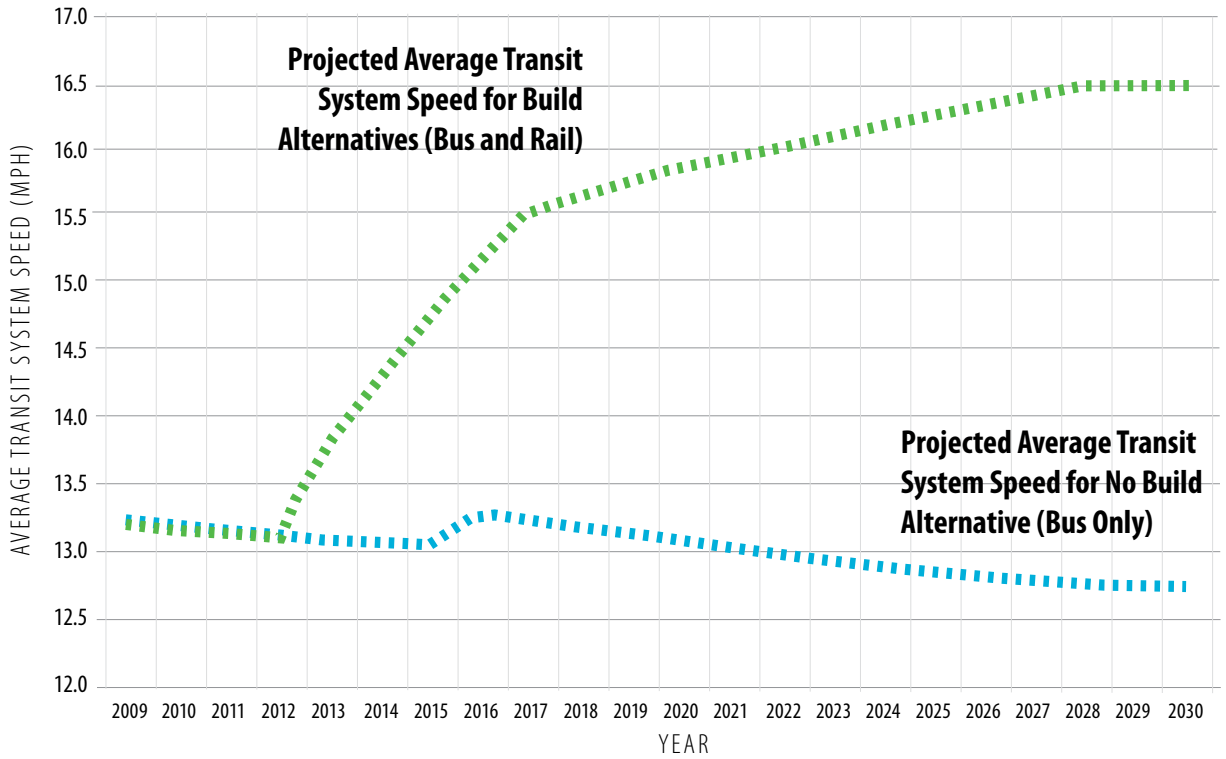


Figure 3-8 Transit Average Operating Speeds in Miles per Hour—2030 No Build and Build Alternatives

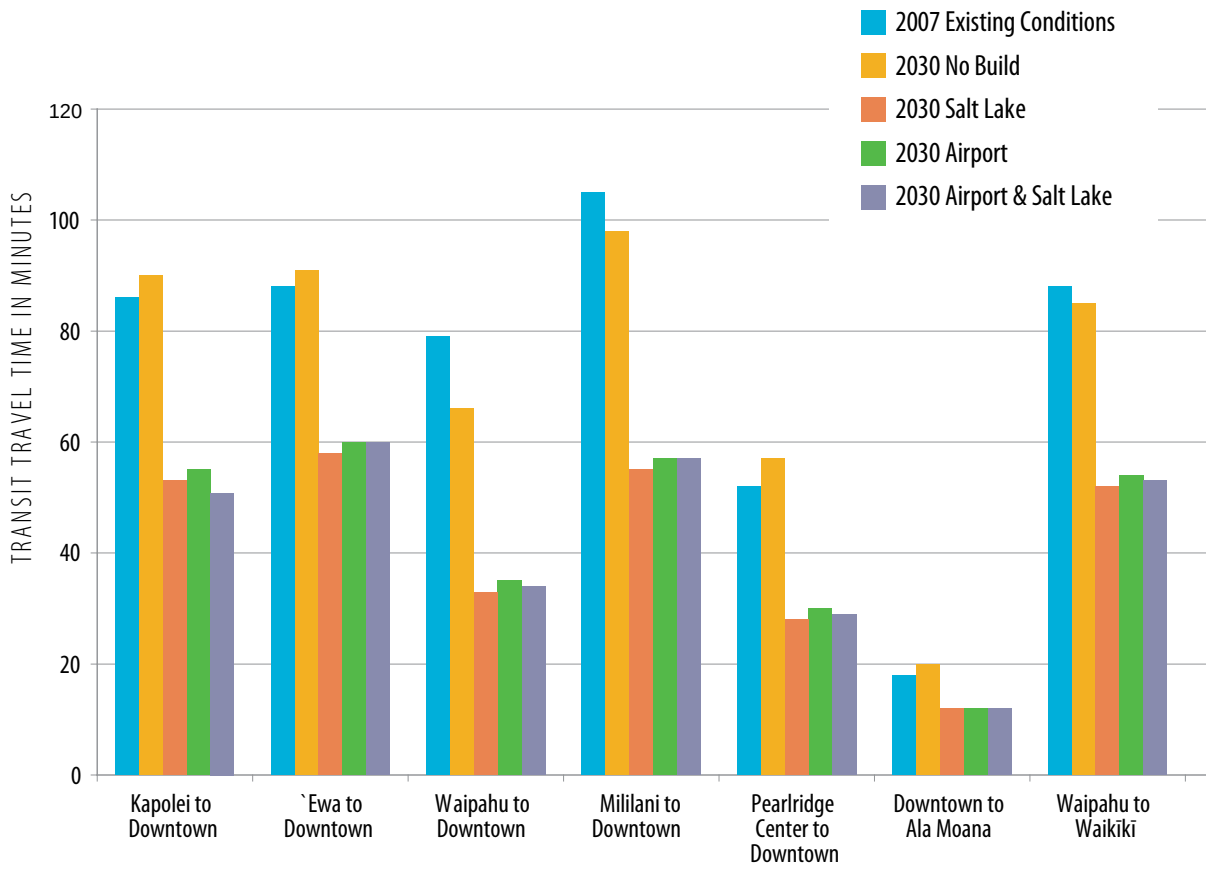


Figure 3-9 A.M. Peak-Period Transit Travel Times

Table 3-15 Station-to-Station Travel Times

Station to Station		Travel Time Between Stations (in minutes, including dwell time)			
		Salt Lake Alternative	Airport Alternative	Airport & Salt Lake Alternative	
				Salt Lake Alignment	Airport Alignment
East Kapolei	UH West O`ahu	2	2	2	2
UH West O`ahu	Ho`opili	4	4	4	4
Ho`opili	West Loch	2	2	2	2
West Loch	Waipahu TC	3	3	3	3
Waipahu TC	Leeward CC	2	2	2	2
Leeward CC	Pearl Highlands	1	1	1	1
Pearl Highlands	Pearlridge	4	4	4	4
Pearlridge	Aloha Stadium SLB	2	n/a	2	n/a
Aloha Stadium SLB	Ala Liliko`i	4	n/a	4	n/a
Ala Liliko`i	Middle Street	4	n/a	4	n/a
Pearlridge	Aloha Stadium KH	n/a	3	n/a	n/a
Pearlridge	Arizona Memorial	n/a	n/a	n/a	3
Aloha Stadium KH	Pearl Harbor	n/a	2	n/a	n/a
Arizona Memorial	Pearl Harbor	n/a	n/a	n/a	2
Pearl Harbor	Airport	n/a	3	n/a	3
Airport	Lagoon Drive	n/a	2	n/a	2
Lagoon Drive	Middle Street	n/a	2	n/a	2
Middle Street	Kalihi	2	2	2	2
Kalihi	Kapālama	2	2	2	2
Kapālama	Iwilei	2	2	2	2
Iwilei	Chinatown	1	1	1	1
Chinatown	Downtown	1	1	1	1
Downtown	Civic Center	1	1	1	1
Civic Center	Kaka`ako	1	1	1	1
Kaka`ako	Ala Moana	2	2	2	2
Total Travel Time		**40**	**42**	**40**	**42**

CC = Community College KH = Kamehameha Highway SLB = Salt Lake Boulevard TC = Transit Center

Table 3-16 Daily Transit Boardings and Trips for 2030 No Build and Build Alternatives

Alternative	Fixed Guideway Boardings	Total Transit Boardings	Total Transit Trips
No Build	n/a	314,000	226,000
Salt Lake	88,000	449,000	270,000
% Change from No Build		*43%*	*19%*
Airport	95,000	450,000	273,000
% Change from No Build		*43%*	*21%*
Airport & Salt Lake	93,000	446,000	272,000
% Change from No Build		*42%*	*20%*

Boardings represent the total number of times someone gets on a transit vehicle, whereas a trip can include transfers.

volumes be realized, the system will be designed to be able to provide substantially higher capacity by adding vehicles or reducing headways. Such operational adjustments would be evaluated as the system approaches the planned capacity toward 2030.

Figure 3-12 shows the number of daily fixed guideway boardings and alightings projected for each station. For all-day travel, the Ala Moana Center Station would experience the highest boardings, alightings, and total passenger activity. Figure 3-13 shows daily passenger volumes for each alternative. Under each alternative, the highest

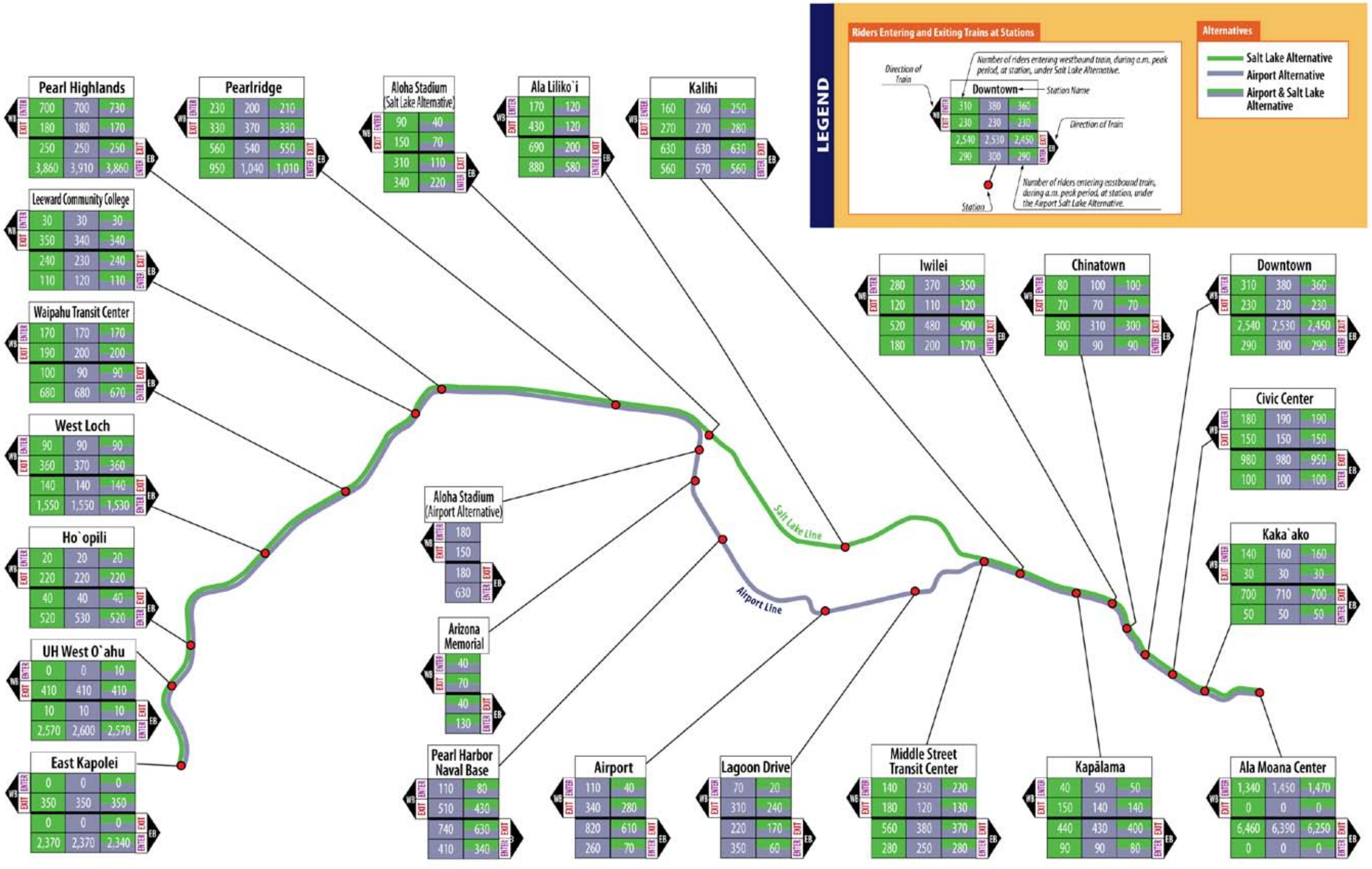


Figure 3-10 2030 A.M. 2-hour Peak Period Boardings and Alightings

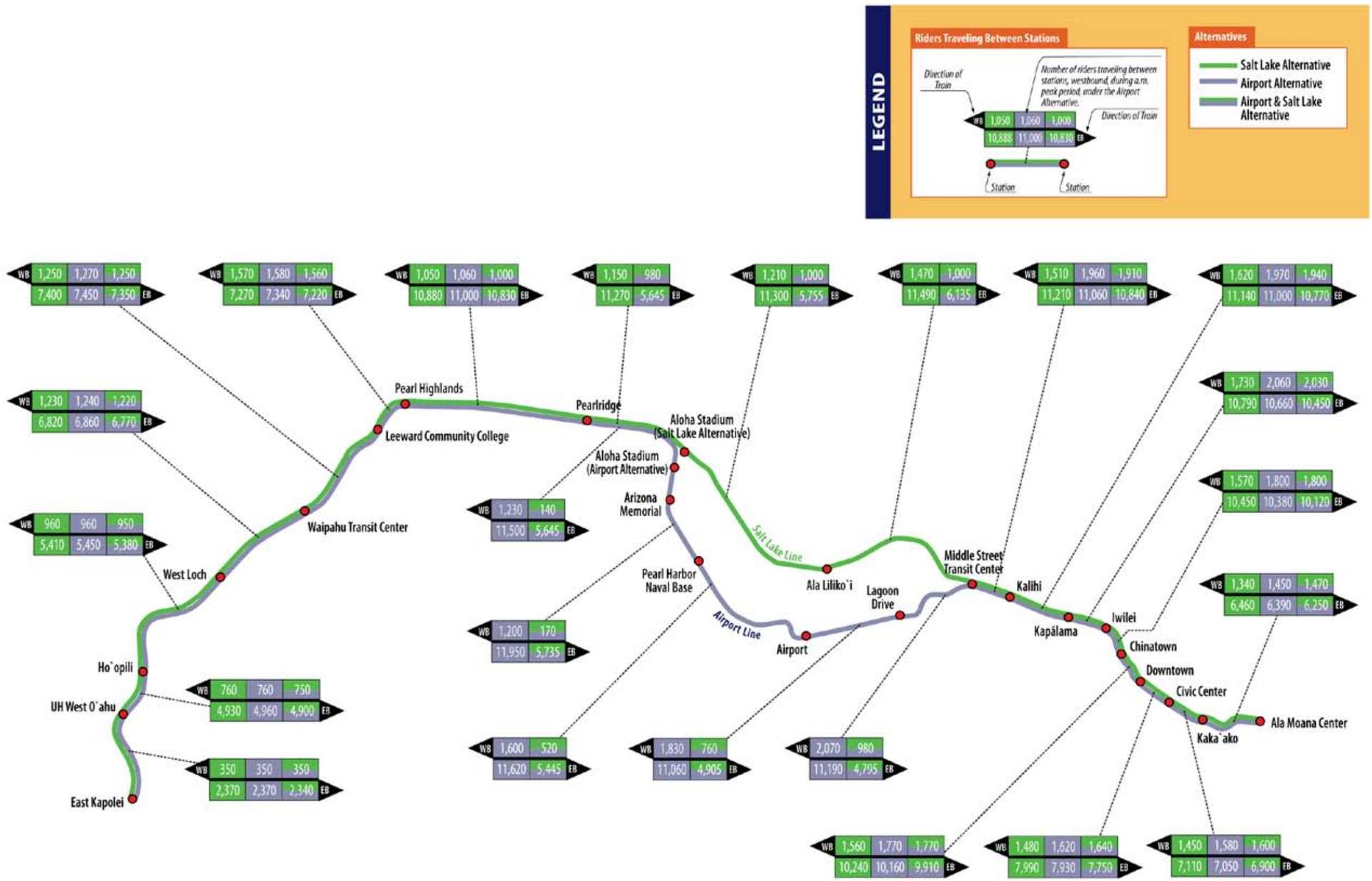


Figure 3-11 2030 A.M. 2-hour Peak Period Link Volumes

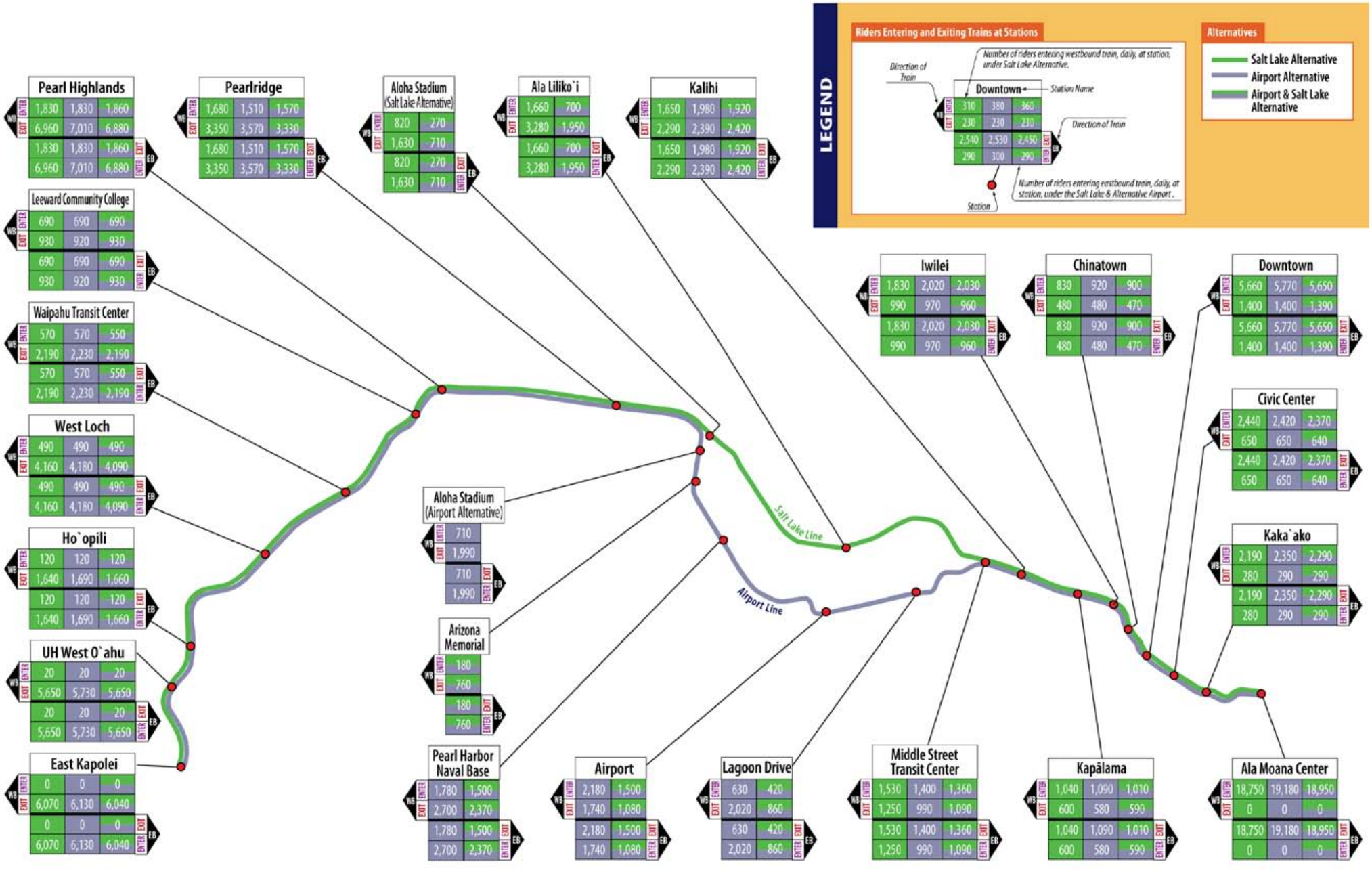


Figure 3-12 2030 Daily Boardings and Alightings

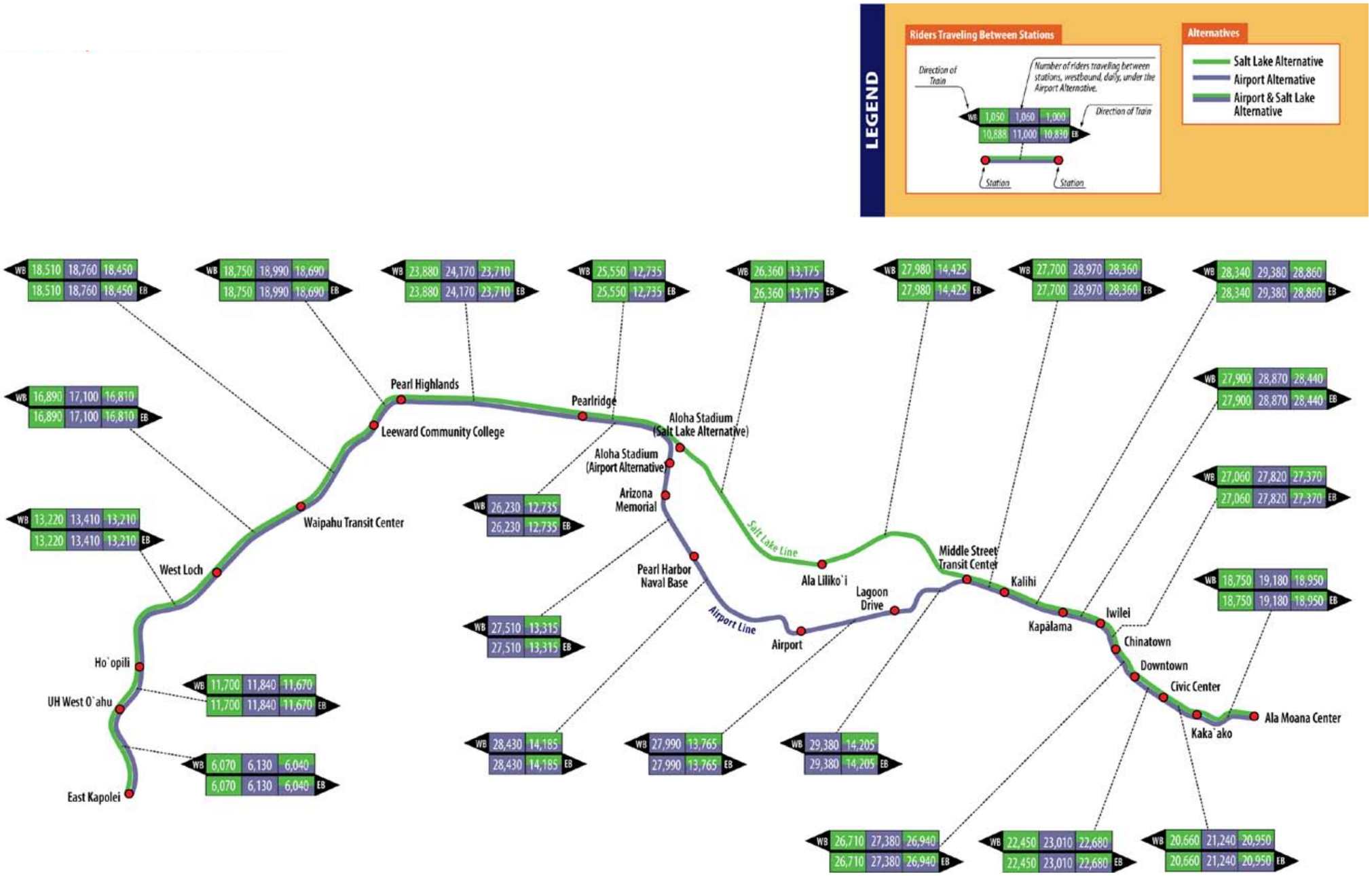


Figure 3-13 2030 Daily Link Volumes

daily link volume would occur between the Kalihi and Kapālama Stations.

Ridership by Type of Service

Table 3-17 summarizes the estimated breakdown of transit boardings by service type for the No Build and Build Alternatives.

Under the No Build Alternative, local bus service would predominate with 98 percent of total boardings. With the Build Alternatives, a shift in ridership would occur from local bus to fixed guideway service. Compared to the No Build Alternative, the local service share of total transit ridership would change from 98 percent under the No Build Alternative to approximately 80 percent for each of the Build Alternatives.

Express bus service shares would be low, decreasing from 1.7 percent for the No Build Alternative to less than 0.5 percent for the Build Alternatives. The fixed guideway would serve as an express route for the entire system.

The amount of bus service provided under the Build Alternatives would approximate those for the No Build Alternative. A review of estimated route-specific demand and service levels for 2030 indicated that bus service capacity would be sufficient to accommodate ridership.

Changes in Transit and Private Vehicle Demand

Figure 3-6 identifies the estimated transit share of home-based work trips under existing conditions and the 2030 No Build and Build Alternatives during the a.m. two-hour peak period. The information is provided for selected travel pairs in the study corridor. As indicated by the figure, there is little difference between existing conditions and the No Build Alternative. In most cases, changes in transit share would be less than 10 percent.

Under the Build Alternatives, the transit mode share for home-based work trips during the a.m. two-hour peak period would increase substantially for most travel pairs compared to the No Build Alternative. For many travel markets, the transit share of trips under the Build Alternatives would double (and in one case triple) the share occurring under the No Build Alternative. For example, the commute-to-work transit share of the ʻEwa to Downtown Honolulu travel market would increase from 23 percent under No Build to between 54 percent and 56 percent under the Build Alternatives. In other words, more than half of the people going from ʻEwa to Downtown to work in the morning would use transit with the Build Alternatives, compared to only a quarter without the Project.

Substantial increases in transit share would also occur for travel markets not directly served by the fixed guideway. For example, the transit share of the Waipahu to Waikīkī market would increase

Table 3-17 Shares of Total Daily Boardings by Transit Service Type (Residents plus Visitors)—2030 No Build and Build Alternatives

Alternative	Local Bus		Express Bus		Fixed Guideway		
	Number of Boardings	Percent Share	Number of Boardings	Percent Share	Number of Boardings	Percent Share	Total
No Build	308,720	98.3%	5,360	1.7%	n/a	n/a	314,080
Salt Lake	360,580	80.2%	1,190	0.3%	87,570	19.5%	449,340
Airport	353,090	78.5%	1,240	0.3%	95,310	21.2%	449,640
Airport & Salt Lake	352,130	78.9%	1,230	0.3%	92,710	20.8%	446,070

from 8 percent under No Build to between 25 percent and 26 percent under the Build Alternatives. This increase in transit share is related to faster systemwide transit speeds and improved access to the fixed guideway system due to more reliable feeder bus service.

With the Build Alternatives, public transit's share of total travel would increase. For several travel markets, transit's share of a.m. two-hour peak-period commute-to-work trips would double.

Transit Reliability

Transit service reliability is highly influenced by the number of vehicles operating in exclusive right-of-way. Under the No Build Alternative, express bus routes would operate in the a.m. and p.m. zipper lanes and HOV lanes. However, these lanes would not be exclusively reserved for transit operations.

The No Build Alternative does not provide any exclusive right-of-way for transit vehicles along major highways that could enhance transit service reliability.

Operating transit vehicles on a fixed guideway would provide substantially higher transit service reliability compared to No Build conditions.

Since the fixed guideway vehicles would be completely separated from roadway traffic operations, the Build Alternatives would provide substantially higher transit service reliability compared to the No Build Alternative. This reliability would not deteriorate over time, even with projected population and employment growth in the study corridor. The reliability of fixed guideway vehicles would be better than the reliability of transit vehicles operating on increasingly congested highways.

The bus network would also be restructured to provide access from surrounding communities to the fixed guideway with more frequent bus service. Bus routes serving guideway stations would typically be shorter and would operate in less congested residential communities. These operations would help maintain service reliability compared to operations of longer-distance routes.

Providing this separation between the guideway system and general traffic would address the gradual deterioration of service reliability. Bus service on O'ahu has been experiencing a decline in service reliability, and this decline is predicted to continue under 2030 No Build conditions.

Access to Fixed Guideway Stations

With the Build Alternatives, overall accessibility to transit would be enhanced. The Build Alternatives would attract substantial ridership via local bus access and from people walking to stations (Table 3-18). Bus and walk access to stations would account for approximately 85 percent of total trips in the a.m. two-hour peak period. Although some drive access is projected at outlying stations, such as East Kapolei, the predominant access would be by local bus and walking. For those leaving stations in the a.m. two-hour peak period, egress via

Table 3-18 Mode of Access to Fixed Guideway Stations—2030 Build Alternatives

Alternative	Daily Persons Trips using Guideway Stations by Mode								
	Walk		Bus		Kiss-and-Ride		Auto		Total
	Volume	% Share	Volume	% Share	Volume	% Share	Volume	% Share	
Salt Lake	13,900	16%	61,190	69%	3,210	4%	10,080	11%	88,380
Airport	16,480	17%	65,190	68%	3,290	3%	10,730	11%	95,690
Airport & Salt Lake	16,330	18%	63,130	68%	3,220	3%	10,220	11%	92,900

Numbers do not equal 100 percent due to rounding.

walking dominates, particularly at stations with large employment concentrations. Escalators and elevators would be available at each station.

Access to stations would also be enhanced by accommodating bicyclists and pedestrians. Several stations would be located at or near existing or planned bicycle facilities. Each station would have facilities for parking bikes, and each guideway vehicle would be designed to accommodate bicycles during off-peak hours. Sidewalks and crosswalks are currently available at stations or would become available as streets and sidewalks are built in developing areas.

The dominance of local buses and walking to the fixed guideway system indicates that overall accessibility would be broad. This is especially important for riders who do not have access to automobiles.

Transfers

A major feature of O'ahu's existing transit service is reliance on transit centers as focal points of activity. The transfer rate in 2007 was 37 percent, and the estimated rate for the 2030 No Build Alternative is 39 percent, which equals about 1.4 bus rides or segments per transit trip.

With any of the Build Alternatives, the rate of transfers would be higher than under the No Build Alternative due to proposed changes in local bus service to maximize access to the fixed guideway system. Some existing routes, including peak-period express service, would be altered to avoid duplication with the fixed guideway system. Some local routes would also be rerouted or reclassified as feeder buses to provide better service to the nearest fixed guideway station. The projected rate of transfers would range from 64 to 67 percent, depending on the alternative, which is about 1.6 to 1.7 transfers per trip.

Because of the high frequency of the fixed guideway service (three-minute headways between trains during peak periods), riders transferring from buses to the fixed guideway would experience minimal wait times. Riders transferring from the guideway service to buses would benefit from improved frequencies on existing bus routes serving stations. Also, several new routes with high frequencies would be provided as feeders to the guideway system. Since these routes would primarily operate in residential areas, they would provide greater reliability versus routes operating along congested arterials. Riders transferring from rail-to-bus would also benefit from coordinated transfers between trains and buses, thereby minimizing wait times.

The use of local bus feeder service also makes the fixed guideway system highly accessible, particularly for people dependent on transit or who would prefer not to drive to stations. The fixed guideway system would facilitate the reorientation of the bus system and improve transit service beyond the immediate vicinity of the study corridor.

To facilitate transfers, fixed guideway stations and other major transit hubs would provide conveniences such as covered waiting areas. Off-vehicle fare collection would reduce travel and wait times.

Comfort and Convenience

As described in Chapter 2, the fixed guideway system's service frequencies (every three to ten minutes) and hours of operation (between 4 a.m. and midnight) would minimize wait times and thus provide major conveniences to riders. The service frequency and train *consists* (the number of cars per train) would also be designed to better meet peak-period/peak-direction rider demand. Comfort for riders would be enhanced by station amenities, including covered waiting areas and seats.

Operation of the fixed guideway in exclusive right-of-way would improve convenience. For riders who stand, the guideway service would also provide increased safety compared to frequent stop-and-go travel that occurs on buses that travel in mixed traffic on uneven roadway surfaces. Because the station platforms would be at the same level as the vehicles, this would accommodate quick and easy boardings for all patrons, especially those in wheelchairs or with strollers.

Transit User Benefits

Transit user benefits represent the amount of transit travel-time savings a user would experience with a given transit alternative compared to the No Build Alternative. This section discusses the transit-user benefits of the Build Alternatives compared to the No Build Alternative. Transit user benefits is an effective way to quantify the four key goals of the Project.

The main factor in determining benefits is travel time. User benefits are measured in minutes and are a summary measure that incorporates travel-time changes for all modes.

Positive Attributes of a Fixed Guideway System

Research indicates that positive attributes (both perceived and real) are associated with the use of a fixed guideway system, which make the system more attractive than general bus transit. These benefits include such things as improved safety, security, visibility, ease of use, comfort, and reliability. These factors or attributes are not captured by the standard travel demand forecasting process. To account for these attributes in this user benefit analysis, FTA has approved an additional factor equivalent to a 14.5-minute savings of in-vehicle time. The factor was incorporated for riders taking the fixed guideway only. A 5.5-minute savings of in-vehicle time was incorporated for riders taking feeder buses to the fixed guideway.

This factor is based on information from several regions where existing rail transit service has been a part of the transit system and where these systems have been recently surveyed.

Transit User Benefits—Selected Major Travel Markets

Transit user benefits have been estimated for various travel markets and at the geographic level. With the Build Alternatives, it is estimated that approximately 50,000 hours of transit travel times per weekday would be saved. Greater use of the transit system, higher transit speeds, and the other attributes noted previously would contribute to these user benefits.

The user benefits, expressed in terms of saved hours per day, can also be identified for specific transit travel markets. Table 3-19 shows estimated

Table 3-19 Estimated Transit User Benefits Resulting from 2030 Build Alternatives (Hours per Day)

Key Transit Market*	Salt Lake Alternative	Airport Alternative	Airport & Salt Lake Alternative
Work trips to Downtown Honolulu	3,840	3,680	3,590
Visitor trips from Waikīkī	1,050	1,450	1,490
Other trips to Downtown	340	310	240
Work trips to Waikīkī	2,830	2,760	2,730
Work trips to Kalihi	1,640	1,570	1,540
School trips to UH Mānoa	2,980	2,900	2,900
Work trips to Kaka`ako	1,400	1,360	1,330
Work trips Mō`ili`ili	1,290	1,250	1,220
Work trips from `Ewa	2,620	2,680	2,610
Work trips from Kapolei	1,420	1,460	1,400
Work trips from Waipahu	1,860	1,910	1,860
Work trips from Mililani	1,380	1,450	1,410
Subtotal	**22,650**	**22,780**	**22,320**
Other	26,330	29,120	27,850
Total	**48,980**	**51,900**	**50,170**

Source: O'ahuMPO Travel Demand Forecasting Model .
*Except for *Visitor trips from Waikīkī*, the markets involve home-based travel.

daily savings for several markets on O'ahu. These savings would range from approximately 240 to 340 hours per day (for Home-Based Other trips destined to Downtown) to almost 3,590 to 3,840 hours per day (for Home-Based Work trips to Downtown Honolulu). In addition, there are transit travel-time benefits for work trips from 'Ewa and Kapolei, both planned development areas. The estimated cumulative savings of approximately 22,320 to 22,780 hours per day represents just under one-half of the approximately 50,000 estimated total daily user benefits that would result from the Project.

As shown in Figure 3-7, there would be substantial travel-time savings for communities with high concentrations of transit-dependent households.

Most areas within the study corridor would experience "user benefits" under the Build Alternatives compared to No Build conditions due to a reduction in transit travel times.

In addition, several markets estimated to experience major user benefits would not be located on the guideway. These include Waikīkī, UH Mānoa, and 'Ewa. The Build Alternatives would result in benefits to users in these areas because residents could access the guideway via local bus service or park-and-rides. With travel-time savings between planned population and employment areas and for transit-dependent households, the Project supports each of the four goals.

3.4.3 Effects on Streets and Highways

This section presents the effects that the Build Alternatives would have on traffic. It focuses on the following:

- Changes in peak-hour traffic volumes at selected screenlines
- Effects on traffic from placing columns to support the fixed guideway structure
- Effects on traffic and parking near fixed guideway stations and the potential maintenance and storage facility

Screenline Volumes and Operating Conditions

To determine the effects of the Project, street and highway system peak-period traffic volumes were evaluated at key screenline locations in the study corridor (Figure 3-4). The Salt Lake Alternative was used as the representative Build Alternative for the purpose of the screenline volume analysis. Table 3-20 compares the No Build Alternative traffic volumes for a.m. and p.m. peak hours to those of the Salt Lake Alternative. Screenlines A and H were not included because they are beyond the ends of the Project. Traffic volumes at most screenlines would decrease compared to the No Build Alternative. Peak-hour/peak-direction traffic-volume would decrease by as much as 12 percent. Traffic reductions would result from people choosing to use transit during peak travel times.

Effects of Guideway on Traffic

Columns to support the fixed guideway would be placed to minimize effects on traffic patterns. In some cases, widening the median to accommodate columns would require reducing lane widths slightly. In almost all cases, there would be no reduction in the number of roadway lanes. These effects are summarized in Table 3-21.

There is only one location along the alignment where roadway capacity would be reduced by placement of the fixed guideway structure: Salt Lake Boulevard between Marshall Road/Pakini Street and Luapele Drive in the 'Ewa-bound direction. To determine the potential effect of this change in roadway capacity, four intersections were studied:

- Salt Lake Boulevard and Kahuapa'ani Street
- Salt Lake Boulevard and Luapele Drive
- Salt Lake Boulevard and Ala'oli Street
- Salt Lake Boulevard and Bouganville Drive

Table 3-20 Traffic Volumes at Screenlines—2030 No Build and Salt Lake Build Alternatives

ID[1]	Screenline and Direction/Facility	No Build Alternative		Build Alternatives		% Change from No Build Alternative (A.M.)	% Change from No Build Alternative (P.M.)
		A.M. Peak Hour	P.M. Peak Hour	A.M. Peak Hour	P.M. Peak Hour		
		Observed Volume (vph)[2]	Observed Volume (vph)[2]	Observed Volume (vph)[2]	Observed Volume (vph)[2]		
B	`Ewa Wai`anae-bound	8,010	8,700	7,860	8,140	-2%	-6.0%
	`Ewa Koko Head-bound	10,010	10,280	9,280	10,040	-7%	-3.0%
C	Waikele Stream `Ewa-bound	10,650	11,130	10,480	10,390	-2%	-9.0%
	Waikele Stream Koko Head-bound	12,070	8,380	11,040	8,280	-9%	-4.0%
D	Kalauao `Ewa-bound	10,250	16,150	10,030	14,770	-2%	-12.0%
	Kalauao Koko Head-bound	20,800	10,810	18,910	10,490	-9%	-5.0%
E	Salt Lake `Ewa-bound	8,670	15,610	8,390	14,380	-3%	-11.0%
	Salt Lake Koko Head-bound	19,520	10,920	17,920	10,990	-8%	0.5%
F	Kapālama Canal `Ewa-bound	13,210	16,710	13,090	15,690	-1%	-9.0%
	Kapālama Canal Koko Head-bound	22,140	16,880	20,760	16,530	-6%	-4.0%
G	Ward Avenue `Ewa-bound	15,000	13,600	14,890	12,960	-1%	-6.0%
	Ward Avenue Koko Head-bound	13,460	17,330	12,560	17,020	-7%	-2.0%

[1] Shown on Figure 3-4.
[2] Traffic count data was obtained from the travel demand forecasting model.

These intersections would be affected by the Salt Lake Alternative and the Airport & Salt Lake Alternative.

Under the No Build Alternative, three of these four intersections would operate at LOS D or better, and the Salt Lake Boulevard and Kahuapaʻani Street intersection would operate at LOS F. With the Project, the intersections operating at LOS D under the No Build Alternative would continue to operate at LOS D, and the intersection already operating at LOS F would not experience an increase in average vehicle delays. Therefore, the Build Alternatives would not affect traffic operations in this area.

Traffic Effects at Stations with Park-and-Ride Facilities

Four guideway stations would have park-and-ride facilities (East Kapolei, UH West Oʻahu, Pearl Highlands, and Aloha Stadium). These stations would have the highest demand of people driving to access the fixed guideway system.

Intersections adjacent to each proposed location were analyzed to determine potential effects resulting from park-and-ride and kiss-and-ride traffic and feeder buses. Twenty-five intersections, both existing and planned, were analyzed. Delay and LOS were analyzed for both the 2030 No Build and Build Alternatives.

As shown in Table 3-22, analysis found that three intersections would be affected by park-and-ride and kiss-and-ride traffic and local bus activity in the a.m. and p.m. peak hours. These three intersections, near the Pearl Highlands Station, would experience traffic volumes under the Build Alternatives that would increase traffic delay compared with the No Build Alternative. Potential mitigation measures are discussed in Section 3.4.5, Mitigation of Long-term Transportation Effects.

Table 3-21 Column Placement Effects on Streets and Highways

Alternative and Street/Intersection	Column Placement	Summary of Potential Effects
Common to All Build Alternatives		
Farrington Highway and Fort Weaver Road	Side/Median	Expand median by 9 feet for column placement. Reduce existing through lanes to 11 feet and left-turn lanes to 10 feet.
Farrington Highway from Kunia Road to Kahualii Street	Median	Expand median. Reduce through lanes to 11 feet and left-turn lanes to 10 feet.
Kamehameha Highway from Acacia Road to Boathouse Entrance	Median	Expand median. Reduce through lanes to 11 feet and left-turn lanes to 10 feet. May restrict left turns at certain driveways.
Kamehameha Highway and Laumaka	Median	Construct 10-foot median. Acquire right-of-way on makai side of roadway.
Dillingham Boulevard from Pu`uhale to Costco Driveway	Median	Acquire 10 feet of additional right-of-way on makai side of roadway. Signal modification may be necessary to account for left-turn phasing.
Dillingham Boulevard from Ka`aahi to King	Varies	Acquire right-of-way to add makai-bound lane for buses to turn left at Ka`aahi.
Nimitz from Maunakea to Halekauwila	Median	Expand median by acquisition of additional right-of-way.
Kona Street and Ke`eaumoku Street	Median	Demolish portions of parking structure ramps.
Kona Street from Ala Moana Center to Mahukona Street	Median	Reduce lanes from 11 feet to 10 feet.
Salt Lake Alternative		
Salt Lake Boulevard from Lawehana Street to Luapele Street	Side	Remove travel lane in `Ewa direction.
Salt Lake Boulevard from Kahuapa`ani Street to Ala Napunani Street	Median	Expand median. Reduce lane widths and sidewalks.
Salt Lake Boulevard/Pūkōloa Street and Pu`uloa Road	Median/Side	Expand median. May need to remove travel/turn lane.
Airport Alternative		
Kamehameha Highway and Radford Drive	Median	Reduce existing through lanes to 11 feet and left-turn lanes to 10 feet.
Kamehameha Highway and Center Drive	Median	Reduce existing through lanes to 11 feet and left-turn lanes to 10 feet.
Airport & Salt Lake Alternative		
Salt Lake Boulevard from Lawehana Street to Luapele Street	Side	Remove travel lane in `Ewa direction.
Salt Lake Boulevard from Kahuapa`ani Street to Ala Napunani Street	Median	Expand median. Reduce lane widths and sidewalks.
Salt Lake Boulevard/Pūkōloa Street and Pu`uloa Road	Median/Side	Expand median. May need to remove travel/turn lane.
Kamehameha Highway and Radford Drive	Median	Reduce existing through lanes to 11 feet and left-turn lanes to 10 feet.
Kamehameha Highway and Center Drive	Median	Reduce existing through lanes to 11 feet and left-turn lanes to 10 feet.

Table 3-22 Effects on Traffic near Park-and-Ride Lots—2030 No Build and Build Alternatives

Station	Intersection			Control	Peak Hour	2030 No Build		2030 Build		Project Delay Change (sec)
						Delay (sec)	LOS	Delay (sec)	LOS	
Common to All Build Alternatives										
Pearl Highlands	Kamehameha Highway	and	Waihona Street/Pearl Highlands Station Park-and-Ride Driveway[1]	TWSC/S[2]	P.M.	122	F	137	F	15
Pearl Highlands	Kamehameha Highway	and	Kuala Street	TWSC	A.M.	71	F	205	F	134
					P.M.	>400	F	>400	F	n/a
Pearl Highlands	Farrington Highway	and	Waiawa Street/Pearl Highlands Station Park-and-Ride Driveway[3]	TWSC	A.M.	76	F	316	F	240
					P.M.	30	D	125	F	95

S = Signal Control, TWSC = Two-Way Stop-Controlled, sec = seconds

[1] Lane configuration would be dual left-turn lane, single through lane, and single right-turn.

[2] Waihona Street currently provides a single left- turn lane and a right- turn lane and is controlled by stop signs. Traffic on Kamehameha Highway is currently uncontrolled. Under future 2030 No Build conditions and 2030 Build conditions, the T-intersection of Waihona Street at Kamehameha Highway is assumed to be signalized under 2030 No Build conditions and 2030 Build Alternativesconditions.

[3] Access would be right-in and right-out only.

Effects of Buses on Traffic Near Stations

Bus routes would be modified to reduce duplication of service and facilitate transfers with the fixed guideway system. In addition to analyzing bus access at stations with planned park-and-ride facilities, an analysis was conducted at selected fixed guideway stations to determine if the increase in buses would affect traffic.

Five stations were selected for detailed traffic analysis: West Loch, Pearlridge, Middle Street, Downtown, and Ala Moana. These stations are projected to have relatively high levels of increased bus trips. Sixteen intersections were analyzed. The complete results of the analysis and number of buses serving each station can be found in the Transportation Technical Report (RTD 2008a).

The addition of feeder buses would not cause a substantial effect on traffic near the West Loch, Pearlridge, Middle Street, and Downtown Stations. LOS would remain the same or improve at 15 of the 16 intersections. The Kona/Keʻeaumoku Street intersection near the Ala Moana Station is the only one studied that would worsen in the a.m. peak hour with the introduction of additional buses and kiss-and-ride traffic. However, this intersection would experience reduced delay during the p.m. peak hour.

Maintenance and Storage Facility Effects on Traffic

Any of the Build Alternatives would require development of a maintenance and storage facility, where up to 100 fixed guideway vehicles would be maintained and stored. Two locations are being considered, but only one of the following sites would be selected:

- Near Leeward Community College
- Near Hoʻopili

A detailed traffic analysis was conducted to determine the traffic effects of a maintenance and storage facility at each location. The study found that 63 trips would be generated by the facility

during each a.m. and p.m. peak period. The traffic analysis concluded that these vehicle trips would not affect any of the intersections analyzed.

3.4.4 Effects on Parking, Bicycle and Pedestrian Facilities, and Freight

Effects on parking include two categories. One involves the estimated loss of existing parking due to placement of the guideway. The other involves effects relating to spillover parking demand in station areas.

Effects on Parking Supply

It is estimated that 820 to 960 off-street and 230 to 250 on-street parking spaces would be removed as a result of the Build Alternatives, depending on the alternative selected. Parking spaces would be removed primarily to accommodate guideway column placement or station entrance locations. The Salt Lake Alternative and the Airport & Salt Lake Alternative would result in greater parking effects than the Airport Alternative due to a high volume of off-street parking spaces removed at the Aloha Stadium (Salt Lake) and Ala Liliko'i Stations. Locations where parking could be removed are identified in Table 3-23.

To analyze the effect of losing parking capacity, a field survey of utilization was conducted in June 2008 of existing parking spaces along the study corridor. The survey counted turnover of parking spaces during weekdays and on Saturdays.

The results of the field survey indicated that most parking spaces that would be affected by the guideway are currently occupied at least part of the day. However, at several locations the extent of parking demand varies. The most dominant demand generally occurs on weekdays in the mid-afternoon.

Spillover Parking Effects on Station Areas

A review of patronage forecasts at each station indicates that some guideway transit passengers may park near stations that do not have designated parking. This is known as *spillover parking*.

An analysis was completed to determine if spillover parking would affect traffic and parking supply near stations. Locations with the largest projected demand for spillover parking were selected for further study. These included West Loch, Pearlridge, Iwilei, and Ala Moana Center. These four stations could attract a spillover parking demand of 140 to 370 automobiles each day, depending on the station and the alternative.

A traffic analysis was conducted for the a.m. peak hours. The intersection LOS analysis determined that additional traffic from spillover parking would not affect local traffic conditions.

The spillover demand for parking was identified by the travel demand forecasting model for the year 2030. However, the actual extent of spillover parking near stations would be influenced by a variety of factors:

- Lack of available parking—some neighborhoods, such as near Ala Moana Center, do not have long-term parking available for commuters. As a result, the actual number of spillover parking would be less because transit patrons would choose to park elsewhere (and use a different station) or would use a feeder bus to access the fixed guideway system.
- Changing conditions between now and 2030—additional parking could be provided in the future, or feeder bus service could be used at a higher rate than anticipated.
- Future development around station areas—new land uses near stations could change the demand for and supply of parking. These factors could influence how people choose to access the stations and where they would park.

Table 3-23 Potential Effects on Parking due to Fixed Guideway Column Placement

Alternative and Street/Intersection			Column Placement	Parking Spaces Lost		
				On-Street		Off-Street
Roadway or Station Name	Cross Street From	Cross Street To		Mauka	Makai	
Common to All Build Alternatives						
West Loch Station	–	–	Median			21
Waipahu Transit Center Station	–	–	Median			13
Ala Ike Street/LCC Station	–	–	Side			180
Kamehameha Highway	H-1/H-2 Interchange	Moanalua Freeway Interchange	Median			43
Dillingham Boulevard	Laumaka Street	Pu`uhale Road	Median			13
Dillingham Boulevard	Pu`uhale Road	Mokauea Street	Median			19
Dillingham Boulevard	Mokauea Street	Kalihi Street	Median			20
Dillingham Boulevard	Kalihi Street	McNeill Street	Median			6
Dillingham Boulevard	McNeill Street	Waiakamilo Road	Median			26
Dillingham Boulevard	Waiakamilo Road	Kohou Street	Side			10
Dillingham Boulevard	Kohou Street	Alakawa Street	Side			15
Dillingham Boulevard	Alakawa Street	Ka`aahi Street	Varies (Median/ Side)			130
Ka`aahi Street	Dillingham Boulevard	End of existing road	Side	8	9	
Halekauwila Street	Punchbowl Street	South Street	Side	8	13	
Halekauwila Street	South Street	Keawe Street	Side	9	6	
Civic Center Station	–	–	Off-street			35
Halekauwila Street	Keawe Street	Coral Street	Side	16	22	
Halekauwila Street	Cooke Street	Kamani Street	Side	17	27	12
Kaka`ako Station	Ward Entertainment Center and Ward Gateway Center	–	Off-street			183
Kona Street	Pensacola Street	Pi`ikoi Street	Median	53	39	
Ala Moana Center	–	–	Median			75
Salt Lake Alternative						
Salt Lake Boulevard	Kamehameha Highway	Luapele Drive	Roadside			89
Ala Liliko`i Station	–	–	Median			56
Airport Alternative						
Aloha Stadium Overflow Parking Lot	–	–	Side			20
Kamehameha Highway	Salt Lake Boulevard	Kohomua Street	Roadside	20		
Airport & Salt Lake Alternative						
Salt Lake Boulevard	Kamehameha Highway	Luapele Drive	Roadside			89
Ala Liliko`i Station	–	–	Median			56
Arizona Memorial Station	–	–	Median			14
Kamehameha Highway	Salt Lake Boulevard	Kohoma Street	Roadside	20		

Potential approaches to mitigating the effects of spillover parking are addressed in Section 3.4.5.

Effects on the Bicycle and Pedestrian Network

Locations where potential effects on bicycle and pedestrian facilities could occur are shown in Table 3-24. Effects could include either narrowing or widening sidewalks or bicycle lanes in some areas. Along Salt Lake Boulevard, striped bicycle lanes would be removed and replaced with a 14-foot-wide shared travel lane, which is generally accepted by the bicycle community.

Many bicycle lanes (planned by the City or State) could connect to fixed guideway stations. Proposed bicycle lanes along Farrington Highway could connect to stations at West Loch, the Waipahu Transit Center, Leeward Community College, and Pearl Highlands. Proposed bicycle lanes along Kamehameha Highway would be linked with the Pearlridge and Aloha Stadium Stations. With the Salt Lake Alternative, potential transit stations would be linked to the bicycle route along Salt Lake Boulevard. Allowing bicycles on trains, as is

Table 3-24 Summary of Potential Effects on Bicycle and Pedestrian Systems due to Fixed Guideway Column Placements

Roadway Name	Cross-street From	Cross-street To	Column Placement	Summary of Potential Effects
Common to All Build Alternatives				
Farrington Highway	Kunia Road	Pupukahi Street	Median	Signed shared roadway would be narrowed from 16 to 14 feet inbound and from 14 to 13 feet outbound.
Farrington Highway	Pupukahi Street	Pupupuhi Street	Median	Existing 4-foot inbound bike lane would be replaced with a 14-foot signed shared roadway.
Farrington Highway	Pupupuhi Street	Awanui Street	Median	Shared roadway (outbound) would be reduced from 15 to 14 feet.
Dillingham Boulevard and Kamehameha Highway	Pu`uhale Road	Mokauea Street	Median	Makai sidewalk would be narrowed to 5 feet (currently 4 to 6.5 feet).
Dillingham Boulevard	Mokauea Street	Kalihi Street	Median	Makai sidewalk would be narrowed from 8 to 5 feet.
Dillingham Boulevard	McNeill Street	Waiakamilo Road	Median	Makai sidewalk would be narrowed to 5 feet (currently 4 to 6 feet).
Dillingham Boulevard	Kokea Street	Alakawa Street	Side	Makai sidewalk would be narrowed to 5 feet (currently 4 to 7 feet).
Dillingham Boulevard	Ka`aahi Street	King Street	Side	Makai sidewalk would be narrowed to 5 to 10 feet (currently 10 to 15 feet).
Halekauwila Street	Punchbowl Street	South Street	Side	Sidewalks would be narrowed to 7 feet.
Halekauwila Street	Keawe Street	Coral Street	Side	Makai sidewalk would be narrowed from 12 to 7 feet.
Salt Lake Alternative [1]				
Salt Lake Boulevard	Lawehana Street	Maluna Street	Median	Width of shared inbound lanes would be reduced.
Salt Lake Boulevard	Ala Liliko`i Street	Peltier Avenue	Median	Removal of the existing inbound bike lane is planned to be replaced with a 14-foot signed shared roadway.
Salt Lake Boulevard	Peltier Avenue	Pu`uloa Road	Median	Both bike lanes are planned to be replaced by a 14-foot signed shared roadway.
Pūkōloa Street	Pu`uloa Road	Ahua Street	Side	Columns may be placed on part of the sidewalk.

[1] Effects of the Airport & Salt Lake Alternative would be the same as for the Salt Lake Alternative.

currently envisioned, would create a demand for bicycle lanes or routes near stations.

Effects on Freight Traffic

The Build Alternatives would generally have little direct effect on freight movement in the study corridor. Honolulu Harbor, Barbers Point Harbor, and Honolulu International Airport are the principal ports for the import and export of goods to and from O‘ahu and the primary sources of freight-related traffic. Cargo is delivered from these ports by truck to a wide array of destinations across O‘ahu. Sections of the fixed guideway structure and several stations would be near these facilities.

In some areas along the fixed guideway alignment, left turns in and out of driveways could be restricted due to column placements. In other locations, such as Kaka‘ako, column placement could interfere with existing truck traffic patterns along certain blocks and streets. This interference would vary by Build Alternative. For example, the Airport Alternative would likely have greater effects given the extent of freight traffic along the study corridor. However, reduced roadway congestion would have a positive effect on freight movement.

3.4.5 Mitigation of Long-term Transportation Effects

The Build Alternatives would benefit the overall transportation system. Where the Build Alternatives would affect roadways, improvements to maintain existing roadway operating conditions could be included.

Traffic

Park-and-ride, kiss-and-ride, and feeder buses would affect traffic at four intersections near the Pearl Highlands and Ala Moana station areas. Potential mitigation measures include widening existing roads, signalizing intersections, and other treatments that would result in fewer peak-hour delays.

Parking

In most cases, there is available parking on nearby side streets to accommodate people currently using parking spaces that may be lost to guideway construction. If parking capacity is not available along nearby streets, other approaches would be considered to replace lost parking, including adding off-street capacity.

Before identifying necessary parking replacement approaches, detailed surveys of the affected areas would be conducted. These surveys would include updated information on available parking use as well as existing and planned land uses in the affected areas. These surveys would occur prior to construction of guideway segments to allow identification of any mitigation measures and necessary follow-up action.

The approaches to mitigating effects of spillover parking would be unique to each station area. Mitigation strategies would be determined in coordination with appropriate stakeholders. Parking surveys of on-street unrestricted parking supply within proposed station areas would be conducted. These surveys would occur approximately six months before implementation of the fixed guideway service. Approximately six months after fixed guideway service starts, surveys would be repeated for all locations. The results of the surveys would be used to identify potential mitigation strategies.

To address spillover parking-related effects at stations, several potential strategies would be considered. These strategies have been successfully implemented in other cities and could include the following:

- Implementing neighborhood parking programs that provide residents with parking permits
- Identifying added parking capacity through leasing arrangements with nearby property

owners (e.g., churches with available parking capacity during weekdays)
- Building new parking facilities in affected areas
- Developing off-street parking management programs with retail centers to minimize on-street spillover demand

3.5 Construction-related Effects on Transportation

This section focuses on short-term, construction-related effects on transportation from the Build Alternatives. Section 4.17, Construction Phase Effects, discusses construction-related effects on the natural and built environments. These effects would be temporary and would occur between 2009 and 2018 at various times and locations in the study corridor.

The Project would be opened to the public as construction phases are completed, and there would be temporary effects on transportation conditions in station areas in the interim between the opening of each phase and project completion. These short-term effects would be primarily transit-related as bus routes are changed to complement the fixed guideway service.

3.5.1 Construction Staging Plans

Construction staging areas and plans would be identified and developed by the contractors and approved by the City. Specific details would be developed and reviewed with the relevant authorities and approvals sought. These details would include, but are not limited to, specific permitted lane closures or road closures, hours of operation, penalties for extending beyond permitted hours, and holiday restrictions. The maintenance and storage facility, park-and-ride lots, and stations could be used for construction staging areas. These areas would be sufficient for the first construction phase. Additional areas would be identified by the contractor as needed for later phases. The contractor would be responsible for obtaining any necessary permits and approvals. Additional construction and staging areas identified and requested by the contractor would be reviewed and approved by the City. Staging areas are not expected to cause a substantial effect.

3.5.2 Construction-related Effects on Transit Service

Local access to transit would be affected by lane closures within the construction corridor. Bus routes would generally be maintained but could be temporarily diverted or relocated to provide reliable service near areas where the fixed guideway would be constructed. Bus stops could also be temporarily relocated, particularly if a street's right lane is closed for construction. TheHandi-Van service could experience some delays due to construction activity.

Existing bus routes were examined to determine the degree of effect during construction. Effects were classified as none, minor, and/or direct. Minor effects would occur when a route intersects and crosses a street with construction activity or traverses a short section of a construction zone. Direct effects would occur where a transit route travels along a considerable length of the construction zone. Table 3-25 lists the bus routes that would be affected by construction. Since some bus routes would pass through multiple parts of the construction corridor, they may experience both minor and direct effects, depending on location.

Table 3-25 Bus Routes Affected by Construction

Minor Effects	Direct Effects
1, 2, 5, 7, 10, 11, 13, 17, 18, 31, 40, 40A, 44, 74, 83A, 86, 86A, 93A, 95, 201, 202, 413, 415, B, F11, F12, F13	2, 3 4, 6, 8, 9, 11, 13, 19, 20, 22, 23, 31, 32, 40, 40A, 42, 43, 52, 53, 54, 55, 56, 57, 57A, 62, 65, 71, 73, 88, 88A, 98A, 201, 202, 203, 434 , A, B, C, E, F2, F3

In addition to the TheBus routes operating near the fixed guideway alignment, construction would affect TheHandi-Van operations. A Transit Mitigation Program, further described in Section 3.5.7, Mitigation of Construction-related Effects, identifies efforts to address construction effects on transit service.

The Project would be constructed in phases and opened as sections are completed. As a result, there would be stations where fixed-guideway service would temporarily end while the next section is under construction. This phased opening approach would require interim changes to bus transit service to complement the fixed guideway service. This could have a short-term effect at station areas as bus routes are temporarily moved to connect with fixed-guideway stations. This includes additional buses traveling near certain fixed-guideway stations and associated traffic and pedestrian effects from the bus service. A plan to accommodate the use of phased openings would be developed in advance.

School buses may also be affected by temporary delays caused by construction activities. Construction-related detours may require alternative routes between school bus stops.

3.5.3 Construction-related Effects on Traffic

This section discusses potential construction-related traffic effects, such as lane closures, which may occur throughout the day, including peak travel periods. Additional lanes may be closed during off-peak travel periods. These additional lane closures would accommodate construction equipment. Construction activities would likely occur in temporary construction corridors. Estimates of construction-related procedures that would affect road closures are as follows:

- **Column Foundations (drilled shafts)**—lane closures would be required throughout the column foundation installation process. The degree of traffic disruption around areas of piling/caisson work would vary depending on the roadway's width and the availability of alternate routes. The following scenarios are anticipated:
  - **Off-peak closures**—two lanes would be closed for each half-mile construction segment for foundation and column construction. If the alignment is along a roadway that is less than three lanes wide (e.g., Halekauwila Street), the road would be closed to non-local vehicular traffic during off-peak periods. If the street's median is more than 8 feet wide (e.g., Farrington Highway in parts of Waipahu), closure of only two lanes may be possible.
  - **Peak closures**—during peak travel periods, closure may be restricted to one or two lanes. If a street is only two lanes wide, efforts would be made to open one lane during peak periods, if necessary.
  - **Cross-streets**—if cross-streets are at least 150 feet apart to allow space for the required equipment, the only restrictions on cross-streets could be turning movements onto the alignment road where lanes are closed. Access could be closed off-peak during erection of segments.
- **Columns**—lane closures would be required throughout the column construction process. Lane closures similar to those assumed for column foundations are assumed for above-ground column construction.
- **Guideway Structure**—during construction of the guideway structure between the columns, lane closures would be required. However, if the active work area spans an intersection, the cross-street would be open (with possible turning restrictions) during peak hours but closed during off-peak hours. Lane closure could also be needed in the off-peak direction during delivery and erection of segments.
- **Stations**—lane closures would be required at all locations where stations would be constructed over a roadway. Some work would

likely require complete road closures, and this would be scheduled for permitted night work.

- **Park-and-Ride and Other System Facilities**—park-and-ride and other system facilities (e.g., traction power substations and the maintenance and storage facility) would primarily be built on parcels not located on public streets and highways. Substantial lane closures are not anticipated during construction of these facilities, but brief lane closures may be necessary during construction of entrances and exitways.

Table 3-26 lists anticipated temporary lane closures along the alignment. In addition to travel lanes, a number of turning lanes would also be temporarily closed. Traffic signals adjacent to the fixed guideway could also be temporarily replaced or re-timed. Delivery of construction

Table 3-26 Potential Peak-Period Temporary Lane Closures During Construction [1]

Roadway Name	Cross Street From	Cross Street To	Number of Lanes	Number of Lanes to be Temporarily Closed	
				Kapolei Bound	Koko Head Bound
Common to All Build Alternatives					
Farrington Highway	Paiwa Street	Kahualii Street	4	1 (a.m.) 0 (p.m.)	0 (a.m.) 1 (p.m.)
Kamehameha Highway	Acacia Road	Boathouse Entrance	6 [2]	0	1
Kamehameha Highway	Middle Street	Laumaka Street	5	1	1
Dillingham Boulevard and Kamehameha Highway	Kohou Street	Alakawa Street (Costco rear parking)	4	1	1
Halekauwila Street	Punchbowl Street	South Street	2	1	0
Halekauwila Street	Keawe Street	Ward Avenue	2	0	1
Kona Street	Pensacola Street	Ke`eaumoku Street	2	1	0
Salt Lake Alternative					
Salt Lake Boulevard	Luapele Drive	Maluna Street/Namur Road	6	1	1
Salt Lake Boulevard	Wanaka Street	Kahikolu Place	2	0 [3]	0 [3]
Salt Lake Boulevard	Ala Liliko`i Street	Ala Napunani Street	5	1	1
Salt Lake Boulevard	Ala Napunani Street	Pu`uloa Road	5	0	1
Pūkōloa Street	Pu`uloa Road	Ahua Street	5	0	1
Airport Alternative					
Kamehameha Highway	Salt Lake Boulevard	Center Drive	5 [2]	0	1
Airport & Salt Lake Alternative					
Salt Lake Boulevard	Luapele Drive	Maluna Street/Namur Road	6	1	1
Salt Lake Boulevard	Wanaka Street	Kahikolu Place	2	0 [3]	0 [3]
Salt Lake Boulevard	Ala Liliko`i Street	Ala Napunani Street	5	1	1
Salt Lake Boulevard	Ala Napunani Street	Pu`uloa Road	5	0	1
Pūkōloa Street	Pu`uloa Road	Ahua Street	5	0	1
Kamehameha Highway	Salt Lake Boulevard	Center Drive	5 [2]	0	1

[1] Additional closures could occur in short segments and/or during off-peak travel periods.
[2] Kamehameha Highway narrows to four lanes around the Moanalua Freeway Interchange.
[3] An existing lane may be removed but would be supplemented with an additional lane at the time of construction.

materials would increase the number of trucks on local roadways.

Balanced cantilever construction likely would be used for the longer spans crossing the H-1 and H-2 Freeways and possibly Fort Weaver Road. Individual lanes would be closed to allow this work to be completed without a full roadway closure. A detailed schedule showing which lanes would be affected would be prepared for the erection of segments. The actual means and methods for erecting these segments would be the contractor's decision. Construction with segmented precast sections would avoid the need for substantial shoring or false work. Appendix C, Construction Approach, describes the general construction process and methods likely to be used to construct the Project.

Phased opening of the Project to the public would have only minor effects on traffic. This would be limited to the station areas where bus transit service has been temporarily altered to complement the interim configuration of the fixed-guideway service.

3.5.4 Construction-related Effects on Parking

In general, on-street parking would be temporarily affected by construction. Table 3-27 identifies on-street parking spaces that would be temporarily unavailable at various points along the alignment.

Some parking lots adjacent to the fixed guideway alignment could also be affected. Construction vehicle parking would occur in staging areas or on site. The contractor would determine the precise effects on parking during construction.

3.5.5 Construction-related Effects on Bicycle and Pedestrian Facilities

Access to existing bicycle and pedestrian facilities would be maintained during all phases of construction as safety allows. Warning and/or notification signs of modification to bicycle and pedestrian facilities during construction would be provided. Proposed pedestrian detours would be submitted to the City for review and approval to ensure they are reasonable for all pedestrians and meet ADA regulations. Proper deterrents, such as barriers or fencing, would be placed to prevent access (shortcuts) through the construction area.

Effects would occur in these areas as a result of the proximity of sidewalks to the roadway median. Many crossings would be temporarily eliminated, and disruptions would occur along adjacent sidewalks and bike paths. Sidewalk diversions would be made when necessary. In areas where additional right-of-way may be required (e.g., Dillingham Boulevard), sidewalks may be temporarily removed and pedestrians rerouted to safe locations.

The Transportation Technical Report (RTD 2008a) identifies potential conflicts or physical effects on existing and proposed bicycle facilities and the pedestrian circulation system that would result from construction of the Project.

3.5.6 Construction-related Effects on Freight Movement

The fixed guideway would be built along several roadways that are heavily used freight routes. Construction effects on freight could occur, especially during off-peak hours. Freight movement may be delayed by the need to use an alternative route. Loading zones along the route could be temporarily relocated.

3.5.7 Mitigation of Construction-related Effects

A Maintenance of Traffic (MOT) Plan and Transit Mitigation Program (TMP) would identify measures to mitigate temporary construction-related effects on transportation.

The MOT Plan would address effects on streets and highways, transit, businesses and residences, pedestrians and bicyclists, and parking. Coordination with TheBus would identify additional bus service to mitigate construction effects.

Table 3-27 Construction-related Parking Reductions

Roadway Name	Cross Street From	Cross Street To	On- Street Parking Temporarily Lost During Construction
Common to All Build Alternatives			
Moloalo Place	Waipahu Depot Street	Mokuola Street	5
Ka`aahi Street	Dillingham Boulevard	Iwilei Road	17
Halekauwila Street	Punchbowl Street	South Street	21
Halekauwila Street	South Street	Keawe Street	15
Halekauwila Street	Keawe Street	Coral Street	38
Halekauwila Street	Coral Street	Cooke Street	10
Halekauwila Street	Cooke Street	Kamani Street	44
Halekauwila Street	Kamani Street	Ward Avenue	9
Queen Street	Ward Avenue	Kamake`e Street	46
Queen Street Extension	Kamake`e Street	Waimanu Street	21
Kona Street	Pensacola Street	Pi`ikoi Street	92
Salt Lake Alternative and Airport & Salt Lake Alternative			
Salt Lake Boulevard	Lawehana Street	Maluna Street	17
Pūkōloa Street	Māpunapuna Street	Ahua Street	38

Construction methods identified by each contractor would be included in the MOT Plan. The TMP would mitigate effects on transit service operating during project construction. These plans would be developed by the contractor for each phase and coordinated/approved by HDOT (for the MOT Plan and HDOT highways only) and the City prior to starting construction in an area.

Construction-related transportation effects would be mitigated with implementation of a Maintenance of Traffic Plan and a Transit Mitigation Program to be prepared by the contractor prior to construction.

The MOT Plan and TMP would include site-specific traffic-control measures and would be developed in conjunction with the transit system's final design. The key objectives of these plans would be to limit effects on existing traffic and maintain access to businesses. These plans would be shared with the public.

Maintenance of Traffic Plan

The following sections discuss measures included in the MOT Plan that would help mitigate construction-related transportation effects. The contractor would be given parameters, such as the number of lanes that could be closed and the procedures for closures, and would develop the MOT plan accordingly with approval from the City or HDOT. The MOT plan would address roadway closures for streets identified in Table 3-26. The Plan would specifically account for the effect of drilled shaft installation, crane access and operations, and the delivery and operation of materials trucks. The MOT Plan would also address the delivery and unloading of pre-cast guideway sections, including crane positioning for unloading. The contractor would submit any proposed changes to the MOT Plan to the City for approval.

Streets and Highways

Construction would be phased so that the duration of pile, caisson, and column work (which have the largest effect on traffic) would be minimized. During final design, whether under design-build or design-bid-build, detailed Work Zone Traffic Control Plans, including detour plans, would be formulated in cooperation with the City, HDOT, and other affected jurisdictions.

Unless unforeseen circumstances dictate, no designated major or secondary highway would be closed to vehicular or pedestrian traffic. In areas where the roadway is more than three lanes wide, no roadways would be completely closed so vehicular or pedestrian access to residences, businesses, or other establishments would still be provided. Temporary lane closures would occur during non-peak hours so that effects on heavy commuter traffic would be minimized.

Delivery of large equipment, such as drilling devices, cranes, and launching gantry truss sections, would occur along arterial routes to the construction corridor. City and HDOT approvals would be sought for proposed haul routes and included in the contract packages.

An extensive public information program would be implemented to provide motorists with a thorough understanding of the location and duration of construction activities, as well as anticipated traffic conditions. The MOT Plan would also address traffic signal changes and relocation of freight loading zones that might be temporarily affected.

Transit

The MOT Plan would determine when and where changes in bus services could be needed and would include Transportation Demand Management elements. The Project would be integrated with TheBus on potential changes to bus routes and service. Changes in bus service could include improving frequencies on existing routes or adding new routes that circumvent specific construction areas.

Pedestrians and Bicycles

Pedestrian and bicycle access would be maintained during construction as much as possible while emphasizing safety. Measures to maintain safe and efficient pedestrian and bicycle access would meet ADA regulations and could include the following:

- Channelizing pedestrian flow in areas where sidewalks would be close to construction—channelized structures are generally steel-framed, three-sided plywood structures built above existing sidewalks
- Making extensive use of signage to direct pedestrians and bicyclists to the safest and most efficient routes through construction zones—signs would warn pedestrians and bicyclists well in advance of sidewalk and bike lane closures

Parking

The MOT would consider potential measures to replace parking spaces that would be temporarily lost during construction. These measures could include the possible lease of off-street spaces to address this temporary loss. A temporary loading zone relocation plan would also be included.

Construction Phasing

The Build Alternatives would be constructed in phases. For example, the Airport & Salt Lake Alternative could be phased so that the guideway between East Kapolei and Ala Moana Center along Salt Lake Boulevard would be built first, followed by a connection from Middle Street Transit Center to the Honolulu International Airport. The connection from the airport to Aloha Stadium could be completed as the final phase of the Project when additional funds become available.

The choice of phasing would not affect construction methods, but would affect the areas that would be disturbed at any specific time. The MOT

Plan and TMP would be developed for the different construction phases to minimize effects to the traveling public.

Transit Mitigation Program

The TMP would define adjustments that would mitigate the effects of construction on existing bus service and would be customized for each construction phase and sized to properly serve projected rider demands.

In some construction sections, parallel bus routes on roads not directly affected by construction may experience an increase in service to accommodate rider demand shifted from affected bus routes. Public information and outreach would be conducted to influence current and prospective transit rider behavior.

The TMP would consider the following factors in determining required bus route service adjustments:

- Minimization of the extent of changes for bus stops and rerouting (if necessary)
- The MOT Plan as it relates to bus routes and pedestrian access to existing or relocated bus stops
- The severity and duration of construction along each corridor section and within each construction phase
- Differences between the scheduled bus route travel time currently operating and the scheduled travel time expected during construction
- The difference between the current travel time for existing traffic and traffic during construction, and whether transit could and should be given temporary traffic priority treatments during construction
- The types of temporary traffic priority treatments for transit that could be provided at a reasonable cost during construction

The TMP would generally maintain existing bus routes and stops. In areas where interruptions are expected, the following approaches may be adopted:

- Temporarily closing or relocating bus stops
- Rerouting existing service for short sections where no additional buses are required
- Rerouting existing service for longer segments that require additional buses
- Introducing new services if they operate on different alignments not affected as heavily by construction
- Ceasing operation of routes or portions of routes temporarily and redeploying service hours to parallel routes
- Initiating a public information program to inform transit riders of service changes during construction
- Rerouting school bus routes that would be substantially delayed

3.6 Cumulative Transportation System Effects

Planned extensions to the fixed guideway system are described in Chapter 2 and include extensions to West Kapolei, UH Mānoa, and Waikīkī. These extensions would provide additional transportation benefits beyond those provided by the Project. Other planned transportation projects (see Table 2-3 in Chapter 2) are included in all of the 2030 analysis throughout this chapter. The cumulative effects of building the Project and these extensions are discussed in this section.

Effects on Transit

The planned extensions would further improve transit performance compared to the Build Alternatives by reducing transit travel times and increasing reliability. Bus system operating expenses also would decrease as more trips would be taken on the guideway and the overall need for transfers to UH Mānoa and Waikīkī would be eliminated.

As a result of the additional stations and destinations covered by the extensions, ridership

on the fixed guideway system with the Project and planned extensions would be substantially higher than with the Project alone. As shown in Table 3-28, daily transit ridership would be more than 25 percent higher for each alternative with the planned extensions compared to the Project. The additional ridership would come from people accessing the fixed guideway system from stations both within and to the extension areas, such as UH Mānoa or Waikīkī.

Effects on Streets and Highways

As shown in Table 3-29, the planned extensions would reduce VMT, VHT, and VHD compared to the Project alone. The planned West Kapolei and Kapolei Parkway Stations would both have park-and-ride facilities. Neither park-and-ride facility would affect local traffic operations.

Table 3-28 Effects of the Planned Extensions on 2030 Daily Transit Ridership

Alternative	Fixed Guideway Boardings
2030 No Build	n/a
Salt Lake	88,000
Airport	95,000
Airport & Salt Lake	93,000
Salt Lake with planned extensions	112,000
% Change from Project	*27%*
Airport with planned extensions	120,000
% Change from Project	*26%*
Airport & Salt Lake with planned extensions	118,000
% Change from Project	*27%*

Other cumulative effects could include removing additional on-street and off-street parking spaces to accommodate the fixed guideway structure, some adjustments to widths of travel lanes, and possible spillover parking effects at stations without park-and-ride facilities. With the extensions, spillover parking effects would be reduced at Project stations as demand would become more dispersed.

Table 3-29 Vehicle Miles Traveled, Vehicle Hours Traveled, and Vehicle Hours of Delay—2030 Planned Extensions

Alternative	Daily VMT	Daily VHT	Daily VHD
Salt Lake	13,097,000	386,000	85,000
Airport	13,086,000	385,000	84,000
Airport & Salt Lake	13,104,000	385,000	83,000
Salt Lake with planned extensions	13,048,000	384,000	84,000
Airport with planned extensions	13,038,000	383,000	83,000
Airport & Salt Lake with planned extensions	13,044,000	383,000	82,000

Summary of Findings: Transportation Conditions and Effects

Existing Conditions

- The bus-only transit system operating on O`ahu is one of the most effective and productive in the country, exceeding several systems that operate in larger metropolitan areas.
- Increasing traffic congestion and constrained transit operating conditions have reduced system reliability and mobility for all travelers.
- Operating buses exclusively in mixed traffic has led to slower speeds, increased costs, and reduced service reliability.
- Reliability of transit service has worsened—almost one-third of bus trips are not meeting their on-time performance standard. Reliability is at level of service "F."
- Transit travel times are increasing. Longer-distance bus service is particularly affected by traffic congestion.

Effects of the No Build Alternative

- Transit operating speeds, reliability, and mobility would worsen by 2030.
- Traffic congestion would worsen, even with $3 billion in other planned roadway improvements, affecting mobility and reliability for all travelers.
- Transit service to new developments planned for West O`ahu would be ineffective, inefficient, and unreliable.
- Equitable distribution of transportation services would become more difficult as increasing congestion makes longer-distance trips slower and less reliable.

Effects of the Build Alternatives

- Transit service mobility, reliability, equity, and access to new development would improve.
- Transit travel times on the fixed guideway would be reliable and consistent regardless of traffic congestion on streets.
- Higher transit speeds would reduce travel times and improve operating efficiency.
- Vehicle miles traveled, vehicle hours traveled, and vehicle hours of delay would all decline compared to the No Build Alternative.
- Transit travel times would improve between major employment centers such as Downtown and emerging population and employment centers in West O`ahu.
- Overall transit system accessibility would be enhanced, resulting in transit carrying a greater share of total travel, particularly for work-related trips during peak hours.
- Daily transit ridership would grow by 40 percent over the No Build Alternative.
- Transit equity would improve as travel times are reduced between areas with high concentrations of transit-dependent households and major employment areas.
- Comfort and convenience would be enhanced through a smooth ride and frequent service available 20 hours a day.
- Guideway support columns would affect some existing streets, parking, and pedestrian and bicycle facilities.
- Effects on parking and other transportation elements would be minimized or mitigated.
- Transit user benefits would increase compared to the No Build Alternative.
- Construction activity would temporarily affect the transportation system, including traffic, parking, bus service, and access to some businesses and residences. Plans would be developed to minimize disruption.

This page left intentionally blank